

Final Program

Thirty-Third Annual International Neuropsychological Society Conference

February 2-5, 2005
St. Louis, Missouri, USA

WEDNESDAY, FEBRUARY 2, 2005

4:15–6:15 PM

Poster Session 1
Room: St. Louis Salon D & E (4th floor)

Aging

1. REY, OL
Performance of Young and Older Adults in a Verbal Fluency Task.
2. YOCHIM, BP
Depression and Cerebrovascular Burden as Predictors of Verbal Fluency in Older Adults.
3. BRICKMAN, AM
Semantic and Phonemic Verbal Fluency across the Adult Lifespan: Relationship to EEG Theta power.
4. COOK, S
Stability of Elders' Hopkins Verbal Learning Test- Revised Performance Before and After Extensive Practice.
5. MACKAY, A
Deconstructing Executive Contributions to List Recall by Older Adults.
6. SWEET, L
Age-Related fMRI Activation Differences among Older Adults Performing a Verbal Working Memory Task.
7. SPRENG, R
The Distribution of Autobiographical Memories and Plans Across the Lifespan.
8. BUFFINGTON, AL
Time of Day Affects Memory But Not Executive Functioning in Older Adults.
9. KAUP, AR
The Effect of Deliberation on Decision-Making in Older Adults.
10. PAXTON, J
Exploring the Effect of Environmental Support and Strategy Training on Cognitive Control Impairment in Older Adults.
11. PAUL, RH
Relationships between cognitive function, subcortical hyperintensities, and regional cortical volume in older healthy adults: selective role for S.
12. HOUSTON, WS
Gene Dose-Brain Response Correlational Maps in Non-Demented Older Adults.
13. MARQUART, MS
Blood Pressure and RBANS Performance in Healthy, Older Adults: Findings from the OKLAHOMA Study.
14. BIELAK, A
Performance on the Hayling and Brixton Tests in Older Adults: Norms and Correlates.
15. KRETZMER, T
Aging has Little Effect on Perception of Stimulus Intensity.
16. TAYLOR-COOKE, PA
Aging Slows Habituation of Visual Attention.

Assessment of Executive Functions, Memory, and Intellectual Function

17. WOODS, S
Evidence for the construct validity of action (verb) fluency.
18. MARSHALL, RC
Performance of Normal Participants on the Rapid Assessment of Problem-Solving Test (RAPS).
19. LEVAV, M
Parents Report on Behavior Problems and Executive Functions: Are these perceived as a single domain?
20. SCHAFER, A
The Influence of Reading Ability on Executive Function Tasks.
21. DEMERY, JA
Predictive Power of Executive Functioning Tests in Mild and Moderate/Severe Traumatic Brain Injury.
22. HISCOCK, M
Poor Performance of University Students on the Iowa Gambling Task: A Replication.
23. SKEEL, R
Two Behavioral Measures of Risk-Taking: The Bechara Gambling Task (BGT) and the Balloon Analogue Risk Task (BART).
24. DAVIS, R
What is the Diagnostic Significance of Errors on the Trail Making Test?
25. DICKINSON, MD
Development of a Non-Manual Trail Making Test: Preliminary Results.
26. NAKASE-THOMPSON, R
Comparison of the DKEFS Verbal Fluency Subtest, Trail Making Test B, and WCST-64 in Persons with Acute Traumatic Brain Injury.
27. HSU, N
Wisconsin Card Sorting Test as a Measure of Executive Function: A Cautionary Note.
28. EISENMAN, D
The Texas Card Sorting Test: A New Executive Function Measure.
29. SEDO, MA
Validity of Non-Reading Forms of the Stroop and the Trail-Making Tests on Presurgical Parkinsonian Patients.
30. WILLIAMS, BR
Reaction Time Inconsistency in a Spatial Stroop task: Age-Related Differences Through Childhood and Adulthood.
31. ISAACS, KL
An Analysis of the New Stroop Interference Score and its Relation to Measures of Executive Functioning in Epilepsy Surgery Candidates.
32. RANDALL, K
The Stroop in a Virtual Reality: Is it Virtually the Same?
33. KERENYI, L
Comparing the Validity of the Wisconsin Card Sorting Test and D-KEFS Sorting Test in MS.
34. KIM, M
Validity study of memory and frontal lobe subtests of KBNA in Korean college students.
35. GRANDE, LJ
A Timely Screening for Executive Functions and Memory.
36. DICKINSON, MD
The Influence of the Flynn Effect on Age Norms for the Wechsler IQ Test.

37. LANGE, RT Evaluation of One- and Two-subtest Short-forms for Estimating WAIS-III Index Scores.
 38. LANGE, RT Development of the Canadian Estimate of Premorbid Intelligence for the WAIS-III.
 39. LANGE, RT Expansion of the Canadian Estimate of Premorbid Intelligence for the WAIS-III: GAI, VCI, and POI.

Mild Cognitive Impairment

40. CHANDLER, MJ Differential Diagnosis of Mild Cognitive Impairment Using the CERAD Neuropsychological Battery Total Score.
 41. TROYER, AK Tests of Prospective Memory Can Differentiate Normal Aging, Mild Cognitive Impairment, and Alzheimer's Disease.
 42. SAXTON, J The Computer-based Assessment of Mild Cognitive Impairment (CAMCI).
 43. HAYMAN-ABELLO, B Digit Symbol Incidental Learning, but not Speed, Differentiates Normal Aging from Mild Cognitive Impairment.
 44. KNOX, MR Diagnostic Accuracy of an Algorithm-based Neurocognitive Checklist in Normal Aging, Mild Cognitive Impairment, and Alzheimer's Disease.
 45. ROLSTAD, SE The Matter of MCI Criteria: Assessment of Premorbid Capacity Versus Age Means.
 46. GRIFFITH, R Executive Dysfunction Predicts Conversion to AD after One Year in Patients with Amnesic MCI.
 47. NORDLUND, A The Goteborg MCI study: Neuropsychological Profiles of Mild Cognitive Impairment with Vascular and Primary Etiology; VaD and AD in their Preliminary Stages?
 48. GREHER, MR Vascular Risk Factors for Progression of Mild Cognitive Impairment to Dementia.
 49. BHALLA, RK Frontal Systems Behavioral Dysfunction and Depression in MCI Amnesic vs. MCI Other.
 50. RABIN, LA Judgment in Older Adults with AD, MCI, and Cognitive Complaints: Development and Preliminary Psychometric Evaluation of the Dartmouth Judgment Questionnaire (DJQ).
 51. COBIA, DJ Descriptive Profiles of Individuals with Mild Cognitive Impairment Using the Wechsler Memory Scale - Third Edition.
 52. VANDERHILL, S Intraindividual Variability in Physical Functioning and Severity of Mild Cognitive Impairment.
 53. LUBINSKY, TR The Mnemonic Benefits of Errorless Learning and the Generation Effect for Individuals with Mild Cognitive Impairment.
 54. GOULD, F The Effect of Subjective Memory Complaint on RBANS Test Performance in MCI and Healthy Aging.

4:30–5:30 PM

Invited Plenary

Aging and Illusory Memories: Was Mark Twain Right?

Roddy Roediger

Room: Promenade Salon C & D (2nd floor)

5:30–6:30 PM

Invited Plenary

Holistic, Part-Based, Episodic and Semantic Processes in Face Recognition: Dissociations and Interactions

Morris Moscovitch

Room: Promenade Salon C & D (2nd floor)

4:30–6:30 PM

Symposium 1

Cognitive Neuroscience Approaches to Traumatic Brain Injury

Chair: William Perlstein, Discussant: Harvey Levin

Room: Promenade Salon A & B (2nd floor)

1. LEVINE, B Attention in Traumatic Brain Injury: Studies with Functional Magnetic Resonance Imaging and Diffusion Tensor Imaging.
 2. NEWSOME, MR Brain Activation During Working Memory after Traumatic Brain Injury in Children.
 3. PERLSTEIN, WM Cognitive Control Dysfunction in Chronic Traumatic Brain Injury.

4:30–6:30 PM

Paper Session 1

Developmental Disorders

Room: Promenade Salon E & F (2nd floor)

1. KLEINHANS, N Atypical Lateralization of Language Activity in Autism Spectrum Disorders.
 2. BIGLER, ED Relationship Between Superior Temporal Gyrus and IQ in Autism.
 3. MAHONE, M Motor Persistence and Inhibition in Autism and ADHD.
 4. KENWORTHY, L Performance on Executive Function Tasks Predicts Social Functioning in Children with Autism and Typical Controls.
 5. BROWN, TM Factors of Biological Risk and Reserve Associated with Executive Behaviors in Children and Adolescents with Spina Bifida Myelomeningocele.
 6. CONNOR, PD Working Memory in Patients with Fetal Alcohol Spectrum Disorders: An fMRI Study.

6:30 PM

INS Welcome Reception

Room: St. Louis Foyer (4th floor)

THURSDAY, FEBRUARY 3, 2005

9:15–11:15 AM

Poster Session 2

Room: St. Louis Salon D & E (4th floor)

Depression

1. DENNING, J Working Memory Abilities in Children: The Effects of Self-Reported Depression on Test Performance.
2. ROTH, RM Reduced Anterior Cingulate Activation During an fMRI Counting Stroop in Bipolar I Disorder.
3. HO, M The Performance of Depressed Patients on the Tests for Detecting Simulated Cognitive Impairment.
4. HOOVEN, TA Impaired Inhibitory Control in Depression: Another Example of Recruitment.
5. GETZ, GE Semantic Clustering of Hopkins Verbal Learning Task in Adult Depression.
6. CORLYN, M The WAIS-III and Major Depression: Absence of VIQ/PIQ Split.
7. CORLYN, M Slowing of Information Processing Speed in Major Depression.
8. HOOVEN, TA Exploring Implicit Memory Deficits in Depression Using fMRI.
9. MORDHORST, MJ Evidence of a Unique Contribution of Depression on Memory Function in a Clinical Sample.
10. WYATT, G Executive Function and Dysfunction in Suicidal Behavior.
11. KEILP, JG Attention, Memory and Language Fluency in Depression and Suicidal Behavior.
12. PYYKKONEN, BA Neuropsychological Performance With Sub-Clinical Anxiety and Depression.

HIV/AIDS

13. GOLDMAN, M Emerging Neurocognitive Deficits in Pediatric HIV Infection.
14. MALEE, K Cognitive and Behavioral Functioning, Health Status, and Medication Adherence in Children and Adolescents with HIV Infection.
15. MARCOTTE, TD Neuropsychological Impairment in HIV Infection: How Typical is the “Typical Profile”?
16. TATE, DF Differential Relationships Between Corpus Callosal Area and Cognition in HIV Infected Patients.
17. WOODS, S Component Process Measures Within the Hopkins Verbal Learning Test - Revised: Construct Validity in an HIV-1 Sample.
18. JUENGST, S Structural Neuroimaging Evidence of the Synergistic Effects of AIDS and Age on the Central Nervous System.

Personality

19. LISS, M Highly Sensitive People: Overwhelmed or Enriched by Sensory Experience?
20. RUOCCO, AC Neuropsychological Support for Eysenck’s Cortical Arousal Theory of Personality.

Psychopathology

21. JAK, A Frontal Lobe Morphometry and Executive Functioning in Children at Risk for Bipolar Disorder.
22. FOSTER, MK Reports of Executive Dysfunction in Adolescents at Genetic Risk for Bipolar Disorder.
23. MARON, L The Relationship between Disrupted Semantic Networks and Thought Disorder in Bipolar Illness.
24. PALMER, BW Correlates of Capacity to Consent to Research Among Middle-aged and Older Patients with Psychoses.
25. MAUCIERI, L Characteristics of Acute Medical Inpatients Referred for Assessment of Mental Competency.
26. BASSO, M Presence of Psychotic Features in Acute Mania: Neuropsychological Effects.
27. JONES, JE DSM-IV Axis I Diagnoses in Individuals with Temporal Lobe Epilepsy Compared to Healthy Controls.
28. NOGGLE, CA Evaluating the Effectiveness of the Dean-Woodcock Emotional Status Examination.
29. BERLIN, HA Borderline Personality Disorder, Impulsivity, and the Orbitofrontal Cortex.
30. SEIBLES, AJ An Itemized Approach to Assessing Behavioral and Psychological Symptoms in Dementia.
31. CARLOZZI, N Neuropsychological Correlates for Memory and Hippocampal Deficits in PTSD.

Schizophrenia

32. O’GRADY, J Psychomotor Performance in a Persistently Psychiatrically Disabled Patient Population.
33. JOHANNESSEN, JK Reduced Auditory Suppression Relates to Working Memory Impairment in Schizophrenia.
34. CLEAVINGER, HB Structural MRI Correlates of Executive Variables During Verbal Learning in Schizophrenia.
35. HAN, S Semantic Priming in Schizophrenia: An fMRI Investigation.
36. KURTZ, MM Differences in Learning Proficiency on the Wisconsin Card Sorting Test in Schizophrenia: Do They Reflect Distinct Neurocognitive Subtypes?
37. MOORE, DJ Clustering and Switching on Verbal Fluency Tasks Among Middle-Aged and Older Schizophrenia Patients.
38. MCDERMID VAZ, SA The Stability and Validity of the Cortical/Subcortical Dementia Typology of Memory Functioning in Schizophrenia.
39. CHAN, RC The COMTSNP genotypes in schizophrenia: relationships to clinical and neurocognitive manifestations.
40. KOVEN, NS Parietal Lobe Volume and Cognition in Schizophrenia.
41. JONES, AP MRI Assessed Hippocampal Morphology and Neuropsychological Factors in Control and Schizophrenia Subjects.
42. PAGULAYAN, KF The Relationship Between Receptive and Expressive Emotional Skills and Social Functioning in Schizophrenia.
43. HILL, EK Neuropsychological Profiles and Psychiatric Disorders in Relatives of Schizophrenics.
44. ROALF, DR Family Ties: Odor Identification Impairments in Patients with Schizophrenia, First-Degree Family Members, and Extended Family Members.

8:45–10:45 AM**Invited Symposium****Recent and remote spatial and non-spatial memory: When is the hippocampus needed?****Chair: R Shayna Rosenbaum****Room: Promenade Salon C (2nd floor)**

1. NADEL, L
2. WINOCUR, G
3. ROSENBAUM, R
4. COHEN, N

The Hippocampus as a Cognitive Map.

Preserved Spatial Memory Following Hippocampal Lesions in Rats.

The Hippocampus is Needed for Remote Memory of Episodic-Spatial Details but not Schematic-Spatial Layouts: Evidence from Amnesic Patients and fMRI.

The hippocampus and declarative memory: Providing a unique solution to representation of arbitrary or accidentally occurring relations among the elements of experience.

8:45–10:45 AM**Symposium 3****Interactions between Child and Family Factors for Children with Developmental and Acquired Brain Insult****Chair: Vicki Anderson, Discussant: Keith Yeates****Room: Promenade Salon A & B (2nd floor)**

1. ANDERSON, VA
2. GONZALEZ, L
3. ANDERSON, PJ
4. ANDERSON, VA

Effects of paediatric traumatic brain injury on self-regulation and social functioning.

Objective and Observer Ratings of Memory Function in Children with Temporal Lobe Epilepsy and their Peers.

Behavior problems in school-aged children born very preterm or with extremely low birthweight: Relationship with IQ and school achievement.

Identifying Factors Contributing to Child and Family Outcome at 30 Months Following Traumatic Brain Injury in Children.

8:45–10:45 AM**Paper Session 2****Dementia****Room: Promenade Salon D (2nd floor)**

1. BELFOR, N
2. RANKIN, KP
3. TSCHANZ, J
4. CORREIA, S
5. POWELL, MR
6. FOLDI, NS

Can Neuropsychological Assessment and Imaging Differentiate Corticobasal Degeneration and Frontotemporal Dementia?

FTLD Patients Fail to Discriminate Emotions Despite Dynamic, Multimodal Input.

Head Injury and Trajectory of Cognitive Decline in Dementia. The Cache County Study.

Diffusion-Tensor Imaging and Executive Function in Subcortical Ischemic Vascular Disease and Mild Cognitive Impairment.

Cognitive Measures Predict Clinical and Neuropathologic Criteria of Alzheimer's Disease.

Visual Attention Measures Detect Early Changes of an Acetylcholinesterase Inhibitor (AChE-I) in Alzheimer Disease (AD).

8:45–10:45 AM**Paper Session 3****Medical Illness****Room: Promenade Salon E & F (2nd floor)**

1. BENEDICT, RH
2. MORROW, LA
3. DIAMOND, BJ
4. MEIDINGER, A
5. JEFFERSON, AL
6. REMINGER, S

Alternate Forms Preserve Validity without Compromising Reliability in MS.

Neuropsychological Deficits in Railroad Workers with Long-Term Solvent Exposure.

Information Processing Speed in Anterior Communicating Artery Aneurysm.

Hepatic Encephalopathy and Post-Transplant Cognitive Recovery.

Cardiac Output and Cognitive Functioning: Evidence for a Relationship Between Systemic Perfusion and Executive Dysfunction.

Neuropsychological Correlates of Diffusion Tensor Imaging Measures in Breast and Colon Cancer Survivors.

11:15 AM–12:15 PM**Birch Lecture****Development of Higher Cognitive Functions in Primates****Jocelyne Bachevalier****Room: Promenade Salon C & D (2nd floor)**

12:30–2:00 PM

Poster Session 3
Room: St. Louis Salon D & E (4th floor)

Emotion

1. LARSON, MJ Affect-Related Modulation of Error-Related Neural Processing.
2. SPRINGER, US Modulation of Emotional Reactivity via Semantic Knowledge of Famous Faces.
3. CHRISTMAN, SD Bilateral Eye Movements Lead to a Neutralization of Affective State.
4. BURTON, K Psychophysiology of “Biologically Prepared” Emotion Stimuli in Healthy Older Adults and Alzheimer’s Disease.
5. MOLLET, CA Affective Auditory Verbal Learning: Evidence for a Negative Emotional Bias in Hostility.
6. EVERHART, DE Luteal and Follicular Phase Related ERP Changes During the Perception of Affective Faces and Emotional Prosody.
7. KINGERY, L Emotional Perception Impairment after Right Hemisphere Stroke: Relationship and Dissociation between Auditory and Visual Modalities.
8. MCKINNON, M Autobiographical memory for a life-threatening traumatic event and September 11th in survivors of an airline accident.

Hemispheric Asymmetry/Laterality/Callosal Studies

9. VOYER, D Target Localization with Fused Dichotic Words.
10. TECHENTIN, C Dichotic Listening with Consonant-Vowel Pairs: An Examination of the Categorization Hypothesis.
11. DRAGO, V Distribution of attention as a function of spatial location: right-left; up-down.
12. PARSONS, TD Gender Differences using Neuropsychological Measures and a Crossed-Uncrossed Differences (CUD) Task in a Virtual Environment.
13. LEE, J Investigation of Hemispheric Asymmetry in the Perception and Memorization of Verbal, Visual, and Tactile Stimuli.
14. FOSTER, PS Baseline Cardiovascular Activity: Covariation with Electrophysiological Asymmetry.
15. MOES, P Gender Differences in ERP Measures of Interhemispheric Transfer Time.
16. ABEARE, C Time Course Differences in Semantic Priming in the Hemispheres and Level of Creativity.
17. BADARUDDIN, D Social and Behavioral Deficits in Children with Agenesis of the Corpus Callosum.
18. DEJONG, JE Sensory-motor Interhemispheric Transfer in Children with Callosal Agenesis.
19. MUELLER, KO Bimanual Coordination in Individuals with Agenesis of the Corpus Callosum.
20. EFROS, DB Callosal Apraxia and Tactile Anomia with Normal Pressure Hydrocephalus.
21. OFTE, SH Laterality in Male Monozygotic Twins with Language Impairments. Case Descriptions.
22. MIZUNO, T Limb Impersistence in Right Hemisphere Injured Patients Using the Blind Line-Drawing Task.
23. ROPER, BL Widespread Right Medial Cerebral Involvement Associated with Persistent Alien Hand Syndrome: Case Report.
24. YAMAMOTO, A Lateralized fMRI Activation of the Supplementary Motor Area During Productive Language Tasks: Comparison with Wada and Intraoperative Mapping.
25. HELLAND, T Degree of Hemispheric Dominance Varies with Degree of Severity of Dyslexia.
26. TAYLOR-COOKE, PA Estimates for Contralateral Strength and Stimulus Intensity are Correlated Following Unilateral Brain Injury of Both Hemispheres.

Multiple Sclerosis/ALS

27. KALMAR, JH Cognitive Deficits and Functional Status in Multiple Sclerosis.
28. PARMENTER, B Working memory deficits in Multiple Sclerosis: a comparison between PASAT and n-back measures.
29. CARONE, DA Interpreting Patient/Informant Discrepancies on Reported Cognitive Symptoms in Multiple Sclerosis: Correlation with Cognitive and Emotional Disorder.
30. RYAN, K Predictors of psychological distress among individuals with multiple sclerosis.
31. CARONE, DA Learning Inconsistency is Associated with Frontal Lobe Atrophy in Multiple Sclerosis (MS).
32. KALMAR, JH Information Processing Deficits Impact New Learning in Multiple Sclerosis.
33. CHELUNE, GJ Relative Risk of Cognitive Impairment Is Mediated by Disease Course and Sex in Multiple Sclerosis.
34. CHRISTODOULOU, C Predicting Neuropsychological Change with Baseline MRI Measures in Multiple Sclerosis Patients with Initial Cognitive Dysfunction.
35. SMITH, MM Other vs. Self-Ratings of Executive Dysfunction in MS Patients and Healthy Controls.
36. JULIAN, LJ Diffusion Tensor Imaging correlates of executive functioning in early stages of multiple sclerosis.
37. BURHART, J Comparison of Alternative and Traditional Scoring Methods for the Paced Auditory Serial Addition Test (PASAT) in MS.
38. ARNETT, P Fatigue in MS is Very Stable Longitudinally Over a Three-Year Interval.
39. BAILEY, CM Response Speed on the Computerized Assessment of Response Bias and Its Relationship to Motivation in Multiple Sclerosis.
40. BOYS, CJ Markers of Disease Progression in Late-Onset Metachromatic Leukodystrophy.
41. BRADSHAW, M Differential Verbal Fluency Deficits in Alzheimer’s Disease and Amyotrophic Lateral Sclerosis.
42. GROSSMAN, A Premorbid Personality Characteristics in Patients with Amyotrophic Lateral Sclerosis: Preliminary Findings.

Neglect

43. JEONG, Y Callosal Neglect in Hydrocephalic Patients.
44. WOODS, AJ Severe Executive Dysfunction is a Component of Left but Not Right Neglect on Cancellation.
45. WOODS, AJ A Broad Spectrum of Cognitive Deficits in Neglect.
46. BARRETT, AM Neglect allokinesia on the line bisection task.

47. FINNEY, GR Co-occurrence of Ipsilesional Neglect and Progressive Hypometria.

Visuospatial Processing

48. ROYAN, J The Visual Imagery Transformation Questionnaire (VITQ): A New Measure of Mental Transformation.
 49. MCMONAGLE, P Examination of Posterior Cortical Atrophy (PCA) Using the Object, Face and Color Agnosia Screen (OFCAS).
 50. NIKI, C Motor Images and Body Schema in Patients with Parietal Brain Tumor: Comparison Between Pre- and Post Operational Stage.
 51. BALL, TD Associations Between Neuropsychological Measures and Performance on the Benton Facial Recognition Test Based on the Hypothesized Encoding Strategies Employed.
 52. DAVIDSDOTTIR, S Qualitative analysis of visuospatial dysfunction in Parkinson's disease.

1:15–3:15 PM

Featured Symposium

Neuropsychology from the Bench to the Clinic: A Symposium Honoring the Contributions of Louis Costa to Neuropsychology

Chair: Jill B. Rich

Speakers: Campbell Clark, Elkhonon Goldberg, Alex Martin, Allen Yozawitz

Room: Promenade Salon A & B (2nd floor)

1:15–3:15 PM

Symposium 5

Early Detection of Preclinical and Early Stage Alzheimer's Disease

Chair and Discussant: David Johnson

Room: Promenade Salon C (2nd floor)

1. FAGAN, AM CSF and Proteomic Biomarkers for AD in Human Subjects.
 2. HEAD, D Structural Neuroimaging in Nondemented Aging and AD.
 3. MINTUN, M Imaging Human Brain Amyloid Plaques with PET.
 4. STORANDT, M Personality Change Precedes Clinical Diagnosis of Dementia of the Alzheimer Type.

1:15–3:15 PM

Paper Session 4

Adult TBI-Outcome Studies

Room: Promenade Salon D (2nd floor)

1. SHERER, M Comparison of Indices of Severity of Traumatic Brain Injury.
 2. BAILEY, CM Visual Memory Predicts Concussion Status Independent of Verbal Memory and Post-Mild Traumatic Brain Injury Symptoms in College Athletes.
 3. ASHMAN, T Cognitive Performance and Fatigue after TBI.
 4. LARSON, MJ Temporal Dissociation of Components of Cognitive Control Dysfunction in Chronic Moderate-to-Severe TBI: An ERP Analysis.
 5. COVEROVER, Y Self-generation to Improving Learning of Everyday Functional Tasks in Multiple Sclerosis and Traumatic Brain Injury.

2:15–3:45 PM

Poster Session 4

Room: St. Louis Salon D & E (4th floor)

Child - Acquired Disorders

1. HERSHEY, T Hypoglycemia, Hyperglycemia and Age of Insult Effects on Spatial Memory in Children with Type 1 Diabetes Mellitus (T1DM).
 2. WARREN, SL Spatial Memory, Hippocampal Volumes, Severe Hypoglycemia (SH) and Hemoglobin A1c (A1c) Levels in Children with Type 1 Diabetes Mellitus (T1DM).
 3. ANDERSON, VA Pediatric MS vs ADEM, More in Common than just the Letter M? Analysis and Comparison of Cognitive Features.
 4. PODRAZA, A Neuropsychological Decline in Juvenile Batten Disease: A Longitudinal Case Study.
 5. MISH, SJ Investigation of Children Treated for Congenital Toxoplasmosis: A Follow-up Study from a Toxoplasmosis Outbreak.
 6. KRIVITZKY, LS Neuropsychological Functioning in a Case of Juvenile Parkinsonism.
 7. MACALLISTER, WS Comparison of Memory Performance in Pediatric MS and Acute Disseminated Encephalomyelitis.
 8. LEJEUNE, BC Language and Behavior in Children with a First Recognized Seizure.
 9. NASH, K Emotion Processing in School-Age Children with Prenatal Cocaine Exposure.
 10. GUSTAFSON-DEBASTOS, AK The Neuropsychological Outcome of Preterm-Birth Preschoolers Diagnosed with Mild Perinatal Intracranial Hemorrhage.
 11. WAKEMAN, DG Sleep Apnea Changes the Brain's Processing of Syllables in Children.
 12. TUREK, JM Neurobehavioral Profile of Long-Term Survivors of Acute Lymphoblastic Leukemia (ALL): Increased Compliance and Decreased Metacognitive Skills.
 13. MAHONE, M Motor and Perceptual Timing Deficits Among Survivors of Childhood Leukemia.

14. BERNABEU, J Aphonic palilalia after transient mutism following cerebellar medulloblastoma resection in a child.
15. RENNIE, KM Inhibitory Control Following Stroke in Pediatric Patients with Sickle Cell Disease.
16. TARAIZI, R Neuropsychological Functioning in Preschool-age Children with Sickle Cell Disease: The Role of Illness-related and Psychosocial Factors.
17. ANDERSON, EJ Fronto-Behavioral Deficits Associated with Childhood Undiagnosed Lyme Disease: A Case Study.
18. BENJAMIN, M BASC Parent and Self-Report Ratings in Pediatric TBI: Pilot Data Examining Rater Differences.
19. STOTT, HD Behavior and Mood Change in Children Following Surgical Intervention for Treatment of Intractable Epilepsy.
20. BLAINE, D Risk Factors for Mental Retardation in Children with Epilepsy and Patterns of Functional Skill.
21. SULI, E Behavioral Disorders in Children with Intractable Epilepsy.
22. KESSOUS, M Psychosocial Functioning and Seizure Variables in Pediatric Epilepsy.
23. HERMANN, BP Neuropsychological Status of Children With New Onset Epilepsy.
24. KATZENSTEIN, J Reading Underachievement in Children with Epilepsy.
25. FASTENAU, PS Academic Achievement Among Children with Epilepsy: Rates of Learning Disability and Relationship to Seizure Variables.

Epilepsy

26. BREIER, JJ Atypical Language Representation in Patients With Chronic Seizure Disorder and Academic Achievement Deficits Using Magnetoencephalography.
27. NEAL, T Effects of Duration of Disorder and Seizure Control Status on Objective Neuropsychological Performance versus Subjective Self-Appraisal in Children with Epilepsy across Six Cognitive Domains.
28. BEST, TL Relationship Between Hemisphere of Seizure Surgery and Performance on the Wechsler Scales.
29. CARSWELL, MA Meta-analysis of Olfactory Functions in Surgical and Non-surgical Epilepsy Patients.
30. PRAMATARIS, P Reliability and Validity of a Three-Category Semantic Fluency Task in Partial Epilepsy Patients.
31. JONES, JE Screening for Major Depression in Epilepsy Using Common Self-Report Depression Inventories.
32. PRICE, C Circadian Cortisol Rhythms after Right or Left Temporal Lobectomy.
33. WITGERT, ME Panic Symptoms in Nonepileptic Seizures.
34. TESTA, S Correlates of Health-related Quality of Life in Epileptic and Psychogenic Nonepileptic Seizures: Mood Symptoms, Personality Factors, and Neurocognitive Functioning.
35. DULAY, MF Relationship Between Memory and Depression After Anterior Temporal Lobectomy.
36. DULAY, MF Contribution of Frontal Lobe Functions to Episodic Memory in Medically Intractable Epilepsy.
37. BUSCH, RM The Impact of Depression and Anxiety on Pre- and Post-Surgical Memory Functioning in Adults with Temporal Lobe Epilepsy.
38. PARRISH, J Recognition and Identification of Famous Faces Following Anterior Temporal Lobectomy.
39. NAKHUTINA, L Three-Year Test-Retest Reliability and RCI Values for Memory Indices for Temporal Lobe Epilepsy.
40. WINSTANLEY, F Post-Operative Verbal Memory and Language Impairment in Left Anterior Temporal Lobectomy patients with a Reversed and Expected Wada Memory Asymmetry Score: Examining Reliable Change Indices.
41. BAYLESS, K A Quantitative MRI Study of Cerebellar Atrophy in Temporal Lobe Epilepsy.
42. SITZER, TE Herpes Zoster and Epilepsy: A Neuropsychological Case Report.

Medical Illness

43. KELLY, MP Time Course of Neuropsychological Recovery with CPAP Treatment.
44. HOPKINS, RO Neurocognitive Impairments in ICU Patients with Prolonged Mechanical Ventilation.
45. ZIMMERMAN, ME Intermittent Hypoxemia and Learning and Memory in Sleep Apnea.
46. ZIMMERMAN, ME Neuropsychological Functioning in Sleep Apnea.
47. CRAGAR, D Comprehensive Neuropsychological Evaluation in Patients with Primary Brain Tumors and Subjective Cognitive Complaints.
48. COLLINS, RL The Effects of Interferon-alpha and 13-cis Retinoic Acid on the Cognitive Function of Adults with Aggressive Squamous Cell Carcinoma.
49. SITZER, TE Neuropsychological Presentation of a Third Ventricle Tumor.
50. STEWART, AF Cognitive Difficulties among Breast Cancer Survivors following Adjuvant Chemotherapy: A Meta-Analysis.
51. RIGGS, R Neuropsychological Functioning, Fatigue, and Sleep in Breast Cancer Patients.
52. MADAN, A Verbal Memory Functioning and End Stage Liver Disease: the Consequence of Excessive Alcohol Consumption beyond Hepatic Insufficiency Alone.
53. NETSON, KL Memory and Executive Function in Elderly Patients with End-Stage Liver Disease.
54. HILSABECK, RC Frontal-Subcortical Functioning in Patients with Chronic Hepatitis C and the Effect of Antiviral Therapy.
55. WEN, JH Neuropsychological Sequelae of Mitochondrial Neurogastrointestinal Encephalomyopathy (MNGIE): Case Report.
56. SCHATZ, J Cerebral infarct volume, brain morphology, and cognitive functioning in sickle cell disease.
57. KEARNEY, L Cognitive Impairment in Systemic Lupus Erythematosus: Hispanics and Caucasians Compared to Normal Controls.
58. HOLLIDAY, S Change in Cognitive Function Over Time in Newly Diagnosed SLE: Brain CONNECTIONS.
59. BOYS, CJ CNS Effects of Myotonic Dystrophies Types 1 and 2.
60. FESTA, JR Reversal of Hemodynamic Failure Improves Neuropsychological Function in Moya-Moya Disease.
61. WICKLUND, A MMPI-2 Patterns in Electrical Injury: A Controlled Investigation.
62. BALDERSTON, CC Neuropsychological, Clinical, and MRI findings of an Adult with Joubert Syndrome.
63. LACY, M Long Term Neurocognitive Impact Of Nonsiphoning Shunt Placement.
64. SCHRETLEN, DJ Serum Uric Acid and Cognitive Functioning in a Community Sample.

65. FLYNN, TB Outcome Following Repair of Total Anomalous Pulmonary Venous Connection (TAPVC): Exploration of Resilient and Vulnerable Neuropsychological Functions.
66. BELL, BD Normal IQ in a 55-Year-Old with Newly Diagnosed Rhombencephalosynapsis.

3:30–5:30 PM**Symposium 6****Cultural Considerations in Neuropsychological Research and Practice****Chair: Jennifer Manly, Discussant: Ruben Echemendia****Room: Promenade Salon A & B (2nd floor)**

1. CHERNER, M Issues of Cultural and Linguistic Diversity in the Neuropsychology of HIV Infection.
2. ECHEMENDIA, RJ Cultural Factors in the Assessment of Patients with TBI/MTBI.
3. HARRIS, JC Cognitive Assessment with Ethnoculturally Diverse Examinees.
4. MANLY, JJ Challenges in Assessing Cognitive Status and Accurate Detection of Dementia among Ethnically Diverse Elders.
5. WHITE, DA Pediatric Sickle Cell Disease: Stroke, Cognitive Outcome, and Race.

3:30–5:30 PM**Symposium 7****Personality Change following Traumatic Brain Injury: Nature, Prevalence, and Measurement****Chair: James Malec, Discussant: Muriel Lezak****Room: Promenade Salon C (2nd floor)**

1. RUSH, B Early and Late Standardized Personality Profiles after Mild and Moderate-Severe Traumatic Brain Injury compared to Orthopedic Controls.
2. MALEC, JF Prediction of Self-rated and Significant Other-rated Outcome after TBI by Standardized Personality Assessment.
3. TATE, RL Assessing Characterological Changes after Traumatic Brain Injury: Comparison Between a Standardised Personality Questionnaire and an Injury-Specific Rating Scale.
4. BUFFINGTON, AL Discrepancies in Self- vs. Informant-Rated Neuroticism and Openness Correlate with Psychosocial Outcome Following TBI.

3:30–5:30 PM**Paper Session 5****Learning Disabilities/ADHD****Room: Promenade Salon D (2nd floor)**

1. WISE, J Receptive Vocabulary Skills and the Development of Phonological Awareness in Children with Reading Disabilities.
2. TUNICK, R Cognitive Overlap between Reading Disability and Speech Sound Disorder: A Test of the Severity Hypothesis.
3. BOLlich, AM Executive Linguistic Functioning Differences in Children with Dyslexia and ADHD.
4. WILLIAMS, BR Reaction Time Performance in Adolescents with Attention Deficit Hyperactivity Disorder (ADHD): Evidence of Inconsistency in the Fast and Slow Portions of the RT Distribution.
5. SELKE, C Affective Modulation of the Startle Reflex in Children with Attention-Deficit/Hyperactivity Disorder.
6. VAURIO, R Organization of Semantic Memory in Children with Attention-Deficit/Hyperactivity Disorder.

3:30–5:30 PM**Paper Session 6****Mild Cognitive Impairment and Preclinical Dementia****Room: Promenade Salon E & F (2nd floor)**

1. AU, R Defining amnesic MCI in the Framingham Offspring Study.
2. HAYDEN, KM Detection of Pre-clinical Vascular Dementia and Alzheimer's Disease in Population Samples: The Cache County Memory Study.
3. WARREN, LH Relationship of Mild Cognitive Impairment to Other Preclinical Dementia Constructs: The Cache County Memory Study.
4. MURPHY, KJ Lower Semantic than Phonemic Fluency Characterizes Mild Cognitive Impairment and Alzheimer's Disease.
5. STERN, Y PET Measure Of Functional Connectivity Predicts Progression In Individuals With Minimal To Mild Cognitive Impairment (MMCI).
6. KRICKORIAN, R Phytoestrogen Supplementation and Cognitive Function in Menopausal Women with Mild Cognitive Impairment.

4:00–5:30 PM**Poster Session 5****Room: St. Louis Salon D & E (4th floor)****Assessment/Psychometrics**

1. KELLY, MP Expanding Training Opportunities in Clinical Neuropsychology through the Use of the Videoteleconference.
2. RIEMENSCHNEIDER, L The Next Best Thing To Being There: A Pilot Study of Neuropsychological Testing Via Low-bandwidth Telemedicine Technology.

3. QUINTIN, G Measuring Attention in an Ecologically Valid Virtual Environment.
4. DONINGER, N Measurement Properties of the Neurobehavioral Cognitive Status Examination in Acute and Post-Acute Traumatic Brain Injury.
5. YANTZ, CL Comparison of the Heaton, et al. Demographically Adjusted Deficit Scale and the Reitan and Wolfson Neuropsychological Deficit Scale Scores in a Sample of Litigating Adults.
6. PARK, AH Six Year Case Study of Serial Neuropsychological Assessments and Repeated Quantitative Electroencephalogram (QEEG) Readings after Accidental Electric Shock.
7. STEGMAN, RL Incremental Validity of Additional Tests when Administering the Repeatable Battery for the Assessment of Neuropsychological Status.
8. SUHR, J Brief Neuropsychological Assessment in the Prediction of Everyday Functional Abilities of Older Adults.
9. NOGGLE, CA Predicting Neurological Impairment with the Dean-Woodcock Sensory Motor Battery.
10. DAVIS, AS Classification and Regression Tree Analysis of the Dean-Woodcock Sensory-Motor Battery with Neurologically Impaired and Normal Individuals.
11. MCBURNEY-REBOL, K Assessment of Social Information Processing: Behavioral and Autonomic Responses to the Thematic Apperception Test.
12. SPENCER, RJ A new screening test of psychomotor speed: The timed alphabet-writing task.
13. GIOVANNETTI, T A Comparison of Two Scoring Methods for Naturalistic Action Assessment.
14. ORME, D A Case for Aviator-Specific Norms.
15. SPENCER, RJ The Symbol-Digit Modalities Test: incidental learning performance.
16. TAN, J Influence of Impending Death on the Mini-Mental State Examination.
17. SCHMIDT, K Validity of the Dementia Rating Scale-2: Alternate Form.
18. SALVATIERRA, JL The Influence of Education on the Mini-Mental State Examination in a Hispanic Elderly Population.
19. HAMILTON, LJ Behavioral Dysregulation as a Function of Age and Task Complexity.
20. REDFIELD, J Demographically Corrected WMS-III Scores For Ethnic Minorities: Use With Caution, If At All.
21. O'BRYAN, SE Discrepancies Between Self-Reported Level of Education and Estimated Reading Level: Potential Implications for Neuropsychological Test Interpretation.
22. FRAKEY, L Identifying Deficits in Spatial Abilities Following Right Medial Temporal Lesions.
23. PARADEE, C Short Form of the Morningness/Eveningness Questionnaire Among Rehabilitation Inpatients.
24. GOLDSTEIN, FC Direct Assessment of Functional Status: A Cultural Bias?
25. LOWERY, DP Subtle attention impairments in the absence of dementia provide sensitive predictors (7- fold increased risk) and markers of post operative Delirium.
26. KINGERY, LR Word and Design Fluency Constitute a Distinct Cognitive Factor.
27. KINGERY, LR Inter-Rater and Test-Retest Reliability of the Design Fluency Test.
28. SCHRETLEN, DJ Inter-Rater Reliability, Construct Validity, and Normative Data for the Clock Drawings of Normal Adults.
29. RUEDA, AD Components of Clock Drawing Performance Bear Different Relations to Cerebral Pathology.
30. CHERVINSKY, AB Attention: Test Performance of Clinical and Forensic Groups, Intraindividual Variability.
31. HUSKEY, M The Experience of Malingering: Test Performance, Coaching, and Strategy Utilization.
32. HUSKEY, M Warning Participants About the Existence of Malingering Tests: Timing, Test Performance, and Face Validity.
33. GALLO, LA A Rare Disorder or Malingering? A Case Study.
34. SUHR, J The Validity of the Letter Memory Test as a Measure of Malingering: Robustness to Coaching.
35. BARRASH, J Assessing Credibility of Neuropsychological Performances of Gulf War Veterans and Military Controls Participating in Research on Gulf War Syndrome.

Forensic Neuropsychology/Malingering

36. TRAHAN, DE Reliable Digit Span: Base Rates of Impairment in Normal Adults and Patients with Known Neurological Disease.
37. PUENTE, A The Influence of Attentional Problems in a Malingering Test.
38. HO, M The Performance of Taiwanese Stroke and Head-injured Patients on Choice Reaction Time Tasks for Detecting Simulated Cognitive Impairment.
39. SPARROW, EP Detecting Attention-Deficit/Hyperactivity Disorder (ADHD) Among Adult Offenders with the Conners Adult ADHD Rating Scale (CAARS).
40. TWEEDY, K Use of the California Verbal Learning Test Second Edition (CVLT-II) Forced Choice Recognition Subtest in Detecting Suboptimal Effort on Neuropsychological Evaluation.
41. BERRY, DT Known-Groups Cross-Validation of the Letter Memory Test in a Compensation-Seeking Mixed Neurological Sample.
42. SILVERBERG, N Further Validation of the Expanded Auditory Verbal Learning Test for Detecting Poor Effort and Malingering: Data from Temporal Lobectomy Candidates.
43. SPIEGEL, E The Rey 15-Item Memorization Test: Performance in Under-Represented Populations in the Absence of Obvious Motivation to Feign Neurocognitive Symptoms.
44. BOONE, KB Comparison of various RAVLT recognition scores in the detection of noncredible memory performance.
45. PEDRAZA, O Relationship between Intellectual Ability and Malingering on the LMT, WMT, and CARB.
46. WHITESIDE, D Criterion Validity of the Rarely Missed Index: Correlation with the Test of Memory Malingering (TOMM).
47. ASHENDORE, L Item Consistency on the TOMM.
48. HABER, AH Cross-Validation of the TOMM in a Compensation-Seeking Sample.
49. CAMPBELL, Z The Dementia Rating Scale-2: A Potential Measure for the Detection of Cognitive Dissimulation.
50. DENBOER, J Performance Characteristics and Detection Rates of Successful Malingering.
51. PEDRAZA, O Classification Accuracy of Malingering Measures in a Yoked Control Group Design.
52. MARSHALL, PS Performance of Mentally Retarded Patients on Five Common Tests of Malingering.
53. LARRABEE, GJ Depression vs. Malingering: Change in Zeitegeist, Change in Diagnosis.

- 54. BERRY, DT Cross-Validation of NEO-PI-R Validity Scales for Detection of Feigned Psychological Symptoms.
- 55. MCCARTHY, J A Comparison of MMPI-2 Symptom Validity Scales with Mild Traumatic Brain Injury Litigants Versus Migraine and Chronic Back Pain Patients.
- 56. BUBB, C Cross Validation of the Minnesota Multiphasic Personality Inventory - 2nd Edition(MMPI-2)Malingering Cut-Off Scores in Coached Traumatic Brain Injury Malingering.
- 57. BAUER, L The MMPI-2 Fake Bad Scale (FBS) for Detection of Incomplete Effort on Neuropsychological Testing.
- 58. FOLEY, JM Neuropsychological Impairment as a Confound in the Interpretation of the Minnesota Multiphasic Personality Inventory, Second Edition, Infrequency Scale.
- 59. CLARK, JA Possible Contribution of MMPI-2 Validity Indicators to the Detection of Malingered Neurocognitive Dysfunction.
- 60. ARNOLD, GL Prevalence, Fake Bad Scale Scores, and Noncredible Performance in Litigating and Non-litigating Patients with 1-3/3-1 MMPI-2 Code-type.

FRIDAY, FEBRUARY 4, 2005

8:30–10:00 AM

Poster Session 6
Room: St. Louis Salon D & E (4th floor)**Alzheimer's Disease**

1. ARANGO, JC Cortical and Subcortical Diseases: Do True Neuropsychological Differences Exist?
2. KAUSHIK, T Validation of the HeadMinder™ Dementia Screening Battery, DSB, – A 10-minute Computerized Screening for Primary Care.
3. BENGE, J Principal Axis Factor Analysis of the Alzheimer's Disease Assessment Scale.
4. MASSMAN, P Longitudinal Analyses of Alzheimer's Disease Assessment Scale Subtests in Large Samples of Mildly and Moderately Demented Patients.
5. GRANT, DE Cognistat References scores in Alzheimer's Disease at Different Levels of Severity.
6. DAVIS, AS The Predictive Ability of Neuropsychological Assessment and Single Photon Emission Computed Tomography in Differentiating Cerebral Perfusion Deficits in Dementia of the Alzheimers Type.
7. CROMER, JR Prediction of Alzheimer's Patients' Future Mental State Using the Groton Maze Learning Test©
8. VILLANUEVA, MR Caregiver Ratings of Cognitive Function of Patients Being Evaluated for Possible Dementia: Relationship to Objective Test Findings.
9. REED, BR Variability of Neuropsychological Profiles in Autopsy-defined "Pure" Alzheimer's Disease.
10. CUSHMAN, LA Psychophysical and Neuropsychological Measures Predict Navigational Ability in Alzheimer's Disease.
11. DEY, S Just Because I Got Lost Doesn't Mean I Can't Drive: A Neuropsychological Analysis of Driving in Patients With Alzheimer's Disease.
12. BHALLA, RK Alzheimer's Disease Patients' Self-ratings of Anxiety Before and After an On-Road Standardized Driving Test.
13. READY, RE Factor Structure of Patient and Informant Ratings on the Dementia Quality of Life Instrument.
14. SESTITO, N Using the Naturalistic Action Test (NAT) to Assess Everyday Action in Healthy Older Adults and Patients with Dementia.
15. GRISS, ME The Influence of Depression and Cognition on Daily Functioning in Dementia Patients.
16. VILLANUEVA, MR Patients Referred for Evaluation of Dementia with Significant Depressive Symptoms have more Cognitive and Behavioral Problems Than those with Few Depressive Symptoms.
17. HOLTZER, R Function But Not Cognition Predicts Depression in Alzheimer Disease (AD).
18. SUHR, J Perceived Threat of Alzheimer's Disease (AD) and its Association with Personal AD Experience.
19. MILLER, SK Persistence of Asymmetric Deficits in a Patient with Autopsy-Proven Alzheimer's Disease.
20. CRAGAR, DE Good Memory Performance Attenuates Risk of Dementia Associated with Age and Family History.
21. HOWIESON, DB Temporal Lobe Correlates of Memory Processes in Alzheimer Patients.
22. LIBON, DJ The Prototypicality of Extra-List Intrusion Errors Produced on a Serial List Learning Task by Patients with Mild Dementia.
23. ROGERS, SA Verbal Memory Among Those at Risk for Alzheimer's Disease.
24. HUA, M Semantic Memory Deficits in Low-Educated Patients with Alzheimer's Disease.
25. ZEC, RF Well-Preserved Picture Recognition Memory in the Majority of Patients with AD in the Mild to Moderate Stages of Dementia.
26. GIOVANNETTI, T The Influence of Personal Experience on Object Naming and Semantic Knowledge in Alzheimer's Disease and Mixed Dementia.
27. WETTER, SR Deficits in Inhibition and Flexibility Are Associated with the APOE-E4 Allele in Nondemented Older Adults.
28. ANAND, R Dissolution of Discourse Gist in Early Stages of Alzheimer's Disease.
29. ALLY, B The endogenously evoked P50 potential in patients with Alzheimer's disease and their biological children.
30. HORNE, NR Differential White Matter Abnormalities and Hippocampal Atrophy in Young-Old and Very-Old with Alzheimer's Disease.
31. SUNDERMANN, EE The Effect of Estrogen Replacement Therapy on Recognition Memory for Olfactory and Visual Stimuli in Female Patients Diagnosed with Alzheimers Disease

Executive Functions/Frontal System

32. CAREY, EC Age Related Cognitive Trends in the Maturation of the Prefrontal Cortex.
33. TOLAR, TD Math Fluency, Working Memory Capacity, and Inhibition in College Students Referred for Learning Difficulties.
34. WELSH, M Formal Operational Thought and Executive Functions in College Freshmen and Seniors.
35. WELSH, M Dietary Restraint and Working Memory Performance in Male and Female College Students.
36. BOEKA, A Executive Functioning Deficits in Women with Bulimia Nervosa.
37. FRIEDRICHSEN, HJ Performance on the Iowa Gambling Task Declines with Age and Predicts Outcome on Other Measures of Executive Functioning.
38. SUHR, J Personality Dimensions Associated with Performance on the Iowa Gambling Task.
39. BROWN, LB Frontal Systems Behavioral Functioning in Unipolar Depression, Bipolar Disorder, and Frontal Systems Damage.
40. VERDEJO, AJ The Role of the Personality Traits of Sensitivity to Reward and Punishment on the Decision-making Deficits of Substance Abusers.
41. SHELTON, A The Neurocognitive Effects of Alcohol-Related Blackouts.
42. SUHR, J The Relation of Substance Use to Decision Making Ability in a Nonclinical Sample.
43. RANDALL, K Multimodal Response Inhibition using a Computer Conflict Paradigm.

44. WATSON, W Reexamination of the Interhemispheric Transfer Hypothesis of Switching (ITS).
45. EASTVOLD, A The Trail Making Test - Part B and its Relationship to the Prefrontal Cortex.
46. MARTIN, CR The Effect of Executive Function on Use of Semantic Clustering.
47. ROTH, RM Initial Development of a Behavior Rating Inventory of Executive Function for Adults.
48. SKEEL, R The Prediction of Risk-Taking Behavior: Personality Variables Versus Behaviorally Based Measures.
49. DAWSON, D The Ecological Validity of the Multiple Errands Test - Hospital Version: Preliminary Findings.
50. GIBBS, MC Assessing Executive Dysfunction Across Neuropsychological Domains.
51. FOLEY, JM The Sensitivity and Specificity of the WCST to Detect Executive Dysfunction in Adults.
52. KANG, Y The Relationship between Frontal Lobe Functions and Intelligence: Comparisons of the College Students, the Normal Elderly, and the Parkinson's Disease Patients.
53. GLEASON, AC Personality and Behavior Changes in Patients with Primary Brain Tumors.
54. KANZ, JE The relationship between decision making and self control in incarcerated offenders.
55. MARGOLIS, A Interhemispheric Connectivity and Executive Functioning In Adults with Tourette's Syndrome.
56. KLEIN, FE Self-Reported Impulsivity and Executive Difficulty in Healthy Adult Smokers.
57. SLACHEVSKY, A Neuroanatomical Correlates of Behavioural Dysfunction and Dysexecutive Syndrome in Patients With Prefrontal Lesions: Preliminary Results.
58. STRATTON, B Age Differences in Concept Formation.

8:45–10:15 AM**Featured Debate****Does Neuroimaging Provide Any Benefits for Rehabilitation?****Elizabeth Glisky ("yes") versus Barbara A. Wilson ("no")****Moderator and Discussant: Michael Kopelman****Room: Promenade Salon A & B (2nd floor)****8:45–10:15 AM****Paper Session 7****HIV/AIDS****Room: Promenade Salon C (2nd floor)**

1. LLORENTE, AM Effects of Polymorphisms of Chemokine Receptors CCR2 and CCR5 on Neurodevelopment and the Onset of Encephalopathy in Children with Perinatal HIV-1 Infection.
2. PARSONS, TD Prevalence and Incidence of Neurocognitive Impairment in users of HAART.
3. MARTIN, E Prospective Memory and Risk Behavior in HIV-Infected Drug Users: A Preliminary Report.
4. MARTIN, E Working Memory Performance in HIV-Seropositive MDMA Users.

8:45–10:15 AM**Paper Session 8****Epilepsy****Room: Promenade Salon D (2nd floor)**

1. LEE, GP Level of Preoperative Ability Predicts Postoperative Memory Decline in Pediatric Epilepsy Surgery Patients.
2. FARGO, J Clinical Neuropsychological Versus Statistical Prediction of Seizure Organicity.
3. LINEWEAVER, TT "Wada" Small Difference the Wada Test Makes in Predicting Memory Outcome Following Anterior Temporal Lobectomy.
4. SABSEVITZ, DS Predicting Verbal Memory Outcome Following Left Anterior Temporal Lobectomy Using fMRI.

8:45–10:15 AM**Paper Session 9****Emotion and Laterality****Room: Promenade Salon E & F (2nd floor)**

1. WOOD, S The Negativity Bias is Eliminated in Older Adults: Age-Related Reduction in Event-Related Brain Potentials Associated with Evaluative Categorization.
2. PENDERGRASS, J A Comparison of Neural Structures Involved in Emotion and Motor Inhibition.
3. BOWERS, D A Cortico-Motor Hypothesis for Face Expression Asymmetries: Converging Data from TMS and Face Digitizing.
4. BOWERS, D Lateralized Asymmetry in Motor Control over the Lower Face: A TMS-MEP Study.

10:15 AM–12:00 PM**Poster Session 7****Room: St. Louis Salon D & E (4th floor)****Dementia: Primary Progressive Aphasia, Frontotemporal Dementia, Vascular Dementia**

1. FINNEY, GR Artwork Before and After Onset of Primary Progressive Aphasia.
2. JACOBS, ML An Unusual Presentation of Primary Progressive Aphasia?

3. HUH, T Relationship Between Structural Changes on MRI and Naming in SD vs. FTD, AD, and PPA.
4. QUITANIA, L Which Cognitive Domains Best Predict Daily Functioning in Alzheimer's Disease and Frontotemporal Dementia?
5. MCKINNON, M Further evidence of deficits in social reasoning in patients with frontotemporal lobar dementia.
6. SPRENG, R Career Selection in Frontotemporal Lobar Degeneration: Relationship to Localization of Atrophy.
7. SPITZNAGEL, MB Cognitive Reserve Moderates the Relationship Between Depression and Awareness of Deficits in Dementia.
8. KANG, Y The Relationship between Depression and Cognitive Functions in Vascular Dementia.
9. MOELTER, S Dissociation of Semantic and Phonemic Fluency in Dementia.
10. WESTERVELT, H Differential Odor Identification Performance in Dementia Subtypes.
11. KLANG, O Different Profiles on Rey Auditory Verbal Learning Test (RAVLT) Indicate Different Profiles of General Cognitive Impairment in a Mild Cognitive Impairment (MCI) Population.
12. CARONE, DA Severe Bilateral Temporal Lobe Atrophy and Amnesia in a Case of Lymphomatoid Granulomatosis Confined to the Brain.

Developmental Disorders

13. DIXON, PE Presence of DSM-IV Criteria in Two-year olds with ASD.
14. DEWEY, D Motor and Praxis Skills in Children with Autism Spectrum Disorder: A Comparison with Developmental Coordination Disorder.
15. GIBBS, MC Toward a Neuropsychological Explanation of Repetitive Behavior in Children with Autism Spectrum Disorders.
16. HILLIER, A Autism Spectrum and Susceptibility to the Visual False Memory Effect.
17. PANDEY, J Detecting Autism Spectrum Disorders in Young Siblings of ASD Children.
18. ESSER, E Predictors of Diagnosis in Four-year-olds with Symptoms of Autism Spectrum Disorders.
19. BOORSTEIN, HC Predictors of Cognitive Functioning in Children with Autism Spectrum Disorders.
20. PROVENCAL, SL Basal Ganglia Morphometry in Autism With and Without Attention Deficit/Hyperactivity Disorder.
21. MILLER, M Frontal Lobe Development in Autism Relative to Head Size.
22. KENWORTHY, L Why are tower tasks difficult for children with autism?
23. WOLF, JM Awareness Threshold for Face Processing in Individuals with Autism.
24. LOCASCIO, G Lateral Ventricle Enlargement in Children with High Functioning Autism.
25. CROCETTI, D Impaired Rotary Pursuit Learning in Children with High-Functioning Autism.
26. O'CALLAGHAN, C Comorbidity in Asperger Students Detected through Simultaneous Electronic Monitoring (SEM).
27. KLEIN-TASMAN, B Early Williams Syndrome Phenotype: Heightened Startle Reactivity?
28. PHILLIPS, K Investigation of the Williams Syndrome Personality Phenotype Using the Children's Behavior Questionnaire.
29. HINTON, VJ Selective Phonological Processing Deficits in Children with Duchenne Muscular Dystrophy.
30. CYRULNIK, S Early Language and Social Deficits in Duchenne Muscular Dystrophy.
31. WILSON, LB Overview of the M-CHAT.
32. KELLY, KG Divergent Neurocognitive Patterns in Siblings with Myelomeningocele.
33. ROVET, JF Functional Dissociation of Individual Working Memory Components.
34. EVIATAR, Z Developmental Right Hemisphere Syndrome and Hemispheric Asymmetry for Emotion Identification, Face Identification, and Lexical Decision.
35. VOELBEL, G Neurocognitive Abilities and Caudate Nucleus Volumes: Is There a Relationship?
36. BRANDLING-BENNETT, E Semantic Fluency in Children with Early-Treated Phenylketonuria.
37. MOES, P Agenesis of the Corpus Callosum: Physical, Sensory and Motor Characteristics.
38. WARSCHAUSKY, S Neuropsychological Correlates of Social Adjustment in Children with Congenital Neurodevelopmental Conditions.
39. AHMAD, SA Intellectual Subtypes of Children and Adolescents with Mental Retardation.

Imaging Studies of Brain Function

40. IRANI SIVASEGARAN, F Preliminary Validation of fNIR using BOLD Response.
41. PULSIPHER, DT Basal Ganglia Morphology following Carbon Monoxide (CO) Poisoning.
42. NOONAN, SK A Frontoparietal System For Source Memory Identified By Functional Connectivity MRI.
43. PRICE, C Quantification of White Matter Alterations: A Reliability Analysis.
44. NAGEL, BJ The Role of Prefrontal White Matter Volume on fMRI Response to a Spatial Working Memory Task Across Adolescent Development.
45. ZIMMERMAN, ME Thalamic Volume and Neuropsychological Functioning in Healthy Adults.
46. BERNAL, B Role of the Anterior Cingulate Cortex in Stroop Tasks.
47. MEYER, SM A Voxel-Based Morphometric Investigation of Cognitive Estimation by Healthy Adults.
48. WABNITZ, A fMRI Reveals Subcortical Activations Bridge The Stimulus-Response Interval During Word Generation By Non-fluent Aphasics.
49. CUTTING, L fMRI of the Judgment of Line Orientation in Neurofibromatosis Type-1 (NF-1), RD, and Control Groups: Preliminary Findings.
50. PERSCHLER, P Brain Areas Subservicing Figural Versus Verbal Encoding.
51. JOVANOVSKI, D The Neurological Correlates of a Novel, Ecologically-Valid Set Shifting Task.

10:30 AM–12:30 PM**Symposium 8****Methodological Challenges in the Measurement of Social Cognition and Social Behavior****Chair: Seth Warschausky, Discussant: Keith Yeates****Room: Promenade Salon A & B (2nd floor)**

1. DENNIS, M
2. WARSCHAUSKY, S
3. TURKSTRA, L

Social Cognition Involves Both Affect and Cognition.
 Methodological Issues in the Assessment of Social Problem Solving.
 Participatory Action Research as a Model for Generating Research Stimuli.

10:30 AM–12:30 PM**Symposium 9****Measurement of Prospective Memory using the Memory for Intentions Screening Test****Chair: Sarah Raskin, Discussant: Elizabeth Glisky****Room: Promenade Salon C (2nd floor)**

1. MATEER, CA
2. TWAMLEY, EW
3. WOODS, SP
4. BEAUVAIS, J

Remembering to remember: The impact of age, injury status, and other cognitive abilities on prospective memory.
 Prospective Memory in Schizophrenia.
 Prospective Memory in HIV-1 Infection.
 Prospective Memory and Adherence to Prescribed Medication.

10:30 AM–12:30 PM**Paper Session 10****Parkinson's Disease and Huntington's Disease****Room: Promenade Salon D (2nd floor)**

1. JOHNSON, SA
2. DUFF, K
3. HOTH, K
4. ANAKI, D
5. DULAY, MF
6. MOBERG, PJ

Motor, cognitive, and psychomotor symptoms in individuals at-risk for Huntington's Disease.
 Executive Dysfunction in Pre-Symptomatic Huntington's Disease.
 Awareness of Executive Dysfunction in Presymptomatic Huntington's Disease is Associated with MRI and Psychiatric Measures.
 Recognition Memory in Normal Aging and Parkinson's Disease: Differential Impairments for Low versus High Frequency Words.
 Depression, Memory, and Executive Functions After Pallidotomy for Parkinson's Disease.
 [99mTc]TRODAT-1 SPECT Imaging Correlates with Odor Identification Performance in Early Parkinson's Disease.

10:30 AM–12:30 PM**Paper Session 11****Developmental Neuropsychology: Normal and Low Birthweight Children****Room: Promenade Salon E & F (2nd floor)**

1. MAHONE, M
2. CHARAK, DA
3. WIEBE, S
4. BUIZER, AI

Gender Differences on Neuromotor Examination in Typically Developing Children.
 Growth Mixture Modeling of Academic Achievement for Children with Varying Birth Weight Risk.
 Individual Differences in Impulsivity and Cognitive Flexibility in Preschool Children, and Relations with General Executive Function.
 Behavioral and Academic Sequelae after Chemotherapy for Childhood Cancer.

1:00–3:00 PM**Poster Session 8****Room: St. Louis Salon D & E (4th floor)****Aphasia/Stroke**

1. KRETZMER, T
2. ALTMANN, LJ
3. ALTMANN, LJ
4. WOMACK, KB
5. MOLLET, GA
6. FUCETOLA, RP
7. WILLIAMSON, JB
8. WILDE, MC
9. SPEIZER, AE
10. JENKS KETTMANN, JD
11. CIAMPITTI, MZ
12. HONN, VJ
13. GREENWALD, M
14. GAIEFSKY, M
15. LEON, SA

Understanding Perceptual Deficits Following Right Hemisphere Injury.
 Etiology of the Paraphasias of Older Adults in a Constrained Sentence Production Task.
 Etiology of Grammatical Errors by Older Adults in a Constrained Sentence Production Task.
 Effects of Age and Race on Aphasia.
 Alexia without Agraphia: A Traditional vs. A Non-Traditional Case.
 Language Competence, Semantics and Negative Mood Predict Functional Communication in Acquired Aphasia.
 Lesion Location and Behavioral Disinhibition: Posterior Fossa Contributions to Quantifiable Behavioral Change.
 The Predictive Validity of the RBANS and MMSE in Acute Stroke.
 Parallelism in Amusia and Aphasia in a Professional Conductor Following Left Parietal Hemorrhage.
 Pre and Post Right MCA Stroke RBANS in a 22-year-old.
 Changes in the Distribution of Aphasia Over Time After Stroke.
 Neuropsychological Profiles of Individuals with Aphasia.
 Phonological Dyslexia Following Stroke Measured by MEG Utilizing MR-FOCUSS.
 fMRI of Language Rehabilitation: Seeing versus Saying.
 A Phase I Study of Interventions for Expressive Aprosodia.

16. ZINN, S Differential Impairment of Executive Functions in Cerebrovascular Disease.
 17. GREENE, K Topographical Heading Disorientation: A Case Study.
 18. PRESTON, AS Effects of Stroke Education on Mood.

Pediatric Assessment

19. GREENAWAY, SD Executive Functioning and Motor Activity in Children with Major Depressive Disorder with and without Comorbid ADHD.
 20. MAHONE, M Behavior Ratings of Executive Function Among Preschoolers with ADHD.
 21. MAERLENDER, A Psychometric Tests and Central Auditory Processing Disorders (APD): A Pilot Study of Diagnostic Efficiency.
 22. BORODYCHUK, I Age-related differences in neuropsychological profile in preschool children.
 23. MELIKYAN, ZA Visual Information Processing in 6-8-year-old Children with Functional Immaturity of Cerebral Regulatory Systems.
 24. WARNER, TD Normative Data for Low SES African American Children on Selected Halstead-Reitan Tests.
 25. WHITE WATERS, KR Evaluation of the Ecological Validity of Tests of Executive Functioning in Children: The Issue of Domain-Specific Content Skills.
 26. KOUSHIK, NS Patterns of WPPSI-R Subtest Performance in a Clinic-Referred Sample.
 27. LANSING, A Gender Differences in Creative Relative to Verbal Intellectual Ability in School Aged Youth.
 28. SIKLOS, S A Rasch Analysis of the Behavior Rating Inventory for Executive Function (BRIEF).
 29. FASTENAU, PS Validity of the Extended Complex Figure Test (ECFT) for Use with Children.
 30. BODIN, D A Survey of Parent Satisfaction with Pediatric Neuropsychological Evaluations.

Language: Fluency and Reading

31. MAGUIRE, MJ An ERP Study of Imageability and Grammatical Class Influences in Noun and Verb Processing.
 32. WILLIAMS, BR Differences in Verbal Fluency Performance in Three Populations as a Function of IQ.
 33. CUTTING, L Are All Tests of Reading Comprehension the Same?
 34. CUTTING, L Reading Comprehension in Spite of Normal Word Reading Accuracy: A Matter of Reading Speed?

Memory

35. GOLD, DA The Effects of Time on Dual-Task Performance of Retrieval from Long-Term Memory.
 36. STORY, ES Enactment and Divided Attention Effects on Free Recall and Recognition.
 37. GSANGER, K Spatial Span Components as Predictors of Attention Problems and Executive Functioning in Adults.
 38. ROVET, JF The Development of Individual Components of Working Memory.
 39. TANEJA, C Differentiating Between Subgroups of Stroke Using the Short Form of the California Verbal Learning Test-Second Edition.
 40. TRAHAN, DE Revised Norms and Clinical Validation for the 6-trial Verbal Selective Reminding Test.
 41. FOLDI, NS What Happened to their Middle Region? Serial Position Effects (SPE) in Late Life Depression, Alzheimer Disease, and Normal Elderly on the Rey Auditory Verbal Learning Test (RAVLT).
 42. POREH, AM Analysis of Mean Learning of Subjects on the Rey Auditory-Verbal Learning Test (AVLT).
 43. LACY, M HVLT-R & BVMT-R: Correlation between Recognition Memory Scores.
 44. PICA, AA The Impact of Executive Functioning and Information Processing Efficiency on Semantic Clustering During Immediate and Delayed Recall Trials of the HVLT-R.
 45. BROWN, MA Quantitatively Varying Stimuli in the Retrieval Practice Paradigm: Effect on Recall Practice and Inhibition.
 46. STORY, TJ A New Recognition Test for the WMS-III Verbal Paired Associates.
 47. STROBER, LB Pollyannaism and its Effect on an Implicit Memory Task.
 48. UZZELL, BP Procedural Memory at Work: Case Report.
 49. FOSTER, PS The Design Learning Test: Support for Right Hemisphere Sensitivity.
 50. FRAKEY, L The Role of the Hippocampus in Spatial Pattern Separation.
 51. FAMA, R Differential Contributions of Explicit Memory Processes to Visuo-perceptual Learning in Alcoholics and Controls.
 52. MARQUINE, MJ Self-Knowledge and the Self-Reference Effect in Memory-Impaired Patients.
 53. SVOBODA, E Autonoetic Consciousness in Retrograde Amnesic Patient M.L.: Functional Neuroanatomy.
 54. ZEC, RF A Case Demonstrating a Dramatic Dissociation between Yes-No Recognition Memory for Words versus Pictures in a Patient with Severe Global Amnesia.
 55. PARK, NW The Relationship Between Verbal Description and Action Production of Novel Naturalistic Actions.
 56. COVEROVER, Y Employing Spaced Learning Trials to Improve Functional Task Performance in Persons with Multiple Sclerosis.

1:15-3:15 PM

Invited Symposium

A Lifespan Perspective of Sex Hormones and Cognition

Chair: Pauline Maki, Discussant: Susan Resnick

Room: Promenade Salon A & B (2nd floor)

1. BERENBAUM, S Prenatal Androgen Effects on Social and Cognitive Development.
 2. HAMPSON, E Estrogen-Related Effects on Cognitive Function in the Premenopausal Woman.
 3. MAKI, P Effects of Ovarian Hormones on Cognition in the Perimenopausal Woman.
 4. RESNICK, SM Hormone Therapy and Cognitive Function in Postmenopausal Women.

1:15–3:15 PM**Symposium 11****Cognitive and Neuroimaging Links between Late-Life Depression and Future Dementia****Chair: Meryl Butters, Discussant: Martha Storandt****Room: Promenade Salon C (2nd floor)**

1. ELDERKIN-THOMPSON, V Cognitive Performance of Minor and Major Depressed Patients on the CVLT and its Relationship to Brain Metabolites.
2. FOLDI, NS Role of Working Memory in High and Low Functioning Patients with Late Life Depression: Using Serial Position Profiles to Differentiate Patterns of Learning and Storage.
3. BHALLA, RK The Five-Year Course of Cognitive Functioning in Late-Life Depression.
4. POTTER, GC Relationship of Neuropsychological and Clinical Definitions of Dementia in the Context of Late-Life Depression.

1:15–3:15 PM**Paper Session 12****Adult TBI: Cognitive Studies****Room: Promenade Salon E & F (2nd floor)**

1. TESTA, JA Neurobehavioral problems and family functioning after traumatic brain injury.
2. LEVINE, B Psychosocial Outcome at 1-year Following Traumatic Brain Injury: Relationship to Quantitative MRI.
3. FREELAND, J Seasonal Affective Disorder Following Brain Injury.
4. VANDERPLOEG, RD Adverse Long-term Neuropsychological Outcomes Following Mild Traumatic Brain Injury.
5. PONSFORD, JL Effects of age on long-term outcome following traumatic brain injury.
6. PONSFORD, JL The influence of ApoE polymorphism on cognition and outcome following traumatic brain injury.

1:15–3:15 PM**Paper Session 13****Normal and Abnormal Executive Function Across the Lifespan****Room: Promenade Salon D (2nd floor)**

1. CONKLIN, HM Working Memory Performance in Typically Developing Children, Adolescents and Young Adults: An Upward Extension of and Methodological Expansion upon Past Investigations.
2. WABER, D Neuropsychological Correlates of Performance on High-Stakes Testing in Children from Disadvantaged Urban Schools: Which Child Left Behind?
3. GOUDRIAAN, AE Executive Dysfunctions in Impulsive and Addictive Disorders: Performance Profiles of Pathological Gamblers, Alcohol Dependent Patients, Tourette Syndrome Patients, and Healthy Controls.
4. RECKNOR, EC Education Facilitates Iowa Gambling Task Performance.
5. BRICKMAN, AM Frontal Lobe White Matter and Executive Functioning Changes across the Adult Lifespan.
6. WIERENGA, C Age-Related Changes in Word Retrieval: Frontal-Executive vs. Temporal-Semantic Substrates.

3:15–5:15 PM**Poster Session 9****Room: St. Louis Salon D & E (4th floor)****Cognitive Intervention/Rehabilitation**

1. LACY, M Psychiatric History in Memory Training Program Volunteers.
2. HERLANDS, T A Randomized Comparison of the Efficacy of Cognitive Remediation and Wait List Control for Psychiatric Outpatients.
3. LILLIE, RA Cognitive Outcomes Following Memory Retraining.
4. BORGARO, S Reliability Studies for the BNI Affect Test.
5. ALDERSON, A Family Needs during Inpatient and Outpatient TBI Rehabilitation.
6. SITZER, DI Predictors, Obstacles, and Facilitators of Treatment Adherence.

Cognitive Neuroscience

7. ROSENBAUM, R Autoegetic Consciousness is not Necessary for Theory of Mind.
8. LEIDIG, LM Spatial Bias in Korean Subjects: Influence of Early Reading Direction.
9. GENOVA, HM Examining the Effects of Lesion Load on BOLD Activation in Multiple Sclerosis.
10. JUNG, RE Biochemical Markers of Individual Differences in Cognitive Functioning.
11. LEVINE, AS Cognitive Spectroscopy: A Window to Neuropsychological Functioning.
12. KONDO, T Cue Availability Alters Odor Intensity Processing in Orbitofrontal Cortex: A Near-Infrared Spectroscopy Study.

Cross-cultural Issues in Neuropsychology

13. REY, GJ A Spanish Verbal Learning Test: Normative and Clinical Data.
14. MENDEZ, C Neuro-Psychiatric Symptomatology and Caregiver Distress in Alzheimer's Disease: A comparison of Hispanic and Angloaxon Groups.
15. WONG, J The Performance of Bilinguals and the Effects of Acculturation on Attention and Information Processing Tests.

16. SUAREZ, PA Demographically Corrected Norms for the Brief Visuospatial Memory Test-Revised Attenuate Education Related Performance Differences among HIV+ Spanish Speakers.
17. PICKETT, L Demographic and Medical Factors Influencing the Performance of Older African Americans on the Mattis Dementia Rating Scale.
18. PEDRAZA, O Item Analysis of the Boston Naming Test in Caucasian and African American Elders.
19. WILDE, MC Racial Discrepancies on the Repeatable Battery for the Assessment of Neuropsychological Status in a Mixed Clinical Sample.
20. MARES, M Demographic Predictors of Verbal Learning and Memory Indices on the World Health Organization-University of California at Los Angeles Auditory Verbal Learning Test in a Hispanic Sample.
21. SEDO, MA Drug Use Related Deficits in Response Inhibition Skills: A Comparison of the Stroop Test and the Five Digit Test in a Large Sample of Substance Abusers.

Electrophysiology/Event-Related Potentials

22. STROTHER, DM Cortical Reorganization and its Relationship to Real and Imagined Movement.
23. RATAJCZAK, E Rule Internalization and Learning in Young Adults Using ERP Measurements.
24. FOSTER, PS Individual Alpha Variability: Variation in Frequency and Amplitude of the Dominant Rhythm.
25. FOSTER, PS Frontal Lobe Inhibition of the Temporal Lobes: Cardiovascular Correlates.
26. PRATT, NL Mood Affects the Processing in the Brain of Affective Language.

Learning Disabilities/ADHD

27. PAILOPOULOS, G Retention of Symbol Sequences by Children with Learning Disabilities: An investigation of memory for letter, number, and symbol sequences amongst dyslexic children and children with additional learning disabilities in Greece.
28. MELIKYAN, ZA Two Types of Visual Information Processing in 5-9-year-old Learning Disabled Children.
29. HOROWITZ, LA Aggression and Withdrawal Related Behavior in Conflict Resolution Progression in Preschool Boys with Language Impairment in Comparison to Preschool Boys with Typical Language Development.
30. KIBBY, MY The Pars Triangularis in Developmental Dyslexia.
31. DAVIS, AS Evaluating the Effects of Computer-Based Phonological Processing Intervention for Children with Reading Disabilities.
32. JANSIEWICZ, E Language Preference in Bilingual Children with Reading Disabilities.
33. O'CONNELL, PA Developmental Gerstmann's Syndrome: Case Report of an Adult Seeking Academic Accommodations for Learning Disabilities.
34. DEWEY, D The Impact of Developmental Coordination Disorder on the Performance of Children with Attention Deficit/ Hyperactivity Disorder and Reading Disability on the Rey Osterrieth Complex Figure.
35. CRAWFORD, S The Impact of ADHD Subtype and Co-occurring Disorders on Everyday Functioning in Children with ADHD.
36. RANDALL, K Perceptual and Motor Inhibition in Children with ADHD.
37. FINN, P A Virtual Reality ADD Classroom and the BASC: A Preliminary Investigation of Convergent Validity.
38. TANGEN, RB Information Processing in Children with Attention-Deficit/Hyperactivity Disorder Subtypes.
39. MARKS, DJ Remediation of Metacognitive Deficits in Adults with ADHD.
40. PRESTON, AS Comparison of ADHD Subtypes on the TEA-Ch.
41. COOPER, K Executive Functions and Social Skills in Children and Adolescents with Attention-Deficit/Hyperactivity Disorder: A Pilot Test of Barkley's Model of Behavioral Disinhibition.
42. SIM, A Relationship Between Self-Reported Learning Disability/ADHD/Previous Concussion to Baseline Scores on the Standardized Assessment of Concussion (SAC).
43. MATUTE, E ADHD Subtypes Prevalence in a Mexican Community Sample.
44. PRESTON, AS Utility of a CPT in Diagnosing ADHD in a Community-Based Sample of Children: A Cautionary Study.
45. WARNER, J Executive Functioning Deficits in Youth with Comorbid Bipolar Disorder+ADHD: Are They Additive?
46. JANUSZ, J Effects of Methylphenidate on the Neural Basis of Working Memory in Children with Neurofibromatosis Type 1 and ADHD.
47. PROCTOR-WEBER, ZE The Impact of Neuropsychological Test Results on Scholastic Achievement Test Scores in a College Aged Population.

3:30-5:15 PM

Symposium 12

Classification of Mild Cognitive Impairment: Issues and Approaches

Chair: Kevin Peters, Discussant: Ronald Petersen

Room: Promenade Salon A & B (2nd floor)

1. PETERSEN, RC Cognitive Subtypes of Mild Cognitive Impairment.
2. LOPEZ, OL Mild Cognitive Impairment Subgroups.
3. PETERS, KR Neuropsychological Subgroups of Cognitively-Impaired-Not-Demented Individuals.
4. FELDMAN, HH Cognitive Impairment Not Dementia (CIND): Does Etiology Matter? Findings from the ACCORD Study.

3:30–5:15 PM**Symposium 13****HIV as a Model for Inflammatory and Neurodegenerative Brain Disease****Chair: Igor Grant, Discussant: Karl Goodkin****Room: Promenade Salon C (2nd floor)**

1. HEATON, RK
2. ARENDT, C
3. GELMAN, BB
4. CHANG, L
5. CLIFFORD, D

Neuropsychological Functioning in HIV-1.
 Dopaminergic Pathway Dysfunction in Neurologically Asymptomatic HIV-1-Positive Patients.
 Neurodegeneration versus Neuronal Dysfunction in HIV-Associated Dementia. The Role of Transcriptional Channelopathies.
 Insights into the Pathophysiology of HIV/AIDS and Substance Abuse from Neuroimaging.
 HIV Associated Cognitive Motor Disorder - Insights from Therapeutics.

3:30–5:15 PM**Paper Session 14****Pediatric TBI****Room: Promenade Salon D (2nd floor)**

1. DONDERS, J
2. CASS, JE
3. YEATES, K
4. GIOIA, GA

Validity of the WCST-64 after Pediatric Traumatic Brain Injury.
 Cognitive Reserve Capacity and Neuropsychological Outcome Following Pediatric Traumatic Brain Injury.
 Post-Concussive Symptoms in Pediatric Mild Head Injury Cannot Be Accounted For Entirely By Non-Injury Related Factors.
 Parent and child concordance of serial post-concussion symptomatology reports.

3:30–5:15 PM**Paper Session 15****Professional Issues****Room: Promenade Salon E & F (2nd floor)**

1. BYRD, D
2. EVANS, J
3. JACAROO, V

Cultural Specificity of the Relationship Between Neuropsychological Test Performance and Functional Capacity.
 NIMH Programs in Geriatric Mental Health Research: Opportunities for Neuropsychologists.
 Neuroinformatics: How it will Reinnervate the Field of Neuropsychology.

5:45–6:45 PM**Presidential Address****Neuropsychological Crimes and Misdemeanors****Jason Brandt****Room: Promenade Salon C & D (2nd floor)****6:45 PM****INS Reception****Room: St. Louis Foyer (4th floor)**

SATURDAY, FEBRUARY 5, 2005

8:30–10:30 AM

Poster Session 10

Room: St. Louis Salon D & E (4th floor)

Subcortical Disorders (Parkinson's, Huntington's, Progressive Supranuclear Palsy)

1. ZGALJARDIC, DJ Huntington's disease (HD) Presymptomatic Gene Carriers: A Neuropsychological (NP) Follow-up Study.
2. RUBIN, LH Rhyme fluency in Huntington's disease.
3. SOLOMON, AC Learning and Memory Performances are Associated with DNA-based Estimates of Onset and Striatal Volume in Presymptomatic HD.
4. BEGLINGER, LJ PET Activation During Working Memory and Spatial Attention Tasks is Abnormal in Presymptomatic Huntingtons Disease.
5. ZGALJARDIC, DJ Self-reported apathy in Parkinson's disease.
6. KIRSCH, L Examining Apathy and Depression in Parkinson's Disease.
7. LUBOMSKI, MM Emotional and Nonemotional Lexical Expression in Parkinson's Disease.
8. SMITH PASQUALINI, M Facial Expressivity During Interactions Between PD Patients and Spouses.
9. BRAND, JC Trail Making Test Performance and Depression in Parkinson Disease.
10. GREHER, MR Cognitive Impairment in Early Parkinson's Disease.
11. MATHIESEN, CM Sequelae of STN-DBS for Parkinsonism: A Case Study.
12. JOHNSON, DK Cognitive Impairment and Parkinson's Disease.
13. ISOMURA, AJ Cognitive Differences among Subtypes of Parkinson's Disease.
14. BALDERSTON, CC Phenylthiocarbamide (PTC) Sensitivity in Patients with Parkinson's Disease.
15. HUA, M Neuropsychological Function Following Bilateral Subthalamotomy for Advanced Parkinson's Disease.
16. KRENGEL, MH Changes in cognition and mood status post DBS surgery for treatment of Parkinsons disease.
17. FRUTIGER, S Determinants of Subjective Well-Being in Patients with Parkinson's Disease.
18. PALMESE, CA Immediate and Delayed Story Recall in Parkinsons Patients.
19. MILLER, KM Clinical Utility of the N-back Task in Detection of Working Memory Impairment in Parkinson's Disease.
20. GRACE, J Relationship between Neuropsychological Tests and On-Road Driving in Parkinson's Disease.
21. AMICK, MM A Comparison of On-Road Driving Performance in Individuals with Alzheimer's Disease and Parkinson's Disease.
22. WETTER, SR Recall Discriminability: Utility of a New CVLT-II Measure in the Differential Diagnosis of Dementia.
23. GRANT, DE Qualitative and Quantitative Differences in Copying Responses in PSP and non-PSP Dementia Patients.

Traumatic Brain Injury: Outcome

24. BELANGER, HG Factors Moderating Neuropsychological Outcomes Following Mild Traumatic Brain Injury: A Meta-Analysis.
25. DIKMEN, S Stability of Employment after Traumatic Brain Injury.
26. KRPAN, KM Executive Function and Coping at One-Year Post Traumatic Brain Injury.
27. SALISBURY, DB A Comparison of Medical, Demographic and Acute Status Variables in the Prediction of Survival And Outcome Following Traumatic Brain Injury.
28. PASTOREK, N Item Response Theory Analysis of the Disability Rating Scale in Patients Representing a Continuum of Disability at Three Months Post Injury.
29. JOHNSON, CE Neuropsychological Predictors of Functional Outcomes Following Pediatric Traumatic Brain Injury.
30. PASTOREK, N Revision of the Disability Rating Scale for Improved Outcome Measurement in Higher Functioning Patients Three Months after Traumatic Brain Injury.
31. VERAMONTI, TL Relationship Between Disability and Awareness of Deficits at 3 Months Post TBI.
32. SEIBERT, LK The Prediction of Everyday Functioning after Traumatic Brain Injury: The Utility of an Objective Functional Battery Relative to Neuropsychological and Common Clinical Measures.

Traumatic Brain Injury: General

33. CONSTANTINIDOU, F Management of Sports Concussion in College Athletes.
34. TRAHAN, DE Age-related Differences in Self-reported Postconcussional-type Symptoms in Normal Adults.
35. SITZER, TE Clinically Meaningful Change Following Mild Traumatic Brain Injury: Development of Reliable Change Scores.
36. BROWN, SA Use of the CES-D for Assessing Depression in Minority MTBI Patients.
37. MCCAULEY, SR Confirmatory Factor Analysis of the Center for Epidemiologic Studies Depression (CES-D) Scale in Mild to Moderate Traumatic Brain Injury.
38. BLANTON, HH The Ecological Validity of the Meyers Short Battery in the Vocational Evaluation of Traumatic Brain Injury Patients.
39. ROWLAND, SM Relationship Between Non-Verbal Working Memory and Self-Awareness Deficits in Individuals with Traumatic Brain Injury.
40. LARSON, E Assessment of Executive Functions in TBI Patients Using the EXIT.
41. PAGULAYAN, KF The Problem of Assessing Awareness in Traumatic Brain Injury.
42. SALISBURY, DB Serial Assessment of Cognitive Functioning After Traumatic Brain Injury.
43. HOOFIEN, D Orienting and Habituation Responses among Persons with Traumatic Brain Injury: Distinctive Manifestations of the Apathetic and Disinhibition Syndromes.
44. KIT, K The Influence of Memory Beliefs in Individuals With Traumatic Brain Injury.

45. DAVIS, AS Premorbid Personality Risk Factors Associated with Traumatic Brain Injury.
46. LEQUERICA, A The Occurrence of Agitation and Post-traumatic Amnesia in Traumatic Brain Injury.
47. WAGNER, DS Motor Cuing on the Line Bisection Task in Subjects with Traumatic Brain Injury.
48. PEREIRA, AA Hippocampal Activity during Encoding in Persons with Traumatic Brain Injury.
49. RITTER, LM The Synergistic Relationship of Extracellular Excitatory and Inhibitory Amino Acids and its Effect on Traumatic Brain Injury Outcome.
50. GENOVA, HM Using fMRI to Examine Cerebral Blood Flow and Oxygen Extraction Fraction Following Moderate and Severe Brain Trauma.
51. SCHEIBEL, S. Brain Activation During Working Memory and Inhibition Tasks in Patients with Severe Traumatic Brain Injury.
52. PAVAWALLA, S. Long-Term Retention of Skilled Visual Search Following Severe Closed-Head Injury.
53. GLASS, K.L. Initial Development of a Parent Report of Post Concussion Symptoms in Children and Adolescents.
54. WERTHEIMER, J.C. Functional Status and Community Reintegration in Severe Penetrating Brain Injuries.
55. ZIEGLER, R. An Investigation of Patients' Level of Engagement and Progress Within Rehabilitation.

9:00–10:45 AM**Symposium 14****Biological Mechanisms Underlying General Intelligence (“g”).****Chair: Rex Jung, Discussant: Richard Haier****Room: Promenade Salon A & B (2nd floor)**

1. YEO, RA Developmental instability and general intelligence.
2. JUNG, RE Neurochemical aspects of general intelligence.
3. PRABHAKARAN, V Neural Substrates of Visuospatial and Mathematical Reasoning: An fMRI study of Raven's Progressive Matrices (RPM) and Necessary Arithmetic Operations Test (NAOT).
4. THOMA, RJ MEG Analysis of the Choice Reaction Time and Intelligence Relationship.
5. HAIER, RJ Why size matters: A voxel-based morphometric study of regional gray and white matter correlates of general intelligence.

9:00–10:45 AM**Symposium 15****How Should We Evaluate the Efficacy of New Cognition-enhancing Medications?****Chair and Discussant: John Sweeney****Room: Promenade Salon C (2nd floor)**

1. PLISKIN, NH The Future of Neuropsychological Assessment in Treatment Investigations: Need for a Paradigm Shift.
2. REILLY, JL Treatment effects of atypical antipsychotic medication on neurocognition in first-episode schizophrenia: Differential sensitivity of neuropsychological and neurophysiological measures.
3. MAKI, P Midlife Risk Factors for Dementia - A Challenge for Drug Development.

9:00–10:45 AM**Paper Session 16****Schizophrenia****Room: Promenade Salon D (2nd floor)**

1. MOELTER, S Does Animal Fluency Reveal Cognitive and Neuroanatomical Heterogeneity in Schizophrenia?
2. BONAFINA-CARACCIOLI, M Time Estimation in Schizophrenia: Relationship to Clinical and Neuropsychological Functioning.
3. MOBERG, PJ Apolipoprotein E Genotype and Odor Identification in Schizophrenia.
4. KINGERY, LR A Voxel-Based Morphometric Study of Gray Matter Concentration in Patients with Schizophrenia and Healthy Adults.
5. NAYAK, GV Use of Hierarchical Linear Modeling to Evaluate Longitudinal Neuropsychological Performance in Middle-Aged and Older Schizophrenia Patients.

9:00–10:45 AM**Paper Session 17****Memory, Aging, and Memory & Aging****Room: Promenade Salon E & F (2nd floor)**

1. BARBUTO, E The Effects of Dual-Task Performance on Retrieval from Long-Term Memory.
2. BRICKMAN, AM Age-associated Change in Orbital, Cingulate, and Dorsolateral Frontal Lobe Gray and White Matter Volume.
3. LERITZ, EC Associative priming, explicit memory, and their relationship to hippocampal volumes in aging and mild cognitive impairment.
4. JEFFERSON, AL Verbal Learning and Memory Performances Among Geriatric Cardiac Participants: Relationships to Apolipoprotein E (ApoE) Gene Polymorphisms.

10:45 AM–12:45 PM**Poster Session 11****Room: St. Louis Salon D & E (4th floor)****Child Development**

1. KEY, AP Effects of Smoking During Pregnancy on Speech Discrimination Ability in Newborn Infants.
2. RATAJCZAK, E Early Sex Differences in Auditory Memory Mechanisms: Evidence From 1-Year-Old Infants.
3. FERGUSON, MC Influences of Nutrition on Early Brain Processing in Breast-Fed and Bottle-Fed Infants.
4. PEACH, K Language Development During the First Two Years of Life: Changes in Brain Organization.
5. HRABOK, M Attention, Working Memory, and Emotional Regulation in Four Year Old Children.
6. MOLFESE, DL Electrophysiological Correlates of Shape Discrimination in 5-year-olds.
7. CUTIONGCO, RC Metacognitive Strategies in Reading among Filipino Fourth Graders.
8. GOMES, H Children's Performance on Auditory and Visual Simple, Selective, and Divided Attention Tasks.
9. CLEMENTS, A Developmental Differences in the Neural Mechanisms Associated with the Judgment of Line Orientation.

Drugs, Toxins, Alcohol

10. STRAUMAN, S Neuropsychological Effects and Mood Change Associated with Occupational Exposure to Nitrous Oxide in Dentists.
11. HAUT, MW Solvent-Related Neuroimaging Changes in Railroad Workers.
12. ROHLING, ML A Meta-Analysis of the Neuropsychological Effects of Occupational Exposure to Mercury.
13. MEDINA, KL Ecstasy (MDMA) Exposure and Neuropsychological Functioning: A Polydrug Perspective.
14. FREILICH, B The Neuropsychological Sequelae of Ethylene Glycol Intoxication - A Case Study.
15. SCHMIDT, K The Neuropsychological Profile of Alcohol-Related Dementia Suggests Both Cortical and Subcortical Pathology.
16. GALLO, J Behavioral and Psychological Symptoms in Alcohol-Related Dementia.
17. GONZALEZ, R Factors Affecting Gambling Task Performance among Substance Dependent Individuals with HIV.
18. MESSINIS, I Effects of Long-term Frequent Cannabis Use on Neuropsychological Functioning in a Greek Sample.
19. SCHWEINSBURG, AD FMRI in Adolescent Marijuana Users After 30 Days of Monitored Abstinence.
20. JACOBSON, MW Visuospatial Attention and Methamphetamine Dependence: Increased Regional FMRI Activation and Response Latency.
21. WILKINS, S Procedural Memory in Smoking and Non Smoking Males.
22. JASPER, BW Prevalence of Affective Sequelae Following Carbon Monoxide Poisoning: A Prospective Longitudinal Study.
23. FEARING, M Basal Ganglia Lesions following Carbon Monoxide (CO) Poisoning.

Pediatric TBI

24. SLOMINE, B Agreement between Parent Reported Measures of Cognitive Functioning, Adaptive Functioning, and Neuropsychological Functioning in Children following Trauma.
25. AYR, LK Sources of Variability in the Reports of Post-concussive Symptoms in Children with Mild Head Injuries.
26. JANUSZ, J Re-Examination of the Construct Validity of the Post-Concussion Symptom Inventory- Self Report (PCSI-S) in Children and Adolescents.
27. MCCAULEY, SR Delaying the Execution of To-Be-Performed Actions Over Brief Delays Impairs Performance Following Mild Traumatic Brain Injury in Children.
28. BROWN, AJ Variance in NAA Distinguishes Between Brain-Injured and Healthy Children and Predicts Cognitive Performance in Total Sample.
29. KERNEN, SJ Spectroscopy Study of Pediatric TBI: A Hierarchical Analysis of Trail Making Tests A and B.
30. SLOMINE, B Attention, Memory, and Executive Functioning in Children with Severe Traumatic Brain Injury with and without ADHD after Injury.
31. KAY, JB Differences in TOVA Continuous Performance Profiles in Children with TBI or ADHD.
32. SCHRODER, MD Memory Functioning after Pediatric Traumatic Brain Injury: What's the Trouble?
33. COOK, LG Self-Regulation and Planning in Children with Severe Traumatic Brain Injury: A Novel Naturalistic Approach.
34. BEERS, SR The Use of a Dopamine Agonist to Enhance Recovery after Pediatric TBI.
35. HORNEMAN, G Traumatic Brain Injury in Childhood: Cognitive Outcome Ten Years Later.
36. WELLS, C Sleep Disturbances & Neuropsychological Outcome Following Moderate to Severe Pediatric TBI.

Sex Differences/Sex Hormones

37. DAVIS, AS Neuropsychological Gender Differences in Planning, Attention, Simultaneous and Successive Processing.
38. IMIG, J Sex Differences in Emotional Recognition and Hemispheric Asymmetry: The Impact of Hormonal Fluctuations throughout the Menstrual Cycle.
39. ZELLER, MA The Effects of Circulating Hormones on Cognition Within a Sample of Depressed and Non-Depressed Postmenopausal Women.
40. DAHLSTROM, P The Effect of Free Testosterone on Cognitive Performance in a Population Based Sample.
41. LACY, M Neurocognitive Impact of Adjuvant Hormonal Therapy in Postmenopausal Breast Cancer Women.
42. DUNKIN, JJ Effects of Estrogen on Cognition in Depressed and Nondepressed Postmenopausal Women.
43. GENEST, CM Cognitive Effects of Hormone Replacement Therapy in Post-Menopausal Women.
44. KERNAN, CL Cognitive Profile During Perimenopause: Parallels to Post-menopause?
45. HOOK, JN Tracking Cognitive Change after Successful Treatment of Cushing's Disease.

11:00 AM–12:00 PM**Invited Plenary****Functional Imaging in Epilepsy Evaluation: Should We "Stick" with the WADA?****David Loring****Room: Promenade Salon A & B (2nd floor)****12:00–1:00 PM****Invited Plenary****Prefrontal Cortex and Neurodevelopmental Disorders****Adele Diamond****Room: Promenade Salon A & B (2nd floor)****11:00 AM–1:00 PM****Symposium 16****The Natural History, Cognitive Profile and Brain-Behavior Correlates of Vascular Cognitive Impairment (VCI)****Chair: David Nyenhuis, Discussant: David Garron****Room: Promenade Salon E & F (2nd floor)**

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|-----------------|---|
| 1. LIBON, DJ | Disambiguating Components of Baddeley's Working Memory Model in Patients with Subcortical White Matter Alterations. |
| 2. MUNGAS, D | Structural MRI and Cognitive Status: Cerebrovascular and Alzheimer's Effects on Cognitive Impairment and Dementia. |
| 3. STEBBINS, GT | Voxel Based Morphometry Gray Matter Density Study of Mild Cognitive Impairment and Vascular Cognitive Impairment No Dementia. |
| 4. NYENHUIS, D | Neither Vascular CIND or Stroke Patients Without Baseline Cognitive Impairment Convert to Dementia When Followed For Up to Three Years. |

11:00 AM–1:00 PM**Symposium 17****The Role of Neuropsychology in Sport-Related Concussion****Chair: Christopher Randolph, Discussant: Jeffrey Barth****Room: Promenade Salon D (2nd floor)**

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|----------------|---|
| 1. MCCREA, M | Sideline Testing: Measuring Acute Effects and Early Recovery from Concussion. |
| 2. BARR, WB | Baseline Testing: The Status of Traditional Pencil-and-Paper Approaches. |
| 3. WOODARD, JL | Computer-Based Approaches to Monitoring Concussion Recovery: Old Wine in New Bottles? |

11:00 AM–1:00 PM**Paper Session 18****Cognitive Neuroscience of Brain-Behavior Relations****Room: Promenade Salon C (2nd floor)**

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| 1. TRACY, J | Listening To Your Body: An fMRI Analysis of Attention to Internal Body Signals. |
| 2. REINKE, K | Neural Underpinnings of Speech Separation and Identification. |
| 3. TRANEL, D | Retrieval of Unique Names Depends on Neural Systems in Left Temporal Polar Region. |
| 4. DORFLINGER, J | Distributed Neural Systems Supporting Number Processing: An Event-Related fMRI Study. |
| 5. BUXBAUM, LJ | Left Inferior Parietal Representations for Skilled Hand-Object Interactions: Evidence from Stroke and Corticobasal Degeneration. |

1:15–2:15 PM**INS Business Meeting (open to all meeting participants)****Room: Promenade Salon A & B (2nd floor)**

Abstracts Presented at the Thirty-Third Annual International Neuropsychological Society Conference

February 2-5, 2005
St. Louis, Missouri, USA

WEDNESDAY AFTERNOON, FEBRUARY 2, 2005

Poster Session 1/4:15–6:15 p.m.

Aging

O.L. REY & L.L. MURRAY. Performance of Young and Older Adults in a Verbal Fluency Task.

Verbal fluency tests are valuable tools to assess the overlap of linguistic skills and executive abilities such as working memory and inhibition. This evaluation is important when studying cognitive changes in normal aging, as previous research has documented executive decline but relatively preserved linguistic abilities in elderly subjects. However, these two aspects have not been specifically studied in verbal fluency tasks. To assess the effects of aging on these two components of the task, we evaluated a younger ($x = 34.68$ years) and older ($x = 76.90$ years) group of healthy adults with high education, using three letter fluency tasks. We compared subjects performance not only in the number of items generated within the time limit (which mostly depends on executive control), but also regarding the lexical frequency of the items produced, based on two databases of English word frequency. Results showed that the group of younger adults always produced significantly more correct items in the established time, and that this measure had a negative correlation with age. When analyzing lexical complexity, older adults tended to produce items that were significantly less frequent. However, this second measure did not correlate with age. These results suggest that the executive and linguistic components of verbal fluency can be dissociated. Older adults will produce fewer items, allegedly as a result of deficits of inhibition and working memory that have been associated with normal aging, while producing more complex, less frequent words, which are part of their consolidated crystallized memory.

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B.P. YOCHIM, S.E. MACNEILL & P.A. LICHTENBERG. Depression and Cerebrovascular Burden as Predictors of Verbal Fluency in Older Adults.

The vascular depression theory suggests that cerebrovascular risk factors (CVRFs) are related to depressive symptoms in older adults. Past research has also found that depression and cognition are linked, with a possible strong link between depression and executive functioning. This study investigated how well baseline cerebrovascular burden and depression predicted verbal fluency three and six months later. The sam-

ple included 139 medical rehabilitation patients, all at least 60 years of age. The Geriatric Depression Scale, Dementia Rating Scale, and Co-Morbidity Index (a measure of medical burden) were administered while patients were hospitalized. Participants were telephoned three and six months after discharge and were administered measures of verbal fluency (Controlled Oral Word Association [F and L] and Animal Naming). Structural equation modeling with maximum likelihood estimation was used to assess the ability of CVRFs and depression to predict verbal fluency, above and beyond demographic variables, medical burden, and baseline cognition. Depression significantly predicted verbal fluency at both time points, independently of demographic variables, baseline cognition, and medical burden. CVRFs did not predict verbal fluency at any time point. The structural equation models accounted for large proportions of the variance in three-month verbal fluency (52%) and six-month verbal fluency (69%). The structural equation models fit the data well, according to various fit indexes. These results highlight the importance of assessing depression when predicting future cognitive functioning. Findings suggest that etiological routes that lead to depression in older adults may also be related to long-term impairment in executive functioning.

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A.M. BRICKMAN, R.H. PAUL, R.A. COHEN, L.M. WILLIAMS, K.L. MACGREGOR, A.L. JEFFERSON, D.F. TATE, J. GUNSTAD & E. GORDON. Semantic and Phonemic Verbal Fluency across the Adult Lifespan: Relationship to EEG Theta power.

The purpose of this study was to examine the impact of age, sex, and education on semantic and phonemic verbal fluency task performance. A secondary goal was to determine whether resting EEG theta power in bilateral frontal and temporal lobes mediates age-associated decline in verbal fluency task performance. A large sample ($n=471$) of healthy, normal participants, age 21 to 82, was assessed for phonemic fluency (i.e., FAS), and for semantic fluency (i.e., Animal Naming), and with a 32-channel EEG system for eyes-open resting theta power. The effects of age, sex, and education were examined using analyses of variance. Correlation analyses were used to test a mediational model of age and fluency performance in relation to theta power by controlling for the effects of theta when examining the relationship between the other two variables. The results indicated that performance on both fluency tests declined linearly with age, but that the rate of decline was greater for semantic fluency. These age changes were not associated with education

level, and there were no sex differences. While theta power was negatively associated with age and positively associated with Animal Naming performance, it did not mediate the relationship between the two. The differential age-associated decline between semantic and phonemic fluency suggests separate neurobiological substrates underlying the two domains of performance. The findings have important implications in clinical neuropsychological assessment.

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S. COOK, M. MARSISKE & K. MCCOY. Stability of Elders' Hopkins Verbal Learning Test- Revised Performance Before and After Extensive Practice.

Previous literature suggests that performance on the Hopkins Verbal Learning Test- Revised (HVLTR) remains relatively stable with repeated administration when using equivalent alternate forms. We investigated whether thirty days of practice with word list memorization would boost HVLTR performance in older adults with and without memory impairment. Fifty-seven older adults (mean age = 74.89 years, education = 16.44 years) with and without low memory performance (operationalized as 1.5 SD or more below normative mean on at least one subscore) received equivalent forms of the HVLTR twice, about 6 weeks apart. Between administrations, participants practiced non-semantically related lists of 15 words once a day for thirty days. Stability of memory classification was dominant; 43 participants had normal memory at both occasions and 8 were classified as low memory at both occasions; $\chi^2 = 25.35$, $r = 0.67$, $p < 0.01$. Thus, the sensitivity of predicting memory level at Time 2 based on Time 1 was 80%, with specificity of 91.5%. Two participants declined (from normal memory to low) and four participants improved (from low to normal memory). There was little evidence of practice-related gain on the HVLTR, despite high gain on the practiced word lists. Consistent with prior research, practice with one specific memory task did not transfer to the HVLTR. Of particular interest, there was no indication that such extensive practice served as an intervention to improve memory in elders experiencing mild memory impairment.

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A. MACKAY, J. PERRY & D. WHITE. Deconstructing Executive Contributions to List Recall by Older Adults.

First, we determined if two common measures of executive functioning are best explained by a single latent construct in healthy older adults. Second, we tested the relation between those two measures and list recall. Community volunteers ($N = 62$) were paid \$10/hour for their participation (age range = 60 to 88 years, mean = 74.3, $SD = .94$). Testing lasted approximately 1.5 hours for each participant and included a health questionnaire, word list recall, simple verbal reaction time; Stroop test (neutral/incompatible, switching/nonswitching), trailmaking tests (visual search, letter and number sequencing, alternating letter/number), and the Vocabulary and Matrix Reasoning subtests of the WASI. Reaction time and accuracy measures were collected. A two-factor model fit the measures of executive function better than a single factor solution. Factor scores were generated after a varimax rotation to create a factor that represented the trail-making test and a factor that represented the Stroop test. The Trailmaking factor and the Stroop factor were entered together at the first step in a hierarchical regression to predict number of items recalled at learning trial 5 of the word list recall measure. A measure of semantic clustering from Trial 2 was entered second. 18% of the variance was accounted for by the factors and an additional 30% of the variance was accounted for by strategy use, to total 48% of the variance in trial 5 list recall ($p < .001$). The trail-making factor and se-

mantic clustering score at trial 2 were significantly correlated with recall ($p < .01$ and $p < .001$, respectively), but the Stroop factor was not. Executive function is not a unitary construct. Not only did the Stroop and trailmaking measures load on different factors in a principle components analysis, only the trailmaking factor was related to list-learning recall. The other significant predictor of list recall was a measure of strategy (i.e., clustering during the learning process).

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L. SWEET, J. GUNSTAD, K.L. MACGREGOR, R.H. PAUL, D.F. TATE, A. POPPAS, J. BROWNDYKE & R.A. COHEN. Age-Related FMRI Activation Differences among Older Adults Performing a Verbal Working Memory Task.

Functional magnetic resonance imaging (fMRI) studies of higher order cognition have frequently demonstrated age effects; however, the direction of activation differences varies. Less activity compared to younger adults has been interpreted to reflect lower cognitive function, while greater relative activity has been interpreted as compensatory recruitment. Some studies have reported that less activity in expected regions is accompanied by greater activity in unexpected regions, particularly contralateral homologues. The goal of this study was to determine if blood oxygen level dependent (BOLD) fMRI signal would decline as a function of age in regions associated with verbal working memory (VWM) in previous studies. Furthermore, we hypothesized that older adults would exhibit greater activity in contralateral homologues. Twenty older adults (ages 57-84) enrolled in a cardiac rehabilitation program were recruited and divided by age into two equal samples matched for cardiovascular disease severity. Each participant completed a difficult 2-Back VWM task during fMRI. Both groups exhibited increased activity in left hemisphere regions associated with VWM in previous studies. However, older adults (>65 years) exhibited less task-related activity in contralateral homologues and sensory and motor regions. The predicted pattern of less activity in expected regions and greater activity in contralateral homologues was not evident, possibly due to significantly lower performance among the older group. Results suggest that older participants normally recruit brain regions associated with VWM in younger samples. However, they may less successfully recruit contralateral homologues and sensorimotor systems in response to a difficult VWM challenge.

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R. SPRENG, P. SENGDY & B. LEVINE. The Distribution of Autobiographical Memories and Plans Across the Lifespan.

Past and future autobiographical thought share and emphasis on the self in subjective time (i.e., autonoetic consciousness). There has been very little research on future autobiographical thought. We investigated the relationship between past and future autobiographical thought by applying an established technique for the dating of autobiographical memories to autobiographical plans (i.e., future autobiographical thought). Four age groups were tested: young-young ($N = 300$, mean age = 19 yr, $SD = 0.77$), young ($N = 50$, mean age = 25 yr, $SD = 3.4$), middle-aged ($N = 50$, mean age = 50, $SD = 7.5$), and old ($N = 35$, mean age = 73 yr, $SD = 5.3$). Using an online version of the Galton-Crovitz cue-word technique, we sampled autobiographical retrospective and prospective events that were subsequently dated. Dating of retrospective events replicated a retention function described in the autobiographical memory literature. Dating of prospective events specified an autobiographical "intention function." Both temporal distributions were best fit with a power function (straight line on a log-log scale) where the highest frequency of events occurred near the present moment and declined in frequency as time extends outwards over the lifespan. These

findings suggest a common substrate for past and future autobiographical thought: autonoetic consciousness. Autobiographical thought may be selectively affected by certain types of brain damage, particularly when the prefrontal cortex is involved. Further research is necessary to understand the nature of future autobiographical thought in healthy adults and patients with brain disease.

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A.L. BUFFINGTON, B. MARTIN, P. BOYLE, K.A. WELSH-BOHMER & J. BRANDT. Time of Day Affects Memory But Not Executive Functioning in Older Adults.

Whereas diurnal variations in particular aspects of cognitive functioning (i.e., memory and executive functioning) have been described, little is known about how time of day of testing affects performance on neuropsychological tests used in clinical evaluation of dementia. Thus, the aim of this study was to evaluate time of day effects on clinical measures of executive functioning and memory. Neuropsychological test performance of 2,030 cognitively normal older adults was examined to evaluate performance patterns as they related to time of day testing was initiated. Multivariate linear regression analyses, controlling for demographic and health variables, were used to examine the association of time of day with standard scores for seven neuropsychological tests, as well as summary scores for tests of memory and tests of executive functioning. While executive functioning was found to be unaffected by time of day, memory was vulnerable to time of day. Best performance occurred during early morning hours and worst performance occurred mid-day (i.e., around noon). Because normal brain function depends on a continuous supply of glucose, it may be that naturally occurring alterations in blood glucose levels (perhaps related to time since last meal) have a significant impact on memory. Findings have important implications for the clinical assessment of patients, design of research studies in dementia, and the daily functioning of older adults.

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A.R. KAUP, N.L. DENBURG, E.C. RECKNOR, S.S. KHALSA, H.J. FRIEDRICHSEN, I. LEVIN, D. TRANEL & A. BECHARA. The Effect of Deliberation on Decision-Making in Older Adults.

Executive functions, including reasoning and decision-making, are thought to undergo disproportionate decline with age in some older persons. A well-studied index of reasoning and decision-making is the Iowa Gambling Task (IGT). During the IGT, participants choose between decks of cards with varying rewards and punishments, and the goal is to maximize profit. Several cognitive processes underlie decision-making abilities. In the present study we manipulated one aspect of the IGT, latency to response, and evaluated its effect on performance. One group ($n=12$) of older adults performed the IGT with no time constraints, choosing cards at a self-paced rate (unstructured), while a second group ($n=12$) completed the IGT under standard instructions (structured), which impose a six-second wait period between choices. Participants were aged 65-75, and the groups were well matched on education, intellect, and motor skill. The unstructured group spent much less time deliberating prior to choosing a card ($M=1.5$ seconds, $SD=0.75$). Consistent with expectations, the structured group outperformed the unstructured group. This manipulation was examined in a sample of younger adults, aged 26-40, and no group differences were observed. We interpret our findings in the context of a two-system model of judgment under uncertainty (Kahneman and others), in which the "intuition system" is a fast, emotionally-charged process, while the "reason-

ing system" is more deliberate and emotionally neutral. Both systems may be important for optimal IGT performance, and it could be that the unstructured group performed less advantageously by relying heavily on the "intuition system." These data suggest that older adults sometimes over-utilize intuition, leading to faulty decision-making.

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J. PAXTON, D.M. BARCH & T.S. BRAVER. Exploring the Effect of Environmental Support and Strategy Training on Cognitive Control Impairment in Older Adults.

Age-related declines in the context processing component of cognitive control have been demonstrated. Mechanisms for improving contextual processing in older adults were evaluated with aims to rehabilitate and delineate the underlying component abilities responsible for this age-related impairment. Two studies assessed the influence of reducing working memory maintenance demands and providing strategy training on proactive context processing. In Study One, 24 young and 24 older adults performed the AX-CPT task of context processing in conditions manipulating maintenance demands. In Study Two, 20 older adults performed the task before and after undergoing specific training in a strategy that encouraged the proactive use of context representations. Forty additional older adults were assigned to control conditions that either entailed both extra practice and experimenter encouragement or just practice. Mixed model ANOVAs in Study One revealed that the reduced maintenance demands did not significantly improve performance among older adults, either for errors or reaction times (RTs). Within subject ANOVAs in Study Two revealed significant improvements in performance among older adults following strategy training, both for errors and RTs. Reductions in working memory load did not improve context processing in older adults, suggesting that working memory impairment cannot explain this age-related deficit. Older adults receiving strategy training produced a pattern of performance indicative of more intact cognitive control. This suggests that age-related impairment in context processing may reflect a failure to use context representation in a proactive manner. Results from the control conditions will provide further information regarding the specificity of the training effect.

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R.H. PAUL, O. HAQUE, J. GUNSTAD, D. TATE, S. GRIEVE, A.M. BRICKMAN, K. HOTH, A. JEFFERSON & R. COHEN. Relationships between cognitive function, subcortical hyperintensities, and regional cortical volume in older healthy adults: selective role for S.

Previous studies have examined the impact of subcortical hyperintensities (SH), a proxy measure of cerebrovascular disease, on the cognitive abilities of otherwise healthy older adults. However, there remains a limited understanding as to what extent this MRI marker of pathological processes explains the decline in specific cognitive functions that occur nearly ubiquitously with advanced age, especially in relation to other age-related imaging markers. In the present study we compared cognitive abilities between a sample of 53 older healthy adults (age range = 50-79) and a sample of 53 younger adults (age range = 21-40). In addition, the cortical volumes were computed using voxel-based morphometry and SH volume was determined for the older sample using a semi-automated thresholding technique. As expected, the older group performed significantly more poorly on most cognitive measures compared to the younger group. In addition, frontal grey matter volume and total grey matter volume were significantly reduced among the older individuals compared to the younger individuals. Only SH volume was

consistently associated with cognitive function, however, this relationship was evident only for a relatively small subset of older individuals with the most severe SH. These results suggest that the relationship between SH and cognition in the elderly is driven by a subset of individuals who may be in the earliest stages of vascular cognitive impairment. In addition, cognitive decline associated with age is determined by factors other than SH for most older adults, however, the presence of significant SH further complicates already affected neural systems. Correspondence: *Robert H. Paul, Ph.D., Psychiatry, Brown Medical School, 1 Hoppin Street, Providence, RI 02903. E-mail: Rpaul@lifespan.org*

W.S. HOUSTON, M.W. BONDI, L.T. EYLER, A.J. JAK, S.S. KINDERMANN & G.G. BROWN. Gene Dose-Brain Response Correlational Maps in Non-Demented Older Adults.

Several fMRI investigations have shown increased intensity and extent of brain activation during learning tasks in cognitively normal older adults with the APOE- $\epsilon 4$ allele. We examined the brain substrates underlying picture encoding in order to determine whether correlational maps of gene-brain associations might produce spatially coherent results. Twenty-two right-handed, nondemented, older adults were genotyped for APOE allele: 10 participants were $\epsilon 3/\epsilon 3$ homozygotes; 4 participants were $\epsilon 4/\epsilon 4$ homozygotes; and 8 were $\epsilon 3/\epsilon 4$ heterozygotes. Demographic and cognitive variables did not differ across APOE allelic types. The picture-encoding paradigm involved a blocked design alternating between encoding and repetition conditions. A forced-choice recognition test for the 48 photos followed scanning. Anatomical MR images and whole brain EPI sequences were collected and analyzed with AFNI. The comparison of interest was the difference in activation levels while viewing to-be-learned pictures vs. a repeated picture. Whole brain maps of the correlations between APOE $\epsilon 4$ gene dose (coded as 0, 1, or 2) and BOLD response during encoding showed several significant regions including the fusiform gyrus, ventral visual cortex, and temporo-occipital cortex where greater BOLD response was associated with a larger APOE $\epsilon 4$ dose. Thus, maps displaying correlations of genetic information with brain activity demonstrate that some between-subject variation in neural activity is under genetic control, even among healthy individuals. Because the APOE $\epsilon 4$ homozygotes, in particular, are at risk for developing Alzheimer's disease, such maps might contribute valuable information about critical brain areas to monitor as pre-clinical patients convert to AD.

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M.S. MARQUART, J. MOLD, J.G. SCOTT & R.L. ADAMS. Blood Pressure and RBANS Performance in Healthy, Older Adults: Findings from the OKLAHOMA Study.

Research has found discrepancies in the association of hypertension to cognitive performance in otherwise healthy adults. The RBANS has never been used to assess this association. This study examined if blood pressure (BP) is differentially related to RBANS indices at initial and 2-year follow-up both in terms of categorization of BP and as a continuous variable. The sample was from the Oklahoma Longitudinal Assessment of Health Outcomes in Mature Adults (OKLAHOMA) study ($n=827$). Individuals with incomplete data or various medical conditions (e.g. stroke, head injury, seizures) were excluded from analyses, leaving 671 individuals for the initial analyses, with 277 remaining for the 2-year follow-up analyses. Groups of BP classifications were based on hypertension history and current systolic BP. Group differences on RBANS indices at the initial and 2-year time-points were assessed using analyses of variance. The association between BP (systolic and diastolic) as continuous variables and RBANS indices were assessed using regression equations. Groups did not differ on any RBANS indices. Elevated diastolic BP was significantly associated with lower initial per-

formances on immediate and delayed memory indices. Elevated systolic BP was significantly associated with lower performances on the immediate memory index at a 2-year follow-up. Other cognitive indices were not associated with either systolic or diastolic BP at initial or 2-year time-points. This is the first study to use the RBANS to assess the relationship between BP and various cognitive domains. The RBANS was shown to be an effective instrument to track the effect of hypertension on cognitive status, and particularly memory. The RBANS offers an efficacious compromise between clinically used brief screening measures, such as the Mini-Mental State Examination, and more extensive neuropsychological batteries. This study also reiterates the usefulness of examining BP and cognitive abilities as continuous variables.

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A. BIELAK, L. MANSUETI, E. STRAUSS & R.A. DIXON. Performance on the Hayling and Brixton Tests in Older Adults: Norms and Correlates.

There is a need to have neuropsychological tests that are sensitive enough to distinguish normal changes associated with aging from those that are pathological. However, these measures are only useful if adequate norms are available. The present study expands the available normative data for two new executive functioning tasks, the Hayling and Brixton tests. The norms include a broad age range of typically aging older adults, and are presented in multiple age midpoints. We also investigate whether selected measures of intelligence explain age-related differences in these two tasks. The tasks were administered as part of the Victoria Longitudinal Study (VLS), a study of aging. 457 community-dwelling older adults (53-90 years) completed a neuropsychological battery, including the Hayling and Brixton tasks and measures of fluid and crystallized intelligence. Even among this sample of older adults, advancing age was associated with poorer performance on both tests. Removal of the fluid intelligence component by regression decreased the correlations between age and performance on these executive functioning indicators. However, three of the five correlations remained significant. Partialing the crystallized intelligence scores did not alter the correlations between age and performance on these two tasks. Our data for the Hayling and Brixton tasks extend the available norms to include a 40-year range of late adulthood. The effect of age on these two tasks is consistent with studies showing declines in executive ability with age. Further, results show that measures of fluid and executive ability tap similar but not identical constructs.

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T. KRETZMER, G.R. JEWELL, H.M. MURPHY, A. MEIDINGER, S. LIEM, A. WOODS, V. MARK, B. ANDERSON, A. CHATTERJEE & M. MENNEMEIER. Aging has Little Effect on Perception of Stimulus Intensity.

Perception of stimulus intensity depends on the formation of mental presentations of stimulus intensity. Normal aging literature has consistently demonstrated significant decrements in threshold sensitivity; however, results of studies examining perception of suprathreshold stimuli in normal aging are less consistent. In some cases, no significant age differences are found. In contrast, other studies have demonstrated flatter growth curves among elderly adults. The objective of the current investigation was to examine the relationship between normal aging and perception of sensory intensity to better understand how age might affect the formation of mental presentations of stimulus intensity. Two groups of normal subjects (M ages 23.9, 71.4 years) were compared on their ability to judge the intensity of suprathreshold stimuli across 12

perceptual continua. Subjects rated intensity using numbers between 10 and 99. All data were log-transformed and estimates were compared to objective measures of intensity using simple linear regression. Slopes and y-intercept values were compared between groups. No differences in the size of the slope or y-intercept were found in the majority of group comparisons (83%). However, elderly subjects demonstrated increased exponents relative to younger, education and FSIQ matched, controls in 2 continua - estimates of numerosity ($t(43)=3.06$, $p=.004$) and sensitivity to point pressure on the right ($t(42)=2.71$, $p=.009$) and left hands ($t(42)=3.09$, $p=.004$). Despite well documented decrements in threshold sensitivity among elderly adults, normal aging does not necessarily alter one's ability to judge the intensity of suprathreshold stimuli. Older subjects may simply be more variable than younger subjects.

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P.A. TAYLOR-COOKE & M.S. MENNEMEIER. Aging Slows Habituation of Visual Attention.

Focused attention requires habituation to non-essential stimuli. Troxler fading, a form of sustained visual attention, refers to the normal disappearance of a peripheral target during periods of prolonged fixation on a central target. While fading is typically slower for targets on the horizontal than vertical meridian, most studies have been conducted with younger or non-naïve participants. One known study was conducted with older individuals, which showed a reversal of these asymmetries in fading. Blinking may have confounded these results, since blinks have been shown to prolong fade times and older individuals blink more often. The current pilot study was designed to address confounding variables from previous studies. Peripheral target size was decreased to reduce fade time and number of blinks per trial. Two healthy groups were recruited, 11 older (age range = 54 to 72, $M = 62.36$) and 8 younger (age range = 23 to 33, $M = 26.25$) participants. Each completed 64 trials on a computerized program of Troxler fading. A repeated measures ANCOVA, covarying on blinks, was used to analyze fade time across the cardinal meridians. Fade time was slower on the horizontal ($M = 12.15$, $SD = 6.05$) than vertical ($M = 8.97$, $SD = 5.14$) meridian, $F(1, 16) = 25.4$, $p > .001$ regardless of age; however, older participants had slower fade times ($M = 12.82$, $SD = 6.96$) than younger participants ($M = 6.91$, $SD = 2.04$), $F(1, 16) = 4.90$, $p < .05$. The reversal previously found in asymmetries for older participants was not replicated. Results indicate instead that aging may slow ones ability to habituate attention to non-essential visual stimuli.

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Assessment of Executive Functions, Memory, and Intellectual Function

S. WOODS, J. SCOTT, C.L. CAREY, A.I. TROSTER, R.K. HEATON, I. GRANT & T. GROUP. Evidence for the construct validity of action (verb) fluency.

The aim of the present study was examine the construct validity of action (verb) fluency, which is a novel task requiring the rapid oral generation of verbs. Action fluency was developed as a measure of executive functions stemming from literature indicating that verb naming is primarily mediated by fronto-striatal circuits. In support of this premise, emerging data indicate that action fluency is more sensitive to fronto-striatal circuit pathophysiology than either letter or animal fluency. Furthermore, preliminary evidence of the convergent and divergent validity of action fluency as a measure of executive functions exists for older

adults; however, the correspondence between action fluency and other neuropsychological measures has not yet been examined in younger, healthy adults. A sample of 95 healthy controls completed action fluency as part of a comprehensive neuropsychological battery. The study sample was 63% male, 60% Caucasian, and averaged 40 ± 12 years of age and 14 ± 3 years of education. The action fluency total score demonstrated moderate correlations with letter and animal verbal fluency, as well as with tests of executive functioning, verbal working memory, and processing speed. No significant associations were observed between action fluency and measures of praxis or verbal and visual encoding. These findings support the construct validity of action fluency as a measure of fronto-striatal cognitive functions as demonstrated by evidence of convergence (i.e., executive functions, working memory, and processing speed) and divergence (i.e., praxis and encoding) with other putative cognitive tasks.

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R.C. MARSHALL & C.M. KAROW. Performance of Normal Participants on the Rapid Assessment of Problem-Solving Test (RAPS).

RAPS is a screening test for problem-solving for use in clinical settings where formal assessment is not feasible. This presentation (1) overviews RAPS materials, administration, and scoring and (2) summarizes normative data on RAPS. Participants were 112 adults (40 males, 72 females) with a range of ages and education levels. Prior to RAPS testing, they were administered a battery of neurocognitive tests. RAPS testing involved solving three verbal problems presented in a "Twenty Questions" format. Problems involved 32-item picture matrices of common objects from known semantic categories (e.g., animals). Participants asked yes/no questions to identify a "target" picture designated by the examiner. Four scores were computed for RAPS: (1) number of questions asked; (2) percentage of constraint-seeking questions; (3) integration-planning score; and (4) question-asking efficiency score. On the average, participants asked 14.08 questions in solving 3 RAPS problems; they used constraint-seeking questions more than 80% of the time. RAPS testing took less than 20 minutes. No learning effects were found on RAPS. A regression analysis indicated that age, gender, and education accounted for less than 6% of the variance on RAPS performance. While participants relied heavily on classification strategies to solve RAPS problems, integration-planning and question-asking efficiency scores revealed a relatively wide range of performance levels on the test. RAPS appears to be sensitive to differences in problem-solving for normals and would therefore appear to be well-suited for use in a clinical setting where testing time is limited. Differences between normal subjects on RAPS appeared to reflect variations in the ability to integrate information from the picture array, to plan question-asking sequences, and to shift question-asking strategies when needed.

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M. LEVAV, B. NADLER & A. BREZNER. Parents Report on Behavior Problems and Executive Functions: Are these perceived as a single domain?

To assess parents appraisal of behavior problems and executive function levels among children with acquired and developmental disorders affecting the brain. 20 boys and 12 girls mean ages 11 years (range 5-17) with a variety of insults to the brain (e.g. epilepsy, tumors, CP, head injury, prematurity, CVA, and other developmental syndromes) attended by a specialized hospital service. An extensive battery of neuropsychological tests was administered. Parents completed the Hebrew versions of the Achenbach Behavior Checklist (CBCL) and Brief Inventory of Executive Function (BRIEF, Gioia et al., 2000, Hebrew: Levav

& Even 2003, unpublished). Significant correlations ($r = .50$ to $.76$, $p < .002$ Bonferroni corrected) were obtained between the CBCL Internalizing factor and the BRIEF Behavioral regulation scale, and between CBCL anxiety-depression and BRIEF shifting, and also between CBCL withdrawal and BRIEF initiate ($r = .60$). Correlations with the Externalizing factor were weaker, although statistically significant. T-tests between the acquired and developmental groups on CBCL and BRIEF scores showed statistically significant differences in the CBCL Internalizing factor (withdrawal, anxiety-depression) and the BRIEF Emotional Control scale. Children affected with acquired insults to the brain were assessed at a much higher risk ($p < .007$) on these two scales. The results highlight the association between behavior problems and executive functions of children with acquired and developmental conditions and the parents contrasting focus on their behaviors. The results may assist in planning ecologically-adapted interventions.

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A. SCHAFER, P.A. LICHTENBERG & L. FICKER. The Influence of Reading Ability on Executive Function Tasks.

In an effort to use normative data most efficiently, psychologists are increasingly making use of years of education. However, examining education alone is not adequate to measure premorbid intellect (Manly, 1998). This would be especially true for populations that are traditionally subject to substandard quality of education. In such persons, it is possible that considering them as intellectual peers of those of equal education may overestimate their ability, which may lead to over-pathologizing. This may be the case with African Americans who are incorrectly diagnosed with dementia with a greater frequency than European Americans. Measures of demonstrable aptitude, such as reading ability, may provide a more accurate measure of comparison. Also examined was the reliance EF tasks have on reading ability, considering the recent attention executive dysfunction has received in the early detection of dementia (e.g., Royall, 2000). Participants in this study included 100 community dwelling and independent-living elders, ranging in age from 59-95. Ninety-four percent of the sample was African-American. A series of multiple regression analyses was conducted in order to determine the influence that reading ability and education have on EF tests, as well as to determine whether reading ability contributed significantly to test results. Reading ability, as measured by the WRAT-3, accounted for a greater amount of variance than did years of education on nine of eleven subtests. Tasks for which reading ability accounted for a significant amount of variance include COWAT, WAIS-III Letter-Number Sequencing and Similarities, Coloured Progressive Matrices, and Trails. Animal Naming and Clox were not affected by reading ability. In populations susceptible to poor educational quality, these tests shown to be influenced by reading ability may be particularly inappropriate for determining cognitive status. Animal naming and Clox are better candidates.

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J.A. DEMERY, P. SEIGNOUREL, R.M. BAUER & W.M. PERLSTEIN. Predictive Power of Executive Functioning Tests in Mild and Moderate/Severe Traumatic Brain Injury.

An important goal of neuropsychological assessment is to aid in the detection of brain/cognitive dysfunction. Importantly, though, traditional neuropsychological tests of executive dysfunction have limited reliability and validity and may be prone to diagnostic misclassification. Our objective in the present study was to examine the relative classification accuracy of several commonly used neuropsychological instruments and several tests derived from the tradition of cognitive psychology in patients with traumatic brain injury. Thus, we compared the performance

of patients with mild ($n=20$) or moderate/severe ($n=26$) TBI to demographically-matched healthy controls ($n=24$) on traditional neuropsychological tests of executive functioning (e.g., Wisconsin Card Sorting Test (WCST)-card version, Stroop-card version, and Digit Span) and tests derived from the cognitive neuroscience tradition (e.g., WCST-computerized version, trial-by-trial task switching Stroop-computerized version, and N-Back working memory task). We then computed indices of predictive power at three levels of impairment (e.g., 1.0, 1.5, and 2.0 SDs) to determine which tests were most diagnostically accurate. Significant between-group differences were found on all tests except for the WCST-card version and Digit Span test. The test that best predicted mild and moderate/severe traumatic brain injury was the WCST-computerized version. Across all tests, predictive power differed as a function of brain injury severity. These findings suggest that tests derived from the tradition of cognitive neuroscience show promise in accurately differentiating healthy controls and mild TBI patients from patients with moderate/severe TBI.

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M. HISCOCK, J.S. CAROSELLI & R. SCHEIBEL. Poor Performance of University Students on the Iowa Gambling Task: A Replication.

Undergraduates from the psychology subject pool of a large public university were administered a computerized version of the GT. Seventy-eight males and 78 females contributed data for each of 100 trials. The dependent variable of interest was the number of times each of the four decks was selected in each block of 20 trials. Deck selections were analyzed in a repeated-measures ANOVA, which yielded main effects for magnitude of reward (\$100 versus \$50) and frequency of net gain (90% versus 10%). As in the earlier study, students preferred high-magnitude (disadvantageous) decks, $p < .0002$, and decks that yield a high frequency of net gain. Overall, 65% of the sample scored in the deficient range, i.e., these students made more disadvantageous than advantageous selections, and another 8% made an equal number of disadvantageous and advantageous selections. Correlational analyses indicated that the pattern of selections on Trials 61-100 was influenced significantly by the subject's reinforcement history on the initial 60 trials. The new data confirm that university students often perform in the impaired range on the GT. Students make choices so as to maximize the number of successful outcomes rather than to maximize winnings.

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C. PILARSKI, J. NEUDECKER, K. PYTLAK, N. SMITH & R. SKEEL. Two Behavioral Measures of Risk-Taking: The Bechara Gambling Task (BGT) and the Balloon Analogue Risk Task (BART).

There is a large body of research pertaining to the use of the Bechara Gambling Task (BGT; Bechara, Damasio, Damasio, & Anderson, 1994) as a measure of risk-taking; however, little research exists on the use of a fairly new measure known as the Balloon Analogue Risk Task (BART; Lejuez et al., 2002). Although both are computerized measures that attempt to simulate the conditions of real world decision-making by requiring individuals to identify the most advantageous response strategy, the BART places participants in a situation where choices must be made in the context of increasing risk. It was hypothesized the BART and the BGT would demonstrate convergent validity. The current study sought to evaluate the convergent validity of the BART by correlating the performance of 70 individuals (20 males and 50 females) on the BART with their performance on another behavioral measure of risk-taking, the BGT. Several possible dependent measures on the BART (total balloon pumps, total pumps adjusted, total balloon explosions, and totals for balloons with low, medium, and high probability of explosion) were cor-

related with the final BGT score (money earned/lost) and the overall BGT difference score (difference between bad and good deck selections). The BGT difference score was found to correlate significantly with the BART total pumps adjusted ($r = -.249$, $p = .038$) and total explosions ($r = .249$, $p = .038$). These findings provide support for the convergent validity of the BART. Clinical implications are discussed.

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R. DAVIS, E.N. ANDRESEN, G.E. LEDAKIS, T. GERVAISE & D.A. THOMAS. What is the Diagnostic Significance of Errors on the Trail Making Test?

The Trail Making Test (TMT) is a popular neuropsychological test that is exquisitely sensitive to brain damage. Normative data exist for time to completion on parts A and B, but not for the sequencing or loss of set errors patients might make. TMT-B errors have been found to increase with age (Rasmussen et al., 1998), to be more common among AD patients than healthy older adults (Amieva et al., 1998), and to distinguish between patients with frontal vs. nonfrontal lesions (Stuss et al., 2001). However, other findings suggest that TMT-B errors do not differentiate between head-injured and non-head-injured patients (Ruffolo et al., 2000), and may evidence poor test-retest stability (McCaffrey et al., 1989). Moreover, norms from the recently developed D-KEFS TMT illustrate that some errors (e.g., 3 errors among 70-79 year-old patients) fall within normal limits. The significance of TMT-B errors is thus unclear. We sought to clarify this issue. Correlates of TMT errors were studied in a mixed clinical sample of 65 patients (29 males, 36 females; M age = 72.43, $SD = 11.67$; M years education = 13.48, $SD = 2.91$) who underwent neuropsychological evaluation. Patients with dementia (AD or VD) made significantly more TMT-B errors than did patients with mild cognitive impairment (MCI), and patients without cognitive impairment (WCI). Differences between MCI and WCI patients were not significant. TMT-B errors increased significantly with age ($r = .36$) but were unrelated to estimated FSIQ, years of education, and gender. Among 43 patients with MRI data, TMT-B errors correlated significantly with the presence of cortical atrophy ($r = .35$), but were unrelated to the presence of small vessel ischemic disease. TMT-B errors also correlated significantly with patients' caregiver rated instrumental activities of daily living ($r = .42$). TMT-B errors appear to have noteworthy diagnostic significance among adults aged 50 and older.

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M.D. DICKINSON, M.L. ADAMS, G.K. BEATTY, J.S. CAROSELLI & M. HISCOCK. Development of a Non-Manual Trail Making Test: Preliminary Results .

The Trail Making Test (TMT) is a widely used neuropsychological instrument. However, the requirement for manual responding may render the test inappropriate for use with patients whose motor functioning is impaired. We have devised a computerized, non-manual TMT (NMTMT) that requires only oral responses. The primary objectives of this presentation are (1) to describe the NMTMT, (2) to specify similarities and differences in the TMT and NMTMT, and (3) to determine the relationship of both tests to other instruments that are thought to measure similar skills. Forty university undergraduates (30 females, 10 males) completed the NMTMT (Parts A and B) along with the conventional pencil-and-paper TMT (Parts A and B), the Symbol Digit Modalities Test (SDMT), a Stroop interference test (STROOP), the Jumbled Numbers Task (JNT), and the WAIS-III Letter-Number Span Test (LNST). Analysis of variance indicated that the NMTMT was executed more slowly than the TMT, $p < .0001$. Also, the difference in completion time between Parts A and B was smaller for the NMTMT than for the TMT, $p < .01$. No gender difference was obtained with either test.

Correlations between TMT scores and NMTMT scores were .39 for Part A and .68 for Part B. Correlations with scores from other tests yielded similar patterns for the TMT and NMTMT. Both tests were associated primarily with SDMT and JNT scores ($r = .42$ to .68). Regression analyses confirmed that the SDMT and JNT were the best predictors of TMT and NMTMT scores. The non-manual TMT is more difficult than the standard pencil-and-paper TMT. Part A scores from the respective tests are correlated moderately, but Part B scores are correlated more strongly. Both the TMT and the NMTMT show similar patterns of association with the other four instruments selected for study. Skills required by the Symbol Digit Modalities Test and the Jumbled Numbers Test overlap substantially with skills required by the computerized and standard Trail Making Tests.

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L. SHIRD, R. NAKASE-THOMPSON, S.T. CONTKOVSKY, A. DOUGHTY & M. SHERER. Comparison of the DKEFS Verbal Fluency Subtest, Trail Making Test B, and WCST-64 in Persons with Acute Traumatic Brain Injury .

Individuals with TBI often suffer cognitive impairments in the domain of executive functioning. Little is known regarding the utility of the Delis-Kaplan Executive Functioning System (DKEFS) for persons with TBI. The purpose of this study was to examine performance on the DKEFS in a sample of persons with TBI admitted for comprehensive rehabilitation. Subjects were consecutive TBI Model System of Mississippi admissions from 04/01/2003 to 03/31/2004. The sample was primarily male (63%), white (67%), single (52%), and competitively employed at the time of injury (67%). The average age was 33; and emergency department Glasgow coma Scale Score (GCS) was 8.21 and number of years of education was 12. Neuropsychological testing was administered at 4 weeks post injury. The neuropsychological testing battery included the DKEFS Verbal Fluency Subtest (DKEFS-VF) and other measures of executive functioning (Wisconsin Card Sorting Test-64, Trail Making Test B). To examine the influence of severity of injury on the DKEFS-VF, analysis of variance was used. Multiple regression was utilized to examine the individual utility of the DKEFS-VF relative to other measures of executive functioning, demographics (age), and injury severity (GCS) in predicting outcome at rehabilitation discharge. Performance on the DKEFS VFS for three injury severity groups was not significant. The perseverative responses index from the WCST64 was the only significant predictor of rehabilitation outcome. The DKEFS-VF, age, and GCS were not significant predictors. More research with the various DKEFS subtests is indicated to better understand its' utility over existing measures in measuring executive dysfunction after TBI. Correspondence: *Risa Nakase-Thompson, Ph.D., Neuropsychology, Methodist Rehabilitation Center, 1350 East Woodrow Wilson Drive, Jackson, MS 39216. E-mail: nakase@aol.com*

N. HSU, G. EGAN, M. KEYES, B. LEWISON, J. ELDER & E. DUNCAN. Wisconsin Card Sorting Test as a Measure of Executive Function: A Cautionary Note.

The Wisconsin Card Sorting Test (WCST) is frequently utilized to assess executive functioning in patients with schizophrenia. The purpose of this study was to examine the affect of attention and memory on executive functioning as measured by the WCST. Persons with schizophrenia ($N=24$) were recruited for this study due to the prevalence of frontal lobe dysfunction (e.g., WCST) in this population. The Attentiveness (d') Value of Continuous Performance Test (CPT), AX version, was used as a measure of attention; immediate- and short-delay free recall on the California Verbal Learning Test - II (CVLT-II), Short-Form were used to assess verbal memory; Number Error Score (NES) on the

Benton Visual Retention Test - Fifth Edition (BVRT-V), Administration A was used as a measure of visuospatial memory; and perseverative errors on the WCST was used as a measure of executive functioning. Linear regression analysis showed that the combined measures (CPT, CVLT-II, BVRT-V) accounted for 66% of the variance on the WCST. Visuospatial memory was the best predictor of WCST performance ($p < .01$), while attention was also a significant predictor ($p < .05$). Verbal memory did not impact performance on the WCST. Intact visuospatial memory and attention appear to be necessary for successful WCST performance. Caution is warranted in the interpretation of the WCST as a sole measure of executive function.

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D. EISENMAN, E.Q. MONTAGUE, L.H. LACRITZ & C.M. CULLUM. The Texas Card Sorting Test: A New Executive Function Measure.

The Texas Card Sorting Test (TCST) is a brief measure of cognitive flexibility and reasoning that involves sorting cards into groups by shared common dimensions (e.g., color, shape, semantic content). The test is briefer (10-15 minutes) than other similar measures and allows sorting along eight dimensions based upon patients' ability to generate different groupings. This study examined the relationship of the TCST to other cognitive measures. The TCST was administered as part of a larger neuropsychological battery to 26 consecutive outpatients presenting with memory complaints (12 M, 14 F; M age = 70 ± 7.9 years; M education = 14.46 ± 3.36). Correlations with other cognitive measures were examined. TCST total score was significantly ($p < .01$) correlated with estimated FSIQ ($r = .67$), Dementia Rating Scale total score ($r = .75$), WCST perseverations ($r = -.59$), Trail Making Test B ($r = -.74$), and Letter Fluency ($r = .70$). Lower correlations were seen with measures of language, (category fluency, $r = .46$, Boston Naming Test, $r = .42$), visual memory, (Rey Osterrieth delayed recall, $r = .46$), and simple attention (WAIS-III Digit Span, $r = .45$), providing some evidence of divergent validity. Results support the TCST as a measure sensitive to global cognition and executive functioning that may be particularly useful in situations which call for more abbreviated evaluations. In addition, the TCST does not involve negative feedback or indices of failure as with other common executive function tests, and thus, may be better received by some patients.

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M.A. SEDO & M. MEERSMANS. Validity of Non-Reading Forms of the Stroop and the Trail-Making Tests on Presurgical Parkinsonian Patients.

A number of specific subjects would benefit from easier alternative forms of our tests of executive functioning. On the Five Digit Test, we can compare Stroop-like behaviors in the absence of reading by using "groups of digits" (requiring "automatic" recognition of the digit values or "selective" counting of the numbers when they are presented in discrepant quantities (such as two 5s, three 4s). The spatial and mental exploration in the Trail-Making Test A and B can also be mimicked without requiring complex learned routines, through the use of "dual" items which require spatial and mental search interfered by other left frontal tasks, such as object naming. 28 presurgical Parkinsonian patients were assessed with the four tests (Stroop, T.M.T., Five Digit Test and the Oral Trails) as a part of a more extensive evaluation. Pearson correlations were calculated between the two sets of data. (FDT also presents a fourth situation, measuring mental switching; and Oral Trails presents a baseline measure of speed of functioning in the absence of spatial or mental search. Homologous parts of the Stroop and the FDT correlated .735, .749 and .697. Homologous parts of the Trails A and B correlated .759 and .710. All these correlations are significant at or beyond the $p = .001$

level. FDT and OT appear to explore cognitive processes closely related to those explored by the Stroop and T.M.T., in spite of the difference in the level of language experience, reading and learning required by the tasks. This could allow not just the testing of much younger or much more dysfunctional subjects; but also for the testing of individuals from different socioeconomical and sociolinguistic backgrounds and immigrant subjects with limited second language mastery; and allow direct comparisons of similar cognitive operations between vastly different linguistic populations.

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B.R. WILLIAMS, E.H. STRAUSS, D.F. HULTSCH & M.A. HUNTER. Reaction Time Inconsistency in a Spatial Stroop task: Age-Related Differences Through Childhood and Adulthood.

Age-related differences in inconsistency (moment-to-moment variation in performance) of reaction time (RT) were examined. The purpose was to replicate findings that inconsistency follows a u-shaped developmental curve, and extend such findings to conditions that require interference control. It was expected that inconsistency would be higher when interference control was required, and inconsistency under such conditions would show a greater rate of development (childhood) and deterioration (adulthood). A spatial Stroop task was used in 546 participants, aged 5 to 76 years. Participants were required to respond to stimulus direction (right or left). Three stimulus locations (left, right, or centre) permitted observations under three conditions: congruent, incongruent, and neutral. Before calculating the measure of inconsistency (i.e. within-subject SD), the data were purified from the effects of practice and fatigue, and from age-related differences in mean RT. Hierarchical regression analyses of neutral condition data indicated inconsistency followed a u-shaped curve. ANOVA demonstrated the relationship between age and inconsistency depended on condition: inconsistency in the congruent condition was higher than inconsistency in both the neutral and incongruent conditions across middle age groups. The finding that inconsistency in RT is characterised by a u-shaped curve across the lifespan was replicated suggesting inconsistency may reflect processing efficiency that is maximal in young adulthood. Moreover, inconsistency was differentially sensitive to demand on executive control processes. However, contrary to expectations, heightened inconsistency was not observed with increased load on the executive system. Inconsistency may also be sensitive to fluctuations in performance that reflect momentarily highly efficient responding.

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K.L. ISAACS, L.A. RUBIN, C. MORRISON, C.M. ZAROFF & W.B. BARR. An Analysis of the New Stroop Interference Score and its Relation to Measures of Executive Functioning in Epilepsy Surgery Candidates.

Chafetz and Matthews (2004) recently published a new method for calculating Stroop interference scores, based on a model of frontal inhibition and suppression. The goal of this study was to determine relations of the New Stroop Interference Scores (NSIS) to established measures of executive functioning and to determine whether these relations are greater than those obtained when using Golden's (1978) original interference score. Participant data were drawn from archived neuropsychological records of 153 adult patients with partial epilepsy undergoing presurgical workups. In addition to the Stroop Color and Word Test, measures included: Wisconsin Card Sorting Test (WCST), Trail-making Test (TMT), Ruff Figural Fluency Test (RFFT), and Controlled Oral Word Association Test (COWAT). The NSIS was significantly correlated with most measures of executive functioning, with values rang-

ing from $r = .227$ to $r = .388$. The highest correlations were observed with the COWAT and the RFFT. Correlations using the Golden formula ranged from $r = .106$ to $r = .288$. Comparisons using Fisher's z transformation found the NSIS to be more strongly correlated with select EF measures including the TMT B and the COWAT. These findings suggest that the NSIS may be a better predictor of specific measures of executive functioning than Golden's interference score. The relationship between the NSIS and measures of verbal and figural fluency were particularly robust. These findings indicate that the NSIS might provide a more valid and useful measure of executive functioning than the score computed with the original formula.

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K. RANDALL, K. KERNS, A. RIZZO & S. YEH. The Stroop in a Virtual Reality: Is it Virtually the Same?

One of the most well established phenomena demonstrating inhibition is the Stroop effect. The Stroop Test (Stroop, 1935) uses a color-word conflict design that requires participants to inhibit their proponent response to read color names when instructed to name conflicting ink colors. This study utilizes a Stroop task presented in a virtual reality (VR) environment and compares it to the classic task to assess the validity of a Stroop task presented in a VR environment. Psychology students ($N = 81$) were immersed in a virtual classroom. Two tasks were administered requiring attending to color boxes or words displayed in differing colors on a blackboard. Word stimuli are either incongruent or congruent as in the classic task. An avatar teacher states a color as the stimuli appeared on the board, and the participant was required to determine if she correctly named the color of chalk in which the stimuli was shown. Participants also completed the Golden (1978) Stroop. A repeated measures analysis on the VR tasks revealed mean RT to colored boxes were significantly faster than RT to congruent word stimuli, and both were significantly faster than RT to incongruent word stimuli. Both the Golden and VR Stroops were all significantly correlated with each other. The significant relationship between Stroop tasks suggests that similar cognitive mechanisms are being activated to complete the two tasks, however the pattern of results for congruent stimuli differed from what is typically seen. Results will be discussed along with the utility of a VR Stroop.

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L. KERENYI, R. GAVETT, J. BRAUN, J. DUQUIN, B. WIENSTOCK-GUTTMAN & R.H. BENEDICT. Comparing the Validity of the Wisconsin Card Sorting Test and D-KEFS Sorting Test in MS.

The Wisconsin Card Sorting Test (WCST) is frequently used to evaluate executive function in MS, but the Sorting Test from the Delis-Kaplan Executive Function System (D-KEFS) was recently recommended by an international panel because it is reliable and has alternate forms. These tests were compared in a prior study (Beatty & Monson; 1996) of 30 patients, the majority of whom had chronic progressive MS. In the present study, we compared the validity of these tests in a larger sample, more representative of the MS population. The WCST and the D-KEFS Sorting Test were completed by 71 MS patients and 25 age- and education-matched controls. Most patients ($n=49$) had relapsing-remitting (RR) disease. ANOVAs were used to compare MS vs controls, and RR vs progressive patients. There were no significant MS/control differences on the WCST. The following MS defects were found on the D-KEFS: Description Score ($p=0.04$), Perseverative Sorts ($p=0.01$), and Correct Sorts (trend). Both tests discriminated relapsing from secondary progressive disease types. Correlations with other cognitive tests were significant and similar across the two tests. The D-KEFS Sorting Test is more sensitive in MS than the WCST and the tests are similar in sensi-

tivity to disease course. Although group effects were smaller than reported by Beatty and Monson, our sample included more mildly affected RR patients, and is more representative of the MS population. The findings support an international consensus panel (Benedict et al, 2002) which recommended the D-KEFS Sorting Test for evaluating MS patients.

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M. KIM & S. PARK. Validity study of memory and frontal lobe subtests of KBNA in Korean college students.

This study explored the validities and reliabilities of memory (Word List & Complex Figure) and frontal lobe subtests (Practical Problem Solving & Conceptual Shifting) of Kaplan-Baycrest Neuropsychological Assessment (KBNA). A total of 94 healthy Korean college students (male:44, female:50) participated in this study. For construct validity, the correlations between Word List and CVLT (California Verbal Learning Test), between Complex Figure and RCFT (Rey-Osterrieth Complex Figure Test), between Practical Problem Solving & Conceptual Shifting and WCST (Wisconsin Card Sorting Test) were performed. And for the test-retest reliability, the memory and frontal lobe subtests of KBNA were readministered with an interval of 4 weeks. The results showed significant associations between the immediate and delayed recalls of Word List and CVLT ($r=.34$, $r=.48$, $p<.01$), and between the immediate and delayed recalls of Complex Figure and RCFT ($r=.31$, $r=.48$, $p<.01$). However, no significant correlations between recognition of Word List and CVLT, and between recognition of Complex Figure and RCFT were observed. There were no associations between Practical Problem Solving & Conceptual Shifting and WCST. In addition, the test-retest reliabilities of memory and frontal lobe subtests of KBNA were high. The correlational coefficients between 1st and 2nd administrations of Word List, Complex Figure, Practical Problem Solving & Conceptual Shifting were .83, .79, .82 and .82, respectively. The present results indicate that Word List and Complex Figure subtests of KBNA are reliable and valid verbal and memory tests, respectively. However, frontal lobe subtests of KBNA and WCST seem to evaluate different frontal lobe functions.

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L.J. GRANDE, W. MILBERG, J. RUDOLPH, M. CAZIANO & R. MCGLINCHEY. A Timely Screening for Executive Functions and Memory.

This study investigated the validity of a brief, domain specific screening measure, Clock in the Box (CIB), to identify early cognitive problems in individuals at risk for vascular-related cognitive impairment. A total of 140 participants including healthy controls and individuals at high risk for stroke completed the CIB and standardized measures of cognitive function. The CIB consists of drawing an analog clock in one of four locations (coded by color), and setting the correct time. The CIB was scored based on eight features, four comprising a memory subtest and four comprising an executive subtest. Controlling for age and education, CIB-memory and CIB-executive function subtests were correlated with performance on the Hopkins Verbal Learning Test (HVLT); and the CIB-executive subtest was correlated with Trail Making B, the Folstein Mini-Mental State Exam, and the Wechsler Test of Adult Reading. Additionally, stepwise linear regression revealed that (1) CIB-memory subtest, education, and age, were significant predictors of list learning and recall (HVLT), and (2) CIB-executive subtest and MMSE were significant predictors of Trails B performance. Further, the executive subtest alone correctly classified 73% of the participants as at risk or

healthy. These results suggest that the CIB scores are predictive of performance on standardized measures, and that the two CIB subtests measure two critical domains of cognitive function. This data indicate that the CIB may be helpful as a screening measure in the primary care setting to alert healthcare provider that a patient may be experiencing early decline and needs additional assessment.

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M.D. DICKINSON & M. HISCOCK. The Influence of the Flynn Effect on Age Norms for the Wechsler IQ Test.

The Flynn effect is a well-documented phenomenon showing that IQ scores have risen substantially since the implementation of intelligence testing. The Flynn effect not only has implications for interpreting testing results of individuals taking various versions of IQ tests, but it may influence how one interprets observed differences between age groups. Age-adjusted norms for subtests of the Wechsler Adult Intelligence Scale-Revised (WAIS-R) and 3rd Edition (WAIS-III) were analyzed to investigate changes in performance across the lifespan as well as changes in performance from one version of the test to another. Difference scores between WAIS-R and WAIS-III subtests and difference scores between 20- and 70-year-olds on WAIS-III subtests were calculated to examine the influence of the Flynn effect on observed age-related performance differences. A Spearman rank-order correlation revealed that WAIS-III subtests showing the largest performance differences between older and younger adults tended to be the subtests that show the largest Flynn effect. Furthermore, analyses indicated that on subtests measuring what is conventionally described as fluid intelligence, observed age-related decrements in performance may actually be amplified by the Flynn effect. For these subtests, the Flynn effect accounted for 50% to 75% of the age-related decline in normative performance. These results indicate that observed performance differences between older and younger adults are actually a combination of the Flynn effect and cognitive changes associated with aging. Current assessment of older adults may significantly overestimate cognitive decline if solely based on WAIS subtest performance.

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R.T. LANGE & G.L. IVERSON. Evaluation of One- and Two-subtest Short-forms for Estimating WAIS-III Index Scores.

For decades, clinicians and researchers have been interested in abbreviated forms of the Wechsler Intelligence Scales for obtaining estimated IQ scores. Unlike its predecessors, the WAIS-III now generates four index scores in addition to traditional IQ scores. The purpose of this study was to evaluate the concurrent validity of short forms for the WAIS-III index scores. Participants were the Canadian WAIS-III standardization sample ($n = 1,105$). Using all possible one- and two-subtest combinations, estimated Verbal Comprehension (VCI), Perceptual Organization (POI), and Working Memory (WMI) indexes were generated by prorating relevant subtest scores. As expected, two-subtest estimations were consistently more accurate than one-subtest estimations. Pearson correlation coefficients between obtained and estimated index scores ranged from $r = .75$ to $.91$ for one-subtest estimations, and $r = .93$ to $.97$ for two-subtest estimations. The agreement rate between obtained versus estimated index scores was high for two-subtest combinations (range = 88-96%), but only moderate when using one subtest (range = 62-79%). Accuracy rates did not vary by age, ethnicity, gender, or education. However, accuracy rates were lowest for index scores falling in the High Average to Very Superior range. For the three index scores, agreement rates were highest when combining Information and Similarities for VCI

(95.9%), Block Design and Picture Completion for POI (92.4%), and Arithmetic and Digit Span for WMI (92.9%). These results suggest that although some two-subtest short forms are useful estimating VCI, POI, and WMI scores, one-subtest estimates should not be used for this purpose.

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R.T. LANGE, M.R. SCHOENBERG, T.S. WOODWARD & T.A. BRICKELL. Development of the Canadian Estimate of Premorbid Intelligence for the WAIS-III.

Normative data for the Canadian WAIS-III was recently published (Wechsler, 2001). However, many Canadian clinicians appear slow to embrace the new normative system, in part due to the absence of a method to estimate premorbid IQ scores. The purpose of this study is to develop regression algorithms to estimate premorbid IQ scores for use with the Canadian WAIS-III norms. Participants were the Canadian WAIS-III standardization sample ($n = 1,105$). The sample was randomly divided into two groups (Development and Validation Groups). The Development Group was used to generate 11 regression algorithms for FSIQ and two equations each for VIQ and PIQ. Algorithms combined demographic variables (i.e., age, education, ethnicity, and gender) with WAIS-III subtest raw scores (i.e., Vocabulary, Information, Matrix Reasoning, and Picture Completion). The algorithms accounted for 48% to 78% of the variance in FSIQ (SEE = 6.88 to 10.53), 70% to 71% in VIQ (SEE = 7.98 to 8.18) and 45% to 55% in PIQ (SEE = 9.47 to 10.44). In the Validation Group, there were moderate to high correlations between predicted and actual IQ scores (FSIQ = .61 to .88; VIQ = .82 to .85; PIQ = .66 to .72). The majority of the sample had predicted IQs that fell within a 95% CI band (FSIQ = 92% to 94%; VIQ = 93% to 95%; PIQ = 94% to 94%) and within 10 points of actual IQ scores (FSIQ = 66% to 87%; VIQ = 78% to 83%; PIQ = 70% to 72%). These algorithms were effective at estimating IQ scores in this healthy population. However, as a method for estimating premorbid functioning, clinical validation is required prior to use.

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R.T. LANGE, M.R. SCHOENBERG, D.H. SAKLOFSKE, T.S. WOODWARD & T.A. BRICKELL. Expansion of the Canadian Estimate of Premorbid Intelligence for the WAIS-III: GAI, VCI, and POI.

Since the release of the Canadian WAIS-III normative data in 2001 (Wechsler, 2001), the clinical application of these norms has been limited by the absence of a method to estimate premorbid functioning. However, Lange et al. (under review) recently developed regression algorithms that estimate premorbid FSIQ, VIQ and PIQ scores for use with the Canadian WAIS-III norms. The purpose of this study was to expand work by Lange et al. by developing regression algorithms to estimate premorbid GAI (Saklofske et al., in press), VCI, and POI scores. Participants were the Canadian WAIS-III standardization sample ($n = 1,105$). The sample was randomly divided into two groups (Development and Validation group). Using the Development group, a total of 14 regression algorithms were generated to estimate GAI, VCI, and POI scores by combining subtest performance (i.e., Vocabulary, Information, Matrix Reasoning, and Picture Completion) with demographic variables (i.e., age, education, ethnicity, and gender). The algorithms accounted for a maximum of 77% of the variance in GAI, 78% of the variance in VCI, and 63% of the variance in POI. In the Validation Group, correlations between predicted and obtained scores were high (GAI = .70 to

.88; VCI = .87 to .88; POI = .71 to .80). Evaluation of individual estimate errors revealed that the majority of estimated GAI, VCI, and POI scores fell within a 95% CI band (93.5% to 97.0%) and within 10 points of obtained scores (72.3% to 85.6%) depending on the subtests used. These algorithms provide a promising means for estimating premorbid GAI, VCI, and POI scores. Future research directions are proposed.

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Mild Cognitive Impairment

M.J. CHANDLER, L.H. LACRITZ, L.S. HYNAN, G. ALLEN, M. DESCHNER, M.F. WEINER & C. CULLUM. Differential Diagnosis of Mild Cognitive Impairment Using the CERAD Neuropsychological Battery Total Score.

To explore the utility of the CERAD neuropsychological battery Total Score in differential diagnosis of mild Alzheimer's disease (AD), Mild Cognitive Impairment (MCI), and normal controls (NC). Demographically corrected CERAD Total Scores (Chandler et al., 2004) were tabulated for mild AD ($n = 95$), MCI ($n = 60$), and NC ($n = 95$) subjects. ROC analyses were performed to determine the accuracy of the CERAD Total Score, MMSE, and CERAD Word List Recall in distinguishing samples. CERAD Total Scores were significantly different among the AD ($M = 60.2$, $SD = 11.9$), MCI ($M = 76.9$, $SD = 8.9$), and NC ($M = 88.4$, $SD = 9.3$) groups, $p < .0001$, and highly accurate in differentiating NC from mild AD [area under the curve (AUC) = .958], NC from MCI (AUC = .823), and MCI from AD (AUC = .882), p 's $< .0001$. The CERAD Total Score was similar to the MMSE and Word List Recall in differentiating NC and AD, but more accurately distinguished NC from MCI compared to the MMSE, and MCI from AD compared to Word List Recall. The CERAD Total Score most consistently differentiated MCI, AD, and NC groups in comparison to the MMSE and CERAD Word List Recall. These results support the CERAD Total Score as a useful screening tool in early identification of MCI and AD that is brief, easy to administer, and quick to score.

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A.K. TROYER & K.J. MURPHY. Tests of Prospective Memory Can Differentiate Normal Aging, Mild Cognitive Impairment, and Alzheimer's Disease.

Prospective memory (PM) is the ability to remember to carry out future intentions and is sensitive to the effects of neurodegenerative disease. We investigated whether time- and event-based PM tasks would detect the earliest cognitive changes associated with mild cognitive impairment (MCI) and Alzheimer's disease (AD). Participants were 29 healthy older adults, 44 patients with MCI, and 22 patients with AD. We developed two multiple-trial PM tasks and administered them to participants throughout a 2-hour assessment. The time-based task required participants to monitor and verbally report the time to the examiner every half hour; the event-based task required participants to select a designated pen for any task requiring a writing instrument. The proportion of targets missed was calculated for each participant for each PM task. Mean failure rates for the time-based PM task for the control, MCI, and AD groups were 1%, 30%, and 55%, respectively. Mean failure rates for the event-based PM task were 5%, 24%, and 44%. MANOVA with post-hoc testing indicated that, for each PM task, all three groups were significantly different from each other (all p 's $< .03$). The same pattern was obtained when PM performance was corrected for retrospective

memory for the task instructions. PM performance clearly differentiated normal aging, MCI, and AD. PM tasks may be sensitive to mild cognitive changes because they provide little environmental support and require considerable self-initiation to perform. These findings indicate that PM performance could be an important predictor in identifying those MCI individuals most likely to progress to AD.

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J. SAXTON, L.A. MORROW, S. BAUMANN, A. ZUCCOLOTTI, W. SCHNEIDER, J. OFFERMAN & S.T. DEKOSKY. The Computer-based Assessment of Mild Cognitive Impairment (CAMCI).

To present data from the Computer-based Assessment of Mild Cognitive Impairment (CAMCI). The CAMCI is a computer test designed to identify patients in the transitional stage between normal aging and Alzheimer disease (AD) known as Mild Cognitive Impairment (MCI). A pilot version of the CAMCI was run on 26 patients at the University of Pittsburgh Alzheimer Disease Research Center and from a local Primary Care Physicians office (mean age 71;56-87). Calculations of sensitivity and specificity were made comparing the ADRC subjects with confirmed diagnoses of AD, MCI or normal. Comparisons were made between impaired and non-impaired patients. On 4 of the 6 domains: verbal & visual memory, executive function, and recognition, the majority of the RT scores discriminated at greater than 75%. The word list recall time had an 87.5% sensitivity and 87.5% specificity. Comparisons were also computed with d prime for the 3 ADRC subject groups. Results demonstrated good discriminability (i.e., all d prime values ranged from 0.5 - 10.5 for controls vs AD, and 0.5 - 1.0 for control vs MCI). PCP patients scored in between the ADRC normals and MCI patients, as would be expected in a general population (i.e. a mixture of normals and MCI patients). The CAMCI has a number of advantages over standard cognitive tests. It provides a quick assessment of cognitive function; it is based on currently accepted criteria for the identification of MCI; and finally, patients can be tracked over time.

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B. HAYMAN-ABELLO, K.J. MURPHY & A.K. TROYER. Digit Symbol Incidental Learning, but not Speed, Differentiates Normal Aging from Mild Cognitive Impairment.

Digit Symbol (DS) performance can distinguish adults who develop dementia from those who do not. DS performance may improve in one trial through memorization of digit-code combinations. We investigated whether persons with mild cognitive impairment (MCI), who have memory decline and elevated rates of developing dementia, show a smaller rate of improvement on DS and poorer memory for the symbols. Participants were 18 healthy older adults and 21 patients with MCI. Each participant was administered the DS (Coding, Incidental Learning, Copy) in a neuropsychological battery, and total correct responses in 15-second intervals was recorded for Coding and Copy. There was a trend towards significance in Coding total scores [MCI $<$ control; $t(37)=1.59$, $p=0.06$], but no significant group difference in Copy total scores. Examining Coding performance with repeated measures ANOVA revealed no improvement between the first and second minutes and no significant interaction. Contrary to predictions, both groups showed declines between the first and last 15-second intervals [$F(1,37)=16.48$, $p<0.01$], and the interaction was not significant. On Incidental Learning, the control group had significantly better performance on Free Recall [$t(37)=3.59$, $p<0.01$] and Paired Recall [$t(37)=4.75$, $p<0.01$]. Free Recall was better than Paired in both groups, with a larger difference in

the MCI group [$t(37)=2.62, p<0.05$]. Incidental Learning, but not speed, differentiated normal aging from MCI on the DS test, but neither group showed improved Coding with practice. DS performance may help identify persons with MCI if Incidental Learning is used, and associative memory appears to be particularly sensitive.

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M.R. KNOX, L.H. LACRITZ, G. ALLEN, C.W. HUGHES, C.A. CLAASSEN & C. CULLUM. Diagnostic Accuracy of an Algorithm-based Neurocognitive Checklist in Normal Aging, Mild Cognitive Impairment, and Alzheimer's Disease.

We hypothesized that through statistical analysis of multiple neuropsychological test variables, an algorithm-based checklist could be developed to differentiate normal elderly (NE), Mild Cognitive Impairment (MCI), and Alzheimer's Disease (AD) populations with acceptable levels of classification accuracy (i.e., substantial agreement with interdisciplinary group consensus diagnoses based on Mayo Clinic and NINCDS-ADRDA Criteria). Subjects included elderly healthy controls ($n = 126$) and similar aged individuals diagnosed with MCI ($n = 40$) or with possible or probable AD ($n = 204$). All underwent neuropsychological evaluation, including the Dementia Rating Scale, California Verbal Learning Test, Wechsler Memory Scale R/III, Trail Making Test, Verbal Fluency, and Boston Naming Test. Subjects were divided into demographically matched cohorts for checklist algorithm development and cross-validation purposes. The checklist-based algorithm was developed through ROC/AUC analyses of group test performances, utilizing selected cut-scores as criteria. Correct classification using the checklist-based algorithm was observed in 87.3% of NE, 95% of MCI, and 90.2% of AD subjects in the algorithm development cohort and in 84.1% of NE, 95% of MCI, and 88.2% of AD subjects in the validation cohort. Substantial agreement between apriori group consensus and checklist-based algorithm diagnoses were obtained in both the development (Kappa coefficient = .82, $p < .01$) and validation cohorts (Kappa coefficient = .79, $p < .01$). The developed algorithm demonstrated high levels of classification agreement with apriori clinical diagnosis. Future application of neuropsychological algorithms appears promising, and may lend additional statistical support to clinical diagnosis in identifying and distinguishing between normal aging, MCI, and AD.

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S.E. ROLSTAD, O. KLANG, S. HANSEN, A. NORDLUND & A. WALLIN. The Matter of MCI Criteria; Assessment of Premorbid Capacity Versus Age Means.

Mild Cognitive Impairment (MCI) has been considered a transitional state between normal aging and dementia, characterized by amnesia; memory impairment but normal general cognitive functioning. Recently other cognitive deficits have been reported, which has led to a modification of MCI criteria. It has recently been questioned whether MCI criteria should be based on age means, or if an individual assessment of premorbid capacity should be carried out. The objective was to explore the applicability of MCI criteria based on age means, compared to criteria based on assessment of individual premorbid capacity. Hundred-and-twelve consecutive MCI subjects and 35 controls were included in the study. They were compared on measures of speed/attention, memory and learning, visuospatial function, language and executive function, as well as measures of premorbid capacity. Controls were significantly older. No differences were seen regarding education or general intellectual capacity. Controls performed significantly better than MCI on tests within all 5 cognitive domains. A greater number of subjects were found to have cognitive decline when criteria based on individual

capacity were applied. Furthermore, an increased power in the prediction of progressive cognitive decline was observed using individual criteria. Our results question the applicability of MCI criteria based on age means. Criteria based on premorbid capacity were found to more precisely detect subjects with cognitive decline, as well as predict progressive cognitive decline. Thus, our results support the notion of MCI criteria based on an individual assessment.

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K.L. NETSON, R. GRIFFITH, L. HARRELL, E. ZAMRINI, J. BROCKINGTON & D.C. MARSON. Executive Dysfunction Predicts Conversion to AD after One Year in Patients with Amnesic MCI.

Previous research in amnesic mild cognitive impairment (MCI) and Alzheimer's Disease (AD) has focused largely on memory impairment, though recent research suggests the involvement of other cognitive domains, including executive function. We assessed a range of domains of cognitive function to determine which measures best identified patients who converted from amnesic MCI to probable AD at one-year follow-up. Baseline neuropsychological test data of 34 patients with consensus-diagnosed MCI were examined for differences in those patients who remained stable ($n=26$) and those who converted to probable AD at one-year follow-up ($n=8$). Theoretical considerations and initial univariate analyses resulted in a predictor pool of semantic verbal fluency, verbal memory, and initiation/perseveration for classification of converters and non-converters. At the univariate level, converters to probable AD scored significantly worse than non-converters on a semantic fluency composite score ($p<.05$), DRS Initiation/Perseveration subscale ($p<.01$), DRS Memory subscale ($p<.05$), and WMS-III Logical Memory I ($p<.01$). Using stepwise discriminant function analysis, DRS Initiation/Perseveration emerged as the only predictor of conversion status, correctly classifying of 79.4% of the sample. Specificity was 84.6% and sensitivity was 62.5%. Interestingly, the addition of verbal memory and semantic fluency measures did not significantly increase classification accuracy. Greater baseline executive dysfunction may be a risk factor for conversion from amnesic MCI to probable AD. Further investigation into the role of executive dysfunction in MCI is warranted in order to identify specific characteristics related to cognitive change and progression to dementia.

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A. NORDLUND, S. ROLSTAD, O. KLANG, S. HANSEN & A. WALLIN. The Goteborg MCI study: Neuropsychological Profiles of Mild Cognitive Impairment with Vascular and Primary Etiology; VaD and AD in their Preliminary Stages?

Mild cognitive impairment (MCI) is, according to several studies, the preliminary stage of dementia disorders, such as vascular dementia (VaD) and Alzheimer's disease (AD). The objective of this study was to investigate whether any differences in the result profiles on a comprehensive neuropsychological battery could be seen when MCI subjects were grouped by etiology. Consecutive subjects ($N=125$) with clinically defined vascular MCI (vMCI) ($N=29$) and primary MCI (pMCI) ($N=86$) were included in the study and compared with cognitively healthy controls ($N=50$). The neuropsychological assessment comprised tests of speed/attention, episodic memory, visuospatial function, language and executive function. vMCI subjects were significantly older than pMCI. When controlled for age, controls performed overall significantly better than both MCI groups on the neuropsychological battery, pMCI performing better than vMCI. On closer analysis, vMCI performed significantly worse than pMCI on tests of attention and executive function.

Controls performed significantly better than both MCI groups on tests of episodic memory, visuospatial function and language, while no significant differences on those tests were seen between pMCI and vMCI. Neuropsychologically controls, pMCI and vMCI constitute three distinct groups, exhibiting differences in both overall performance and result profiles. The differences seen between vMCI and pMCI are in agreement with most reports on the neuropsychological differences between VaD and AD. These findings raise the question of whether it is possible to identify VaD and AD at their preliminary stages.

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M.R. GREHER, J.O. ATTMORE, L.H. LACRITZ, L.S. HYNAN, A.M. LIPTON & R. DIAZ-ARRASTIA. Vascular Risk Factors for Progression of Mild Cognitive Impairment to Dementia.

Vascular risk factors appear to be associated with cognitive impairment and dementia. This study examined the relationship of various vascular risk factors to rate of progression from mild cognitive impairment to dementia. Subjects included 104 individuals (59 M, 45 F; age M = 76.83 years \pm 8.63; education M = 13.61 years \pm 2.91) presenting with memory complaints, but who did not meet NINCDS-ADRDA criteria for dementia [Time 1 Clinical Dementia Rating (CDR) scale = 0.5, MMSE M = 26.71 \pm 2.4]. Subjects were divided into two groups based on stability or progression of CDR scores over a subsequent three-year period. Progressors included those who advanced to a CDR of \geq 1, while non-progressors remained at a CDR of 0.5 or below. The following vascular risk factors and demographic variables were analyzed through logistic regression to examine relationships with CDR progression: age at Time 1, duration of cognitive symptoms, education, gender, hypertension, heart disease, myocardial infarction, stroke, diabetes, and smoking. Gender and smoking were the only variables found to be significant predictors of CDR progression. Specifically, progressors were 3.8 times more likely to be female and 6.7 times more likely to be smokers. There were also significantly more females in the progressor than non-progressor group (59% versus 34%, $p = .01$). Results suggest that female gender and history of smoking may increase risk of progression from mild cognitive impairment to dementia, while presence of other vascular risk factors was not related to CDR progression over a three-year period.

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R.K. BHALLA, G. TREMONT, W.J. HOLLY & J.D. DAVIS. Frontal Systems Behavioral Dysfunction and Depression in MCI Amnesic vs. MCI Other.

MCI represents a transitional stage between normal aging and very early dementia. There have been few reports examining neuropsychiatric symptoms in patients with differing MCI subtypes. The purpose of this study was to examine whether MCI amnesic and MCI other populations differ in ratings of depression and frontal systems behavioral dysfunction. We compared self-ratings on the Beck Depression Inventory II (BDI-II) and informant ratings of apathy, executive dysfunction, and disinhibition on the Frontal Systems Behavior Scale (FrSBe) in 27 patients classified as MCI amnesic and 12 MCI other patients. The two groups were similar in age, educational attainment, and all had a CDR of 0.5. Petersen criteria were used to define the MCI amnesic group and patients who met the same criteria, without memory impairment, were classified as MCI other. ANOVA revealed that informant ratings of apathy were significantly higher in the MCI other group than in the MCI amnesics ($p=0.027$). There was no significant difference between the groups on the BDI-II. Furthermore, although there were no significant group differences, the MCI other group scored in the clinically significant range on measures of executive dysfunction ($p=0.064$) and total

FrSBe score ($p=0.064$). Even mildly impaired patients exhibit behavioral changes in the absence of functional decline. Furthermore, neuropsychiatric profiles may differ by MCI subtype. As a group, MCI other had significantly elevated levels of apathy compared to MCI amnesic, though the two groups did not differ in depressive symptomatology. Neuropsychiatric symptom profiles in MCI subtypes may provide insight into the etiology of and conversion rates to specific dementia subtypes. Correspondence: *Rishi K. Bhalla, PhD, Geriatric Psychiatry, Western Psychiatric Institute and Clinic, 1 Maple Ave., Riverside, RI 02915. E-mail: bhallark@upmc.edu*

L.A. RABIN, M.J. BORGOS, A.J. SAYKIN, M.D. ROOT, H.A. WISHART, L.A. FLASHMAN, G.C. SPREHN & R.B. SANTULLI. Judgment in Older Adults with AD, MCI, and Cognitive Complaints: Development and Preliminary Psychometric Evaluation of the Dartmouth Judgment Questionnaire (DJQ).

Judgment in everyday situations is an important aspect of executive functioning that warrants formal assessment during neuropsychological evaluations of older adults with suspected dementia. Knowledge about patients' judgment skills can inform decisions about diagnosis, functional and cognitive competence, and treatment. Despite the significance of this cognitive domain, few objective tests of judgment have been developed, and those currently in use lack sound psychometric properties, normative data, and clinical utility. The current study sought to develop a judgment test appropriate for use with older adults and to investigate its ability to detect group differences. The DJQ is a 17-item, open-ended questionnaire that evaluates judgment in four content domains: safety, social/ethical, financial, and medical. Participants listen to brief scenarios and report aloud what they would do in each situation (item scores range from 0-3). Participants ($N=80$) were older adults drawn from a larger Memory and Aging study and included patients with mild Alzheimer's disease (AD), patients with amnesic mild cognitive impairment (MCI), nondepressed individuals with cognitive complaints (CC) but normal neuropsychological test performance, and demographically-matched healthy controls (HC). Inter-rater reliability was .91 for the overall composite score. Group comparisons showed that patients with mild AD performed significantly worse than HCs. There were no reliable differences among the HC, CC, and MCI groups, confirming that judgment is not impaired in preclinical disease stages. These initial results encourage the further development of the DJQ as an indicator of judgment skills in clinical diagnostic or research settings, and suggest that this brief assessment is sensitive to early stages of AD. Longitudinal assessments are being performed to examine predictive validity for progression.

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D.J. COBIA & D.J. LAVOIE. Descriptive Profiles of Individuals with Mild Cognitive Impairment Using the Wechsler Memory Scale - Third Edition.

The boundary between normal aging and early Alzheimer's disease (AD), a condition identified as Mild Cognitive Impairment (MCI), has been the subject of intense interest. While objective memory assessment is key to identifying this condition, a lack of normative profiles for performance on the widely utilized Wechsler Memory Scale (WMS) remains. Such data is needed to provide a more accurate picture of MCI patients' memory function, to provide a better understanding of this condition relative to other potentially dementing disorders. This research presents preliminary normative WMS data from MCI patients. Descriptive testing profiles using the WMS-3rd Edition (WMS-III) were produced by collecting data on 25 individuals, aged 64-83, classified as having MCI according to Petersen et al. (1999) criteria. The sample was primarily male (65%) and Caucasian (92%), with a mean education of 15.2 years.

Of the 11 WMS-III subtests, all 6 of the primary subtests and 3 of the optional subtests were administered (8 subtests total), using standard administration procedures. The subtests utilized in this study allowed for the calculation of 8 index scores. Analyses of the index scores indicated impaired performance in visual memory, immediate memory, and the General Memory index (an index based on delayed memory subtests). Auditory memory and working memory were unimpaired. These findings indicate that while the most common characteristic of MCI is memory impairment, not all aspects of memory function are impaired. These findings distinguish MCI from other dementing conditions.

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S. VANDERHILL, E. STRAUSS, D.F. HULTSCH & M.A. HUNTER. Intraindividual Variability in Physical Functioning and Severity of Mild Cognitive Impairment.

Current classification systems for identifying individuals likely to develop dementia, based primarily on cognitive measures, may be limited in scope. Given the known links between cognitive and physical status in elderly individuals and between intraindividual variability in cognitive and physical performance and compromised neurological functioning, it is possible that older individuals exhibiting mild cognitive impairment (MCI) will show lower mean level of and elevated inconsistency in physical functioning. The present study examined cognitive and physical functioning in a sample of 304 nondemented, older volunteers aged 64 to 92. Participants were classified as Not Cognitively Impaired (NCI), MCI-Single (MCI-S: performance 1+ SD below normative group mean on one of five benchmark cognitive tests), or MCI-Multiple (MCI: performance 1+ SD below normative group mean on two or more tests). Physical performance was assessed weekly over five sessions using measures of balance/gait, grip strength, fine motor dexterity, blood pressure, and respiratory function. Results revealed that lower levels of and greater inconsistency in physical functioning were found in older participants and in participants with increasing severity of cognitive impairment. Evaluation of the combined and unique contributions of level and inconsistency in physical functioning to predicting cognitive status group membership revealed that, for some physical measures, inconsistency in physical functioning provided unique information beyond level of performance. These results are consistent with the notion that inconsistency in performance may be a behavioural marker of compromised neurological functioning and that information regarding physical functioning may prove useful for identifying individuals likely to develop dementia. Correspondence: *Susan Vanderhill, Psychology, University of Victoria, University of Victoria Dept Psychology, PO Box 3050 STN CSC, Victoria, BC V8W 3P5, Canada. E-mail: sr@uwic.ca*

T.R. LUBINSKY, J.B. RICH & N.D. ANDERSON. The Mnemonic Benefits of Errorless Learning and the Generation Effect for Individuals with Mild Cognitive Impairment.

Mild Cognitive Impairment (MCI) refers to a clinical condition in which individuals experience a memory impairment, yet they do not meet criteria for Alzheimer's Disease. Previous research has demonstrated that memory performance is enhanced when learning is errorless (when subjects are not allowed to guess during the learning phase) and self-generated (when target information is generated by the subject). The goal of this project was to investigate whether these conditions improve memory in people with MCI, and moreover whether their combination is even more beneficial. Thirty healthy young adults, 24 healthy normal older adults, and 24 individuals with MCI completed four memory tasks representing the crossing of errorless / errorful and self-generated / experimenter-provided learning. Memory was tested by free recall and recognition. Consistent with previous research, young adults recalled more than healthy older adults and healthy older adults recalled more than

individuals with MCI. By contrast, recognition performance did not differ between young adults and healthy older adults, but both groups had better recognition performance than individuals with MCI. Contrary to predictions, self-generation did not improve free recall for any group. However, for all three groups, errorless learning enhanced free recall, and this effect was most pronounced for individuals with MCI. Furthermore, all groups benefited from errorless learning and self-generation on delayed recognition. Overall, this study revealed that errorless learning enhances memory performance in people with MCI and can be used as a memory rehabilitation technique in these individuals. Correspondence: *Tobi R. Lubinsky, M.A., Psychology, York University, 4700 Keele Street, Toronto, ON M3J 1P3, Canada. E-mail: tobi@yorku.ca*

F. GOULD, M. LOPEZ & J.L. WOODARD. The Effect of Subjective Memory Complaint on RBANS Test Performance in MCI and Healthy Aging.

While the Petersen et al. (2001) criteria for mild cognitive impairment (MCI) requires subjective memory complaint (SMC), research evaluating the relationship between self-reported memory complaints and cognitive performance has yielded mixed results. We examined performance on 12 RBANS subtests in MCI and Healthy Aged (HA) controls. We hypothesized that performance of MCI and HA participants with SMC would not significantly differ from those without SMC on RBANS subtests. Participants were 97 HA controls and 18 individuals with MCI, defined as performance more than 1 SD below the age and education adjusted mean on the long term percent retention from the RAVLT and intact performance on the Mattis Dementia Rating Scale (MDRS) and Lawton IADL scale. HA was defined as performance above the 16th percentile for these same measures. 50% of the MCI participants and 39% of the HA participants acknowledged SMC by answering, "yes" to the question, "Do you think you have a memory problem?" One way ANOVAs were computed for the MCI and HA groups to assess the effect of SMC on RBANS subtest performance. SMC did not influence performance on any subtest. The presence of SMC did not significantly impact performance of MCI or HA participants on broad measures of cognitive function. These findings are noteworthy for the MCI group who exhibited significant, psychometrically defined memory impairment. In light of the questionable relationship between SMC and cognitive test performance further research is needed to ascertain whether SMC should continue to be part of the diagnostic criteria for MCI. Correspondence: *Felicia Gould, M.S., Psychology, Rosalind Franklin University of Medicine and Science, 3333 Green Bay Road, North Chicago, IL 60064. E-mail: felicia.gould@students.rosalindfranklin.edu*

Symposium 1/4:30–6:30 p.m.

Cognitive Neuroscience Approaches to Traumatic Brain Injury

**Chair: William Perlstein
Discussant: Harvey Levin**

W.M. PERLSTEIN. Cognitive Neuroscience Approaches to Traumatic Brain Injury.

Investigations of traumatic brain injury (TBI) have begun to employ methods derived from cognitive neuroscience and functional brain imaging to complement findings from neuropsychological studies. This symposium brings together investigators with different cognitive neuroscience approaches to examining the neuro-cognitive sequelae of TBI. We will present new findings representative of different lines of re-

search and different levels of analysis. Dr. Levine et al. will present findings from recent functional (fMRI) and structural (DTI) brain imaging studies, relating these findings to performance on the Sustained Attention to Response Task to reveal functional-anatomical relationships in TBI. Dr. Newsome et al. will present fMRI findings from a study which examined the neural correlates of working memory dysfunction in children with TBI, and will discuss the role of longitudinal investigations of brain activity in TBI-related working memory deficits. Dr. Perlstein et al. will present findings from cognitive studies using tasks derived from cognitive psychology and neuroscience, which include behavioral, ERP and fMRI methods, and which draw from cognitive control theory of frontal cortex functioning. Finally, Dr. Levin, the Discussant, will critically assess the approaches outlined in these studies, and comment on the evolving role of cognitive neuroscience in research and assessment of TBI and how these approaches may make meaningful contact with cognitive rehabilitation efforts. In sum, this symposium will encourage the further application of cognitive neuroscience methods to the study of TBI, and suggest ways that these approaches can both influence and be influenced by cognitive rehabilitation efforts.

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B. LEVINE, C. O'CONNOR, N. RICHARD, D. TISSERAND & I.H. ROBERTSON. Attention in Traumatic Brain Injury: Studies with Functional Magnetic Resonance Imaging and Diffusion Tensor Imaging.

Objective: Patients with traumatic brain injury (TBI) often have attentional deficits. These deficits are likely related to white matter pathology, which is a primary pathology in TBI. The nature of this relationship is difficult to determine with standard structural neuroimaging. This presentation will focus on our research on alternative imaging methods for better resolving functional-anatomical relationships in TBI. Methods: The functional MRI (fMRI) studies involve the Sustained Attention to Response Task (SART), a measure previously known to be sensitive to TBI. The SART was administered to control subjects and a preliminary sample of moderate-to-severe TBI patients during scanning with fMRI. A separate sample of moderate-to-severe TBI patients was scanned with diffusion tensor imaging (DTI). Fractional anisotropy (FA), a measure of white matter integrity, was derived for large white matter pathways as well as for individual brain regions. FA data were compared to high resolution structural MRI imaging of white matter. Results: Healthy controls activated a predicted sustained attention network, including activation in the thalamus, right posterior parietal cortex, and right dorsolateral prefrontal cortex. TBI patients showed an altered pattern of activation. DTI data revealed reduced FA in regions in which white matter appeared normal on structural MRI. Conclusions: Novel neuroimaging methods are necessary to better understand the neural correlates of attentional deficits in TBI. Our fMRI and DTI data show abnormalities in brain function and microstructure not appreciated on even the highest quality structural MRI scans. Future studies will involve pre- and post-rehabilitation imaging using fMRI/SART paradigm.

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M.R. NEWSOME, R.S. SCHEIBER, J.V. HUNTER, Z.J. WANG & H.S. LEVIN. Brain Activation During Working Memory after Traumatic Brain Injury in Children.

Objective: Children with severe TBI have impaired working memory (WM), a cognitive ability mediated by a frontally guided network. Functional magnetic resonance imaging (fMRI) has shown that brain activation during performance of a WM task is more diffuse in adults with severe TBI relative to uninjured controls, but a corresponding

study has not been reported in children. Method: Five children (ages 9-15 years) with moderate to severe TBI underwent fMRI during an N-back WM task in which the memory load was adjusted from 1 to 3-back to obtain a criterion of at least 75% correct. Subjective task difficulty was controlled by matching patients and controls on the highest level of N-back performed at criterion. Results: In comparison to individually-matched uninjured children, three patients reached criterion performance under lower memory loads and exhibited less extensive brain activation. Two other TBI patients performed the WM task at criterion under the highest memory load and exhibited bilateral frontal activation similar to uninjured children. Discussion: Overall, extent of brain activation did not differ between TBI and uninjured children in a group analysis. Frontal activation within the TBI group was positively correlated with age and time since injury. Longitudinal fMRI data are needed to analyze the effects of TBI severity and age at injury on changes in brain activation associated with WM development.

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W.M. PERLSTEIN, M.J. LARSON, J.A. DEMERY, P.J. SEIGNOUREL & D.A. STIGGE-KAUFMAN. Cognitive Control Dysfunction in Chronic Traumatic Brain Injury.

Objective: TBI patients show deficits in cognitive control—the ability to exert control over thought and action. The representation and maintenance of context information used to guide task-appropriate behavior, and post-error strategic performance adjustments are critical components of control, but their integrity has not been examined in TBI. Methods: Healthy controls and mild and moderate/severe (M/S) TBI patients performed an AX-CPT and a task-switching Stroop, both designed to place demands on the representation and maintenance of context. For the Stroop task, word-reading and color-naming instructional cues were temporally separated from the congruent, neutral, and incongruent Stroop stimuli by 1- and 5-s delays. The AX-CPT similarly separated cues and probes, and allowed for selective examination of context maintenance, implementation of control, and post-error strategic adjustments. Event-related potentials during Stroop performance were also acquired to enable the temporal dissociation of component processes. Finally, the relationship of context maintenance to self- and other-reported everyday symptoms was also examined. Results: M/S TBI patients performed most poorly on task conditions requiring the maintenance of context, but not on other conditions reflecting generalized impairment. M/S TBI patients also showed impaired strategic adjustment following erroneous performance. Finally, performance across tasks was highly correlated among conditions requiring context maintenance and was related to reports of everyday functioning. Conclusions: TBI patients are impaired in a severity-dependent manner in the ability to represent and maintain context information to guide task-appropriate behavior. This context processing deficit, presumably mediated by the prefrontal cortex, was related to measures of daily functioning, suggesting that cognitive control dysfunction may have meaningful ecological, adaptive implications in patients with TBI. Correspondence: *William M. Perlstein, Ph.D., Clinical and Health Psychology, University of Florida, HSC Box 100165, Gainesville, FL 32610. E-mail: wmp@grove.ufl.edu*

Paper Session 1/4:30–6:30 p.m.

Developmental Disorders

N. KLEINHANS, D.N. COHEN & E. COURCHESNE. Atypical Lateralization of Language Activity in Autism Spectrum Disorders.

Atypical language development is a prominent behavioral marker of autism spectrum disorders (ASD), but its neurobiological underpinnings

are incompletely understood. We conducted an fMRI study of letter fluency in 14 high functioning ASD individuals and 14 age-matched controls. Overt verbal fluency performance (B,H,R,F) was compared to self-paced repetition of the word "nothing." Responses were recorded to ensure accurate performance. The ASD participants generated fewer words per fluency block (4.5s) than controls (10.4 vs. 14.8, $p = .001$). No group differences were found in errors per block (0.35 vs. 0.61, $p > .05$) or amount of head motion. The ASD group had significantly greater activity than controls in right frontal (BA 13, 44, 45, insula) and right temporal (BA 20, 21, 22, 37) regions at $p < .05$, corrected. Between group differences were not observed in left prefrontal cortex. A follow-up analysis was conducted to further characterize the abnormal functional lateralization. Significant clusters of positive activity in right and left prefrontal cortex were identified in each participant ($p < .05$, one-tailed, corrected) and an asymmetry index was computed: $(L-R)/(0.5(L+R))$. Significantly greater leftward asymmetry was observed in controls than in the ASD group (1.62 vs. 0.38 respectively, $p < .001$). In fact, all controls showed leftward asymmetry whereas 12 of the 14 ASD individuals evidenced right, bilateral, absent, or weak left lateralized activation patterns. These data indicate reduced hemispheric differentiation for complex language in ASD. Abnormal functional organization may be related to early, rapid overgrowth of frontal and temporal lobes and subsequent arrested brain development recently reported in autism. Such growth dysregulation may disrupt the protracted developmental progression by which the left hemisphere becomes dominant for language, and in turn contribute to the language impairment seen in autism.

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E.D. BIGLER, S. PROVENCAL, S. MORTENSEN, M.A. FEARING, W. MCMAHON & J.E. LAINHART. Relationship Between Superior Temporal Gyrus and IQ in Autism.

There is converging evidence for critical regional differences in brain growth that may differentiate autistic from typical developing individuals. Given the core language deficits in autism, development of the superior temporal gyrus (STG) is a region of interest. STG morphometry was compared between high-functioning children with autism ($N=30$) and a control group of typically developing children and reading-disabled children ($N=39$). Images were obtained from a 1.5 Tesla MRI scanner and analyzed by two independent raters. Volumetric measurements of the STG were compared between the two groups after controlling for total intracranial volume. STG gray and white matter growth was also evaluated within and between the two groups according to performance on standardized IQ test scores. Results found no significant differences in total STG volume between autism and control participants; however, various significant correlations between STG volume and verbal, nonverbal, full scale intelligence quotients were found for autism and control groups. Further investigation revealed significant differences in white matter growth patterns for autistic individuals, particularly those with the lowest verbal IQ scores. Deviant developmental trends in tissue growth within the control group occurred more often in the reading disabled children as compared to the typically developing children. In summary, the relationship between STG volume and intellectual function was different between subjects with autism versus controls. Given that controls with the lowest verbal intellectual ability were more like subjects with autism, it may be that the STG findings are not specific to autism but more to the language-based deficits associated with aberrant tissue growth in the STG. Funded by NICHD 5 U19 HD035476-07, the NICHD Collaborative Programs of Excellence in Autism, and the Ira B. Fulton Foundation.

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C.W. LOFTIS, M. MAHONE, M.C. GOLDBERG, M.B. DENCKLA & S.H. MOSTOFISKY. Motor Persistence and Inhibition in Autism and ADHD.

While executive and motor control have been the focus of many studies in children with neurodevelopmental disorders, few studies have examined differences in patterns of skill profiles between neurodevelopmental disorders. An understanding of which specific abilities are impaired or spared may better illustrate risk factors and neurobehavioral markers for different neurodevelopmental disorders. The present study compared children with Attention-Deficit Hyperactivity Disorder (ADHD), high functioning autism (HFA), and controls on a selected set of measures emphasizing motor persistence and inhibitory control. A total of 136 children (52 ADHD, 24 HFA, 60 control) ages 7-13 completed measures of motor persistence (Lateral Gaze, NEPSY Statue), and inhibitory control (Conflicting and Contralateral Motor Response Tests). After controlling for gender, presence of learning disability, and IQ, children with ADHD were impaired (relative to controls) on both motor persistence and inhibition tasks. In contrast, children with HFA were impaired (relative to controls) only on the two motor persistence tasks, and were more proficient than children with ADHD on tasks of inhibition. These results suggest that motor persistence and inhibition are dissociable elements of executive control that can contribute to our understanding of the patterns of deficits in high functioning autism and ADHD. The findings are consistent with the literature suggesting that inhibition is one aspect of EF that is spared in HFA.

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L. KENWORTHY, D.O. BLACK, L. GILOTTY, P. LEE, G. WALLACE & C. GIBBS. Performance on Executive Function Tasks Predicts Social Functioning in Children with Autism and Typical Controls.

Executive Dysfunction is well documented in children with autism, but its relationship to the social deficits which characterize autism has been elusive. We previously demonstrated a relationship between executive functioning (EF) and social communication in autism but used two parent report measures to do so. We sought to extend our earlier findings using laboratory measures of EF and including a group of typically developing children. We examined the relationship between tasks of EF (i.e., planning, flexibility, fluency, verbal and spatial working memory, attention/memory span, and processing speed) and parent-reported social communication skills in a mixed sample of 22 children with autism (mean age = 10.8(1.25); 19 male; FSIQ = 98(18.1)) and 22 age matched typical controls (mean age = 10.9(0.89); 17 male; FSIQ = 119(16.6)). Data were analyzed using multiple regression with measures of EF as the predictors and the Social Reciprocal Communication score on the Social Communication Questionnaire (SCQ) as the outcome variable. Results indicated that laboratory measures of EF are significant predictors of SCQ Social Reciprocal Communication scores ($F = 5.18$, $p < .01$, R-square change = .56) with a large effect size (Cohen's standards) for planning, medium effect sizes for verbal fluency and flexibility, and small effect sizes for verbal working memory, processing speed, and attention/memory span. In this sample, there is a relationship between EF tasks and social reciprocity, which bears further investigation, because of its theoretical implications, and its potential relevance to the treatment of social deficits in children with autism. Correspondence: Lauren Kenworthy, PhD, Childrens National Medical Center, 111 Michigan Ave, NW, Psychology Dept., Washington, DC 20010. E-mail: lkenwort@cnmc.org

T.M. BROWN, M.D. RIS, D. BEEBE, P.K. SHEAR & R.T. AMMERMAN. Factors of Biological Risk and Reserve Associated with Executive Behaviors in Children and Adolescents with Spina Bifida Myelomeningocele.

The aim of this study was to examine differences between healthy children and adolescents and those with spina bifida myelomeningo-

cele (SBM) on the Behavior Rating Inventory of Executive Function (BRIEF). It was also designed to determine whether aspects of biological risk associated with SBM and reserve factors within the family could account for variability in executive function outcome in this population. Participants were 35 patients with SBM, ages 10-17, and 42 healthy controls of similar age. BRIEF scores for participants with SBM were compared to normative data (z-test) and the non-clinical comparison group (MANCOVA). To evaluate the contributions of risk and reserve variables to a statistical model of executive behavior outcome, multiple regression was performed for each composite index from the BRIEF: Metacognition (MI) and Behavior Regulation (BRI). Patients in the SBM group consistently exhibited more problems on MI when compared to normative data ($z = 6.81$, $p < .001$) and the healthy comparison group ($F = 10.15$, $p < .01$). No group differences were found for BRI. BRI in children and adolescents with SBM was best predicted by parent report of general psychological distress ($F = 8.25$, $p = .001$), whereas number of shunt-related surgeries and history of seizures emerged as significant predictors of poorer performance on MI ($F = 4.925$, $p < .01$). Results from the current study highlight the need to understand the etiology and impact of metacognitive dysfunction, independent of behavior regulation problems, in children and adolescents with SBM so that effective prevention efforts, accommodations, and remedial interventions can be put into place.

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P.D. CONNOR & R. MAHURIN. Working Memory in Patients with Fetal Alcohol Spectrum Disorders: An fMRI Study.

Previous research has shown that adult male subjects with Fetal Alcohol Syndrome (FAS) and Fetal Alcohol Effects (FAE) with overly thick corpus callosa, compared with controls, demonstrate impairments in executive functioning. Other studies have found that certain measures of executive function are directly related to prenatal alcohol exposure while others are indirectly related to such exposure through the mediation of IQ. The current study focuses on one aspect of executive function, working memory, in an fMRI environment assessing patients with Fetal Alcohol Spectrum Disorders (FASD). Subjects included patients diagnosed with FAS ($n = 16$), FAE ($n = 15$) and age- and sex-matched controls ($n = 16$). Ages ranged from 17 to 30 years. A 2-back memory task was chosen for the fMRI paradigm. This task required subjects to push a button when they saw a letter that was the same as one presented two stimuli previously (i.e. M-Q-M, not M-Q-L-M). The control task was a simple stimulus detection (i.e. push the button each time the letter X appears). Compared with FAS subjects, control subjects displayed increased activation bilaterally in the dorsolateral prefrontal cortex (DLPFC) and bilaterally in the intraparietal sulcus. In addition, control subjects displayed increased activation, compared with subjects with FAE, in bilateral posterior parietal regions and right DLPFC. These findings indicate that, during a working memory task, patients with FASD display an abnormal pattern of reduced brain activity and confirm hypotheses that the brains of patients with FASD function less efficiently than those of healthy individuals. Research funded by NIAAA: grant AA12419 to P.D. Connor

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THURSDAY MORNING, FEBRUARY 3, 2005

Poster Session 2 /9:15–11:15 a.m.

Depression

J. O'JILE & J. DENNING. Working Memory Abilities in Children: The Effects of Self-Reported Depression on Test Performance.

The literature is mixed regarding the negative effects of depressive symptoms on neuropsychological test performance. Equivocal findings in previous studies may have been a result of the variety of patient populations sampled, inpatient status, neuropsychological tests used, the severity of depressive symptoms, and the method of assessing depression. The purpose of this study was to determine if self-reported depressive symptoms, as measured by the Children's Depression Inventory (CDI), significantly affected children's performance on working memory measures. Seventy-nine children, ages 6 through 15, attending an outpatient psychiatric clinic completed the CDI and a comprehensive neuropsychological test battery that included several tests of working memory (Trailmaking Test A and B, CVLT-C, and subtests from the WISC-III and WRAML). After controlling for age, gender, and Full Scale IQ, the effects of self-reported depressive symptoms accounted for less than 4% of additional variance in working memory scores. Only Trailmaking Part B was significantly lower in a subset of children who reported clinically significant levels of depression on the CDI. Results suggest that children's self-reported depressive symptoms had little effect on working memory performance when age, gender, and Full scale IQ were taken into account. However, extremely high levels of reported depressive symptoms may negatively affect more complex measures of working memory.

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R.M. ROTH, J.J. RANDOLPH, L.A. FLASHMAN, N.S. KOVEN, H.S. PIXLEY, S.M. RICKETTS, H.A. WISHART & A.J. SAYKIN. Reduced Anterior Cingulate Activation During an fMRI Counting Stroop in Bipolar I Disorder.

Frontal-subcortical abnormality has been implicated in bipolar disorder, consistent with evidence associating this circuitry with impulse control and emotion regulation. Recent studies have reported reduced prefrontal cortex activation in bipolar I disorder during an fMRI color-naming Stroop Task, which was unrelated to current mood. The prior studies, however, employed infrequent incongruent stimuli relative to congruent stimuli, raising the possibility of oddball-related activation patterns confounding or masking activation associated with the classic Stroop effect. We sought to replicate the frontal finding using a Counting Stroop task designed to be free of methodological limitations of the prior studies. 8 adults with bipolar I disorder and 13 healthy controls completed incongruent, congruent and neutral conditions of a Counting Stroop task. The probability of each stimulus type was equivalent, and participants provided a motor rather than verbal response. fMRI images were obtained on a 1.5T GE scanner. Data was analyzed using a random effects model in SPM99. Groups did not differ with respect to mean reaction time or commission error rates for any of the conditions. Controls showed significantly greater activation of the anterior cingulate gyrus than the bipolar group ($p < .01$, $K = 3$) when asked to inhibit responding to task-incongruent information (incongruent greater

than congruent contrast). The bipolar group activated a more broadly distributed network of lateral frontal and posterior brain regions compared to the control group. These findings are consistent previous observations of anterior cingulate gyrus abnormality in patients with bipolar I disorder.

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M. HONG, H. OU, S. LEE, M. HO, Y. YANG & C. BRADSHAW. The Performance of Depressed Patients on the Tests for Detecting Simulated Cognitive Impairment.

Depression can interfere with neuropsychological performance, particularly memory and speed of responding. The present study aims to investigate whether depressive illness will complicate the clinical measures for detecting simulated cognitive impairment. 29 healthy participants and 52 patients fulfilling DSM-IV diagnostic criteria for major depressive disorder were recruited. General cognitive ability (Raven's Matrices) and mood state were assessed in each participant, and all participants underwent a choice reaction time task for detecting malingering (CRTDM), the Test of Memory Malingering (TOMM) and the Rey 15-item Memory Test (RFIMT). The reaction time task was based on quantitative analysis of choice reaction times in a series of eight matching tasks of graded difficulty. The stimuli used for measuring the choice reaction times on the tasks consisted of arrays of English letters, ranging from 1 to 10 letters. All the measures were compared between the groups using independent *t* tests or ANOVA with repeated measures in the case of TOMM ($\alpha=0.05$). The patient group showed higher scores on the Beck Depression Inventory ($t=6.97$; $P<0.01$), but no differences were found between the two groups in years of education, general ability or age. There were linear relationships between the reaction times and the number of letters in the stimulus arrays on the CRTDM in both groups. The depressed patients showed steeper slopes of the linear functions than the control group [$t=2.48$; $P<0.02$], but the intercepts did not differ between groups [$t=1.12$; $P>0.2$]. A measure based on the proportionate increase in reaction times as a function of task difficulty did not differ between groups [$t=1.14$; $P>0.2$]. No differences were found in all measures obtained from the TOMM or RFIMT. In agreement with previous studies, the depressed patients have slower speed of responding. However, the measures for 'insufficient effort' or malingering did not appear to be altered as a result of depression.

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S.A. LANGENECKER, T.A. HOOVEN, L. OWN, M.J. MORDHORST, S.E. KENNEDY, L. GUIDOTTI, V. MURPHY-WEINBERG, E.A. YOUNG & J. ZUBIETA. Impaired Inhibitory Control in Depression: Another Example of Recruitment.

To determine whether executive functioning deficits in depression are related to dysfunction of prefrontal brain regions To examine how response inhibition is affected in depression, we used event-related fMRI in conjunction with a Go/No-go task that demands selective motor responses and inhibition to rapidly presented visual cues. We measured functional brain activity in adult depressed and control subjects ($n=9/9$) during responses and inhibition, as well as overall behavioral performance on the task. We hypothesized that depressed subjects would show greater behavioral inhibition than controls, and that functional analysis would reveal a pattern of active inhibition among depressed subjects, involving bilateral prefrontal and parietal regions. Although our behavioral data trends did not reach statistical significance, functional analysis yielded three significant results: 1) Behavioral response inhibition corresponds with heightened parietal and prefrontal activity in depressed and control subjects, suggesting an active, rather than passive,

mechanism. 2) During response inhibition, depressed subjects show greater functional activity than controls in sixteen brain regions, including bilateral prefrontal and parietal areas and, unexpectedly, a large portion of bilateral posterior cingulate. 3) Our study found no brain regions whose activity among controls exceeds activity among depressed subjects during response inhibition. These findings are consistent with the set of brain regions previously implicated in response inhibition, consistent with studies demonstrating bilateral prefrontal recruitment as a compensatory mechanism. Alternatively, these findings might suggest that depression involves over-activation of several inhibitory centers.

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G.E. GETZ, V. FAZIO & M.D. FRANZEN. Semantic Clustering of Hopkins Verbal Learning Task in Adult Depression.

It is well established that the ability to acquire and retain new information declines steadily with increasing age. Depression, independent of age, is also a factor that negatively affects memory. While semantic clustering has been shown to be an effective strategy to improve performance on memory tasks, it remains unclear as to how semantic clustering differs across various ages in depressed patients. The present study examined differences in performance on the Hopkins Verbal Learning Task (HVLT) among young, middle aged and older clinically depressed inpatient participants. Twenty young (<40 years old), 20 middle aged (40-59 years old) and 20 older (>60 years old) clinically depressed inpatient adults were administered the HVLT as part of a larger testing battery. As hypothesized, there were significant differences among the groups on overall recall and semantic clustering on learning trials of the HVLT [$F(2, 57) = 11.0$, $p < .001$]. The young group performed significantly better than the other two groups and utilized semantic clustering strategies more frequently than the other groups on the immediate recall portion of the test. The middle age group performed significantly better than the older group and used semantic clustering more frequently than the older group. Semantic clustering was only modestly correlated with overall immediate learning in the young group ($r < .25$, $p > .28$), but was significantly correlated in the other two groups ($r > .67$, $p < .001$ for both cases). After a 20 minute delay interval, semantic clustering on the immediate recall portion of the task was significantly correlated with delayed recall performance for all three groups ($r > .65$, $p < .001$ for all cases). This study suggests that semantic organization of new information may be predictive of delayed recall performance for depressed patients. Semantically organizing information appears to help memory processes in depressed patients regardless of age.

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M. GORLYN, J.G. KEILP, M.A. OQUENDO, H.A. SACKEIM & J.J. MANN. The WAIS-III and Major Depression: Absence of VIQ/PIQ Split.

Poor Performance IQ (PIQ) relative to Verbal IQ on the Wechsler Adult Intelligence Scale-Revised (WAIS-R) is a hallmark cognitive profile in depression. However, it is unclear if this profile is found on the WAIS-III, the latest revision of the scale. This study examined WAIS-III performance of 121 unmedicated adult subjects in a major depressive episode and 41 healthy volunteers. T-score conversions of WAIS-III IQ, index and subscale scores were used for statistical analyses, adjusting for gender, education and ethnicity. The depressed subject group had lower Full Scale IQ ($t=2.3$, $df=159$, $p=.023$), PIQ ($t=2.7$, $df=159$, $p=.008$), and Processing Speed Index ($t=3.7$, $df=160$, $p<.001$) scores relative to controls. However, neither mean VIQ/PIQ score differences ($t=-1.3$, $df=159$, $p=.187$) nor prevalence of >1 SD VIQ/PIQ splits ($\chi^2=.61$, $p=.433$) differed between groups. Lower PIQ scores were largely

attributed to deficient Processing Speed. Subtest differences were found only on the tasks comprising this index (Digit Symbol: $t=3.9$, $df=160$, $p<.001$; Symbol Search: $t=2.6$, $df=158$, $p=.012$) or with a timing component (Block Design: $t=2.2$, $df=158$, $p=.030$). Processing Speed and its subtests were negatively correlated with depression severity ratings (HAM-D) (Processing Speed: $r=-.23$, $p=.011$; Digit Symbol: $r=-.27$, $p=.003$; Symbol Search: $r=-.15$, $p=.094$). WAIS-III scores were similar between subjects with major depressive and bipolar disorders, as well as between subjects with and without melancholic depression or history of suicidal behavior. Results from the WAIS-III suggest intellectual impairment in depression is best characterized by deficits in processing speed rather than general nonverbal abilities. These impairments are consistent across depression subtypes.

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M. GORLYN, H.M. KLAIN, J.G. KEILP, M.A. OQUENDO, H.A. SACKEIM & J.J. MANN. Slowing of Information Processing Speed in Major Depression.

Psychomotor retardation is a common feature of depression, but the nature of the impairment is not fully understood. Here, we examined motor and psychomotor performance in unmedicated subjects in a major depressive episode to determine the relative importance of each component. In total, 132 adult depressed subjects and 41 healthy controls with similar ages and levels of education received sets of motor and psychomotor tasks as part of a comprehensive neuropsychological assessment. Motor function was assessed with Finger Tapping, Simple Reaction Time (RT) and Choice RT tests. Psychomotor performance was assessed with Trail Making tests and WAIS-III Digit Symbol. All scores were corrected for age, sex, and education for analyses (z and T -scores). Depressed patients performed more poorly on Simple RT ($t=-2.8$, $df=168$, $p=.006$), Choice RT ($t=-3.0$, $df=171$, $p=.003$), Digit Symbol ($t=3.8$, $df=168$, $p<.001$), and Trails-B ($t=2.3$, $df=169$, $p=.024$). No differences were found for Finger Tapping (dominant hand: $t=1.2$, $df=162$, $p=.247$; non-dominant: $t=1.2$, $df=161$, $p=.226$) or Trails-A ($t=1.4$, $df=169$, $p=.165$). No group differences were found between unipolar and bipolar depressed subjects, or between those with and without melancholic depression or history of suicidal behavior. Overall, depression had a consistent effect across subtypes. Reaction time increases and psychomotor speed decreases were, on average, 10-15% above/below non-patient performance. However, depressed subjects showed no reduction in gross motor speed. Those with HAM-D retardation symptoms differed only on Choice RT. Data suggest a core cognitive feature of depression is a moderate slowing of information processing speed, in the absence of gross motor slowing.

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T.A. HOOVEN, M.J. MORDHORST, S.E. KENNEDY, L. OWN, L. GUIDOTTI, V. MURPHY-WEINBERG, E.A. YOUNG, J. ZUBIETA & S.A. LANGENECKER. Exploring Implicit Memory Deficits in Depression Using fMRI.

To examine frontal and temporal brain regions implicated in decreased memory performance in depression We recruited adult depressed and control subjects ($n=9/9$) to participate in an event-related functional magnetic resonance imaging (fMRI) study examining depression-related changes in implicit memory. Depression status was determined using the Hamilton Depression Scale; ($M=2.75$ control and $M=23.33$ depressed) and the Structured Clinical Interview DSM-IV. Our hypothesis was that impaired memory in depression would be related to activation differences in frontal and temporal brain regions. While inside the scanner, each subject viewed 216 words with positive, negative, or neutral emo-

tional valence. Approximately 45 minutes later, after scanning was complete, subjects were asked to select as many previously-presented words as possible from a list composed of both presented (target) and non-presented (lure) words. Depressed subjects recognized fewer target words than their control counterparts, but were equally likely to commit false-positive errors. Functional imaging data demonstrate that word presentation resulted in increased bilateral superior and middle frontal activation in control subjects relative to depressed subjects, regardless of whether the word was later recognized or not. These results support a hypothesis of diminished frontal and limbic activity as potential causes of implicit memory impairment in depression, although activation relationships between memory and activation are still unclear. Future analyses can examine interactions between the emotional valence of presented words, functional activation, and later recall/recognition.

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M.J. MORDHORST, L. GUIDOTTI, S.A. LANGENECKER, A.K. CAVENEY, C.C. PERSAD, L.A. BIELIAUSKAS, N. FOSTER & B. GIORDANI. Evidence of a Unique Contribution of Depression on Memory Function in a Clinical Sample.

This study sought to clarify the relationship between severity of depressive symptoms and memory function after controlling for general mental status. It was hypothesized that depression would have a significant and independent influence on memory function. Participants consisted of 252 patients ages 18 to 88 years ($M=69.19$, $SD=14.02$) with an average of 13.86 years of education ($SD=3.20$), referred for neuropsychological testing at the University of Michigan Hospitals. Participants represented a wide variety of neurological, psychiatric, and general medical conditions. Scores on the Mini Mental State Exam ranged from 3 to 30 ($M=21.78$, $SD=6.59$). Level of depression was assessed by one of three standard inventories (Hamilton Rating Scale of Depression, Personality Assessment Inventory, or Geriatric Depression Scale) and classified as asymptomatic, mild to moderate, or severe according to psychometrically and empirically derived thresholds. The age-corrected score on the Logical Memory I subtest of the Wechsler Memory Scale was used as the dependent measure. Multiple regression analyses were used to predict memory scores from years of education (step 1), Mini Mental State Exam score (step 2), and level of depression (step 3). The overall regression model was significant, $F(3,215)=26.88$, $p<.001$. Level of depression made a significant contribution to memory scores when entered as the last variable in a forced-entry, three-step model ($Beta=.33$, $p<.001$). Depression influences memory in a way that is independent of demographic factors and overall mental status. These results validate previous suggestions that practitioners consider the unique influence of depression on cognition, even for patients with pervasive cognitive compromise.

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G. WYATT, J.G. KEILP, M.A. OQUENDO, H.A. SACKEIM & J.J. MANN. Executive Function and Dysfunction in Suicidal Behavior.

Executive functioning may impact judgement, planning, and response organization in depressed patients at risk for suicide. Standard executive function measures, though, have not typically been effective in identifying deficits in suicidal subjects. In this study, unmedicated past suicide attempters ($n=28$) and non-attempters ($n=32$) with major depression were contrasted on the Wisconsin Card Sorting Test (WCST), a task typically associated with functioning of the dorsolateral prefrontal

cortex, and the Object Alternation Test (OA), a paradigm more sensitive to inferior prefrontal functioning. Based on findings from post-mortem studies of suicide completers, attempters were expected to perform more poorly on inferior prefrontal measures. As expected, attempters and non-attempters did not differ on primary WCST indices, although attempters were more impaired on the WCST Failure to Maintain Set index ($t[58]=1.965, p=.05$) - an index associated with inferior prefrontal dysfunction. However, contrary to the study hypotheses, attempters outperformed non-attempters on OA, the task designed to measure inferior prefrontal functioning ($\chi^2[1,58]=4.135, p=.04$). High lethality suicide attempters showed the best performance on OA overall ($\chi^2[2, 58]=9.076, p=.01$), and the absence of failure to maintain set on this test was associated with the objective planning subfactor of the Suicide Intent Scale ($r=-.626, p=.001$). Differences in attempters' performance on the two task appear related to the WCST's greater demands on explicit reasoning and the varying nature of the criteria for establishing and maintaining set. Neuropsychological deficits in attempters appear related to inadequate regulation of inferior prefrontal function under changing task conditions.

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J.G. KEILP, M. GORLYN, M.A. OQUENDO, H.A. SACKEIM & J.J. MANN. Attention, Memory and Language Fluency in Depression and Suicidal Behavior.

Impairments of attention, memory and language fluency are common in depression, and may play a role in risk for suicidal behavior. We sought to characterize these deficits in depressed subjects with and without histories of suicidal behavior and relate them to suicide risk factors. Subjects were 178 unmedicated depressed subjects - including 42 with a history of high lethality suicide attempt, 53 with a history of low lethality attempt, and 83 with no history of attempt - and 66 non-patient subjects. Sustained (computerized CPT) and selective (computerized Stroop) attention, various aspects of memory (Buschke SRT, Benton VRT, WMS-III Logical Memory and Faces), and fluency (letter and category) were assessed. Groups did not differ in CPT performance (d-prime: $p=.44$), but differed significantly on the interference measure on the Stroop (% increase in RT: $p<.001$). Group differences were found on the Buschke SRT ($p=.014$), Benton VRT ($p<.001$), and Logical Memory Delayed subtest ($p=.022$), with Faces Delayed subtest approaching significance ($p=.075$). Only category ($p=.010$) but not letter fluency ($p=.245$) differentiated groups. In all cases, highly lethal past attempters performed most poorly. Stroop interference ($\rho=.27, p=.01$) and relative deficit in category fluency ($\rho=.30, p=.006$) were the strongest correlates of past attempt lethality. Specific impairments in selective attention, item memory, and semantic fluency were found among depressed subjects with a history of suicidal behavior. Severity of depression-related, non-executive functions may play a significant role in risk for suicidal behavior.

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B.A. PYYKKONEN, B. LEAHY & S. HILL. Neuropsychological Performance With Sub-Clinical Anxiety and Depression .

Research examining correlations between MMPI/MMPI-II profiles and neuropsychological performance in clinical populations is mixed; indicating modest correlations primarily implicating depression and anxiety (Dikmen & Reitan, 1975, 1977; Gass & Apple, 1997), and suggesting these domains are unrelated (Zillmer & Williams, 1996; Williams et al. 1998). Few have explored clinical scale elevations on MMPI/MMPI-II and neuropsychological performance in non-clinical populations. Hypothesis: neuropsychological performance predicts group membership between those with depression and anxiety elevations and non-elevated controls.

Participants volunteers from University of Pennsylvania were screened for psychiatric/medical conditions related to neuropsychological performance. 290 remaining participants were screened for invalid MMPI/MMPI-II profiles. Remaining participants produced 29 significant D elevations, 33 significant Pt elevations and 28 significant combined D/Pt elevations. A control group without elevations ($n=30$) was created. Participants were administered a neuropsychological battery including measures of, abstraction, attention, verbal memory, spatial memory, visuospatial skills, language, sensory, and motor. Neuropsychological performance's predictive ability for these groups was assessed. Logistic regression analyses comparing normal controls to depression/anxiety groups indicate neuropsychological performance predicted groups. Chi Square analysis were all significant: D -> Controls [Chi square(4, N=58)=12.99, $p=.011$] Pt -> Controls [Chi square(4, N=57) = 15.09, $p=.005$], both D and Pt -> Controls [Chi square(4, N=60) = 13.36, $p=.010$]. Results indicate neuropsychological performance can predict group membership between sub-clinical symptomatics and asymptomatic controls, indicating that there are subtle effects of depressive and anxiety related symptomatology. Findings suggest a slight effect related to these symptoms in neuropsychological performance.

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HIV/AIDS

M. GOLDMAN, E. WILLEN, J. LEVY JAFFE, D. WEBER, P. LYNCH & D. ARMSTRONG. Emerging Neurocognitive Deficits in Pediatric HIV Infection.

The current study was conducted to evaluate the effect of chronological age and viral load on a specific area of neuropsychological functioning in a sample of children with HIV. Pathology and neuroimaging findings in pediatric HIV include calcification of the basal ganglia and cerebral atrophy. Damage to or disconnection of the basal ganglia from subcortical frontal regions may result in visual motor deficits often seen clinically in children with HIV. Prior research suggests that with advancing chronological age, children begin to have more difficulty on tasks requiring visual-motor integration. Furthermore, viral load has been shown to be a strong predictor of neurocognitive functioning in children with HIV. Participants are 125 children (6-18 years), who are part of an ongoing longitudinal study examining neurodevelopment in children vertically infected with HIV. Each participant's viral load and performance on the Beery-Buktenica Developmental Test of Visual-Motor Integration-Fourth Edition (VMI) was examined. Pearson's r revealed a significant inverse correlation for chronological age and performance on the VMI, with older children performing more poorly ($r=-.208, p<.05$). To include viral load in the model as a continuous variable, a log transformation was performed. Significant correlations were not detected for viral load and age, or viral load and performance on the VMI. Results of this study suggest that visual motor integration may appear more pronounced in children as they get older. Results provide empirical support for a neurodevelopmental model of brain development in that functional deficits may become more apparent as children age and tasks become more dependent on complex cognitive processes. With regards to viral load, based on this preliminary investigation, no significant relationship between viral load, age, and performance on the VMI was found. These findings further highlight the need for longitudinal assessment of neurocognitive functioning in children with HIV.

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K. MALEE, B. KAMMERER, P. WILLIAMS, G. MONTEPIEDRA, S. NICHOLS, P. SIROIS, J. FARLEY & D. STORM. Cognitive and Behavioral Functioning, Health Status, and Medication Adherence in Children and Adolescents with HIV Infection.

The relationship between cognitive and behavioral functioning and medication adherence was examined in a prospective study of long-term outcomes of HIV infection conducted by the Pediatric AIDS Clinical Trials Group. 1537 perinatally infected children and adolescents, ages 3-18 years, received a cognitive evaluation (Bayley or age-appropriate Wechsler test) and adherence assessment. Adherence was measured by an interview that requested the individual responsible for medication to report missed doses in the past three days. Behavioral functioning was evaluated with the Conners' scales in a subset of the original cohort (n=1137). Significant predictors of non-adherence included person responsible for medication-taking (self or biological parent vs other adult), lower caregiver education level, detectable HIV RNA levels, and HIV disease classification (non-class C). The rate of cognitive impairment (IQ<70) increased across age groups but was not significantly associated with adherence. Similarly, no significant differences were found in the distribution of Full Scale IQ scores between individuals adherent and non-adherent to the entire regimen or any individual drug class. Significant behavioral problems (T score>65) were predictive of non-adherence. Higher cognitive status, older age, female gender, and knowledge of HIV status were significant predictors of whether children/adolescents self-reported their adherence (n=326, 21%). These findings suggest that adherence to antiretroviral medication is a complex and dynamic process, with multiple and variable influences during childhood and adolescence.

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T.D. MARCOTTE, R.K. HEATON, R.J. ELLIS, I. GRANT & HNRC GROUP. Neuropsychological Impairment in HIV Infection: How Typical is the "Typical Profile"?

To examine the variability in patterns of neuropsychological (NP) performance in HIV positive (HIV+) participants with overall cognitive impairment. We reviewed data on 851 HIV+ individuals who underwent comprehensive NP testing assessing 8 cognitive domains (Executive/Abstraction, Attention/Working Memory, Learning, Memory [retention], Verbal, Perceptual Motor Speed, Motor, and Sensory-Perceptual). A classification of NP Impaired required that the participant be impaired in at least two cognitive domains, based upon blind clinical ratings. All individuals with poor NP performance attributable to factors other than HIV were excluded. Three-hundred twenty participants were classified as having HIV-associated NP impairment. Within this group, we identified the various combinations of impairments across domains. The majority of the 320 NP Impaired participants had mild (70%) or mild-to-moderate (25%) impairment. There were 164 different impairment patterns across the 8 domains in this group. While Learning (62%) and Attention/Working Memory (59%) problems were the most frequent, only 36% of the sample evidenced impairments in both of these domains. No more than 11 participants shared any one pattern of impairments. Although at the group level cognitive dysfunction in HIV infection has a prototypical "subcortical" presentation, consistent with disruption of frontostriatal pathways, there is significant variability in individual patterns of performance. This is consistent with prior reports of HIV-associated deficits being "spotty." For maximal sensitivity to brain dysfunction, clinicians and researchers should assess a broad range of NP abilities since the most common impairments are not necessarily seen in all participants/patients.

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D.F. TATE, R.H. PAUL, A.M. BRICKMAN, R.A. COHEN, T. FLANIGAN, B. NAVIA & HIV MRS CONSORTIUM, ACTG 700 TEAM. Differential Relationships Between Corpus Callosum Area and Cognition in HIV Infected Patients.

Pathological evidence suggests the need for additional studies of structural white matter changes in HIV. This study was designed to investigate morphometric changes in the surface area of the corpus callosum (CC) in HIV. The relationship between changes in the CC area and cognition have not been well studied and was examined for unique insights into HIV-associated cognitive change. 47 HIV infected patients and 22 demographically matched controls were analyzed. The CC area was manually traced in the mid-sagittal slice and corrected by the surface area of the intracranial vault to control for head size confounds. All participants were administered Trails Making A and B, Grooved Pegboard, Reaction Time, Serial Reaction Time, and Timed Gait. Scores were converted to standard z-scores using normative data. Group comparisons of the CC area were made using one-way ANOVA. The relationship between CC area and cognition were accomplished separately for controls and HIV patients using Pearson correlation methods. Comparison between groups was not significant for corrected CC area ($F=1.04$, $p=.31$), though there is a decline in CC area related to ADC staging ($r=-.34$, $p=.01$). A single significant relationship between CC area and Trails B ($r=.39$, $p=.04$) was found in controls, while multiple significant relationships between CC area and cognition were found in HIV patients (Trails A, $r=.40$, $p=.003$; Grooved Pegs-Dom, $r=.28$, $p=.03$; Grooved Peg NonDom, $r=.35$, $p=.008$; Timed Gait, $r=.28$, $p=.03$; and the global NPZ-8, $r=.17$, $p=.23$). The differences in the correlational relationships are likely due to changes in CC area specific to HIV infection. Lack of significance between groups may be related to regionally specific white matter changes noted in HIV or greater individual differences in HIV patients than in controls. Additional studies involving regional CC area analyses and/or the use of more sensitive imaging methods may be useful in determining HIV specific white matter changes.

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J. SCOTT, S. WOODS, M.S. DAWSON, C.L. CAREY, T.D. MARCOTTE, R.K. HEATON, I. GRANT & HNRC Group. Component Process Measures Within the Hopkins Verbal Learning Test - Revised: Construct Validity in an HIV-1 Sample.

The aim of the present study was to examine the construct validity of component process measures within the Hopkins Verbal Learning Test - Revised (HVLT-R). The HVLT-R is among the most sensitive indicators of neuropsychological impairment associated with HIV-1 infection. In fact, the fronto-striatal circuit neuropathogenesis of HIV-1 is known to result in a prominent profile of executive dyscontrol of verbal episodic learning and memory. However, no prior studies have examined the profile of deficits in an HIV-1-infected sample using HVLT-R component process measures, despite emerging evidence for their reliability and construct validity in delineating underlying mechanisms of cognitive impairment in other clinical disease samples. HVLT-R component process indices were examined in 42 persons with HIV-1 infection and 29 demographically comparable seronegative controls. The HIV-1 sample performed significantly below seronegative controls on Total Recall, Semantic Clustering, and the Retrieval Index (all p -values $< .05$). The two groups performed comparably on Serial Clustering, Pair Frequency, Learning, Repetitions, Semantic False Positive Recognition Errors, and the Recognition Discrimination Index. In the HIV-1 group, Semantic Clustering and the Retrieval Index correlated with well-validated clinical measures of frontal/executive function. Results are commensurate with prior literature indicating that HIV-1 disease is associated with deficient executive control of encoding and retrieval from

verbal episodic memory, as measured by component process measures from the HVLT-R. Furthermore, correlational analyses support the convergent validity of these indices in HIV-1 infection. In sum, these findings provide evidence for the construct validity of component process measures within the HVLT-R.

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S. JUENGST, J.T. BECKER, H.J. AIZENSTEIN & O.L. LOPEZ. Structural Neuroimaging Evidence of the Synergistic Effects of AIDS and Age on the Central Nervous System.

An increasing proportion of new AIDS cases are older than 50 years, when brain structural abnormalities become more common even in the absence of AIDS. This study evaluated brain structure in AIDS as a function of age. 33 AIDS patients and 17 HIV-seronegative controls underwent a T1-weighted high resolution anatomical MRI study of the brain. The volumes were spatially normalized to an age-appropriate template and then segmented into gray and white matter using a modified mixture model cluster analysis technique in SPM2. The segmented images were smoothed using a 10 mm isotropic Gaussian kernel. There was a significant interaction between AIDS and Age, indicating that there were regions of gray and white matter more affected by Age in the AIDS patients than would be due to either Age or AIDS alone. Specifically, there was greater grey matter atrophy in the posterior third of the cingulate gyrus, sparing retrosplenial cortex (BA31) (-4, -42, 31; 1, -33, 32), and the medial temporal lobe (-28, 3, -45; 19, -10, -34), bilaterally. There were also significant differences in white matter, including the centrum semiovale bilaterally (-31, -3, 25; 24, -47, 23). AIDS and aging act synergistically to produce gray and white matter volume loss greater than would be expected by either process alone. This suggests a neuroanatomical basis for the findings that older AIDS patients are more likely than younger to express cognitive impairments.

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Personality

M. LISS & J. MAILLOUX. Highly Sensitive People: Overwhelmed or Enriched by Sensory Experience?

Individuals may process sensory information differently; some individuals may notice and respond to less intense or a greater number of stimuli in the environment than others. Sensitivity to environmental stimuli has been related to anxiety, behavioral inhibition and introversion. However, sensory processing sensitivity appears to encompass two distinct constructs. One involves reacting strongly to stimulation in the environment and possibly being overwhelmed. Another involves being emotionally sensitive and attuned to subtleties in the environment. Individuals with autism react strongly to stimuli in the environment but are not attuned to subtleties. Alexithymia has been hypothesized to represent a decoupling between physiological arousal and the ability to interpret and appropriately react to that arousal. Two hundred and one undergraduate students were administered the highly sensitive person scale (HSPS), as well as measures of anxiety, depression, behavioral inhibition, alexithymia and the autism spectrum questionnaire. A principal components factor analysis was run with a varimax rotation. A two factor solution was deemed most appropriate for the data; one factor measured being overwhelmed by stimuli and another tapped being enriched by sensory and emotional experiences. The first factor was strongly related to anxiety, depression, behavioral inhibition, and autistic symp-

toms. The second factor was unrelated to depression, autism and alexithymia but was related to anxiety. Results confirm that sensory processing involves two distinct conceptual components. Reacting strongly to sensory information does not necessarily lead to being able to appropriately process and interpret that information.

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A.C. RUOCCO & K.K. TROBST. Neuropsychological Support for Eysenck's Cortical Arousal Theory of Personality.

Eysenck (1967) proposed that extraversion and neuroticism constitute the two primary dimensions of personality, and that high extraversion (E+) and low neuroticism (N-) are each characterized by low levels of cortical arousal, whereas low extraversion (E-) and high neuroticism (N+) each constitute dispositionally high levels of cortical arousal. Despite evidence in support of enhanced learning and memory abilities for the sanguine (E+/N-) versus the melancholic (E-/N+) personality types, data implicating differences in other neuropsychological domains is limited. The current investigation examines differential performance of these groups on select neuropsychological measures. A total of 227 undergraduate students completed the NEO Personality Inventory-Revised and a series of neuropsychological measures including the Wisconsin Card Sorting task, Trail Making test, Digit-Symbol, Symbol Search, Controlled Oral Word Association, Stroop Colour-Word, and Letter-Number Sequencing test. Participants were separated into two groups based on their levels of E and N, with 59 participants in each of the sanguine and melancholic groups. T-tests were conducted comparing sanguine and melancholic groups on each of the neuropsychological measures. Sanguine participants performed better than the melancholic group on the Trail Making test (Part A), Controlled Oral Word Association test, and Stroop colour-naming condition. A principal components factor analysis of the neuropsychological measures revealed a two-factor solution, with the sanguine group demonstrating better performance than the melancholic group on the executive function factor but not on the processing speed factor. Support for Eysenck's cortical arousal theory of personality is provided by the current neuropsychological investigation. High levels of arousal in the melancholic group as compared to the sanguine group appear to act as impediments to efficient performance in particular neuropsychological domains.

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Psychopathology

A. JAK, P.K. SHEAR, M.P. DELBELLO, P. MCDONNOUGH-RYAN & S. STRAKOWSKI. Frontal Lobe Morphometry and Executive Functioning in Children at Risk for Bipolar Disorder.

The purpose of the present study was to investigate prefrontal morphometry and executive functioning in children at familial risk to develop bipolar disorder, in order to better understand the developmental neuropathology and neurocognitive presentation of bipolar disorder and those at risk to develop the disorder. MRI-derived prefrontal subregion volumes were examined in tandem with performances on tests of executive functioning in children ages 8-12 who had a least one parent with bipolar disorder (n=22) and in a group of children of psychiatrically healthy parents (n=24). The at-risk group (AR) was also examined in more detail, comparing individuals with a mood syndrome diagnosis to those without. Results suggested larger anterior cingulate volumes in syndromal AR children as compared to healthy controls, as well as larger orbital gray matter proportions in the syndromal AR group as compared

to the non-syndromal children. On the executive functioning measures, the AR group was more perseverative than the HC group, and the AR syndromal group exhibited slower reaction times and performed more poorly on delayed recall of a complex figure than the HC or AR non-syndromal group. The results of the current preliminary study suggest that morphometric alterations are present in the anterior cingulate and orbital gray matter of children at risk for bipolar disorder. Weaknesses in executive functioning found in this at-risk sample are consistent with the adult bipolar and emerging at-risk literature.

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M.K. FOSTER, P.K. SHEAR, M.P. DELBELLO, E.P. HOUTERLOOT & S.M. STRAKOWSKI. Reports of Executive Dysfunction in Adolescents at Genetic Risk for Bipolar Disorder.

Bipolar disorder (BPD) is a serious mental illness with a strong genetic component that is often associated with executive dysfunction. Previous research suggests that adolescents who are genetically at risk for BPD demonstrate executive deficits. The goal of this study was to compare caregiver reports of performance on activities thought to require executive functioning skills in groups of at-risk adolescents who did (At Risk-Syndromal; AR-S) or did not (AR-NS) have bipolar disorder, and in healthy volunteers (HV). Participants included adolescents with no lifetime or family history of serious psychiatric illness (HV; N=10) as well as adolescents who had at least one parent with a diagnosis of BPD I and either themselves had no lifetime history of mood or psychotic disorder (AR-NS, N=9) or met criteria for BPD but were currently not experiencing a full mood syndrome (AR-S, N=9). Mean ages were 13.22±1.23, 14.44±1.33 and 15.00±1.73 in the HV, AR-NS and AR-S groups, respectively. Each participant's primary caregiver completed the Parent Form of the Behavior Rating Inventory of Executive Functioning (BRIEF). The Behavioral Regulation and Metacognition Indices for both at-risk groups were significantly higher than those of the HV group. In addition, the AR-S group showed significantly more elevated BRI (t=17.43, p<0.0001) and MI (t=24.09, p<0.0001) scores than did the AR-NS group. Only the AR-S group demonstrated clinically significant scale elevations. These results support the presence of executive dysfunction in at-risk adolescents and suggest that those AR individuals with mood syndromes are at disproportionate risk for cognitive deficits.

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L. MARON, M. PAULUS, A. MINASSIAN & W. PERRY. The Relationship between Disrupted Semantic Networks and Thought Disorder in Bipolar Illness.

Thought disorder, defined as the improper use of semantic and relational aspects of language, manifests as loose associations and derailments, irrelevant responses, circumstantiality and intrinsic illogicalities. Efforts to objectively study the impaired cognitive processes that underlie thought disorder in schizophrenia (SCZ) have focused on disturbances in the semantic system (Aloia et al., 1996). Bipolar affective disorder (BD) patients represent another population in which high levels of thought disorder have been detected, however, the cognitive mechanism by which disturbed thinking occurs in this population remains enigmatic. Preliminary evidence suggests a prominent affective component to the thought disorder of BD patients (Solovay et al., 1987; Murphy et al., 2001). The current study examined the hypothesis that the organization of words in acutely ill BD patients is dominated more by affect than by semantic category. To that end, we administered a modified semantic decision task (Tallent et al., 2001), which required subjects to categorize words, organized in triplets, based upon similarity of

meaning. Unbeknownst to participants, word lists were constructed from one semantic (living/non-living) and one affective (positive/negative) dimension. Subjects consisted of SCID diagnosed inpatients with BD manic or mixed type and healthy comparison subjects. Multidimensional scaling analyses revealed that BD patients grouped words more consistently than comparison subjects (Mean BD stress coefficient = 11.2; Mean comparison group stress coefficient = 14.9) due to a greater tendency to attend to the affective rather than semantic attributes of words, as indicated by maps of semantic space. These data, while preliminary, support the hypothesis that the semantic system of acutely ill BD patients is dominated more by affect than semantic category and may provide a first step in understanding the cognitive mechanism underlying thought disorder in this population.

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B.W. PALMER & D.V. JESTE. Correlates of Capacity to Consent to Research Among Middle-aged and Older Patients with Psychoses.

To evaluate the relationships between cognitive test performance and other patient characteristics with capacity to consent to research participation among middle-aged and older patients with psychotic conditions. Participants were 93 people ages ≥40 years with DSM-IV disorders (other than dementia) for which treatment with antipsychotic medications was indicated. We evaluated participants' in terms of four commonly recognized dimensions of decisional capacity (understanding, appreciation, reasoning, and expression of a choice) using the corresponding subscale scores from the MacArthur Competence Assessment Tool for Clinical Research. The latter scale was tailored in reference to a longitudinal study of antipsychotic medications. Participants completed a cognitive test battery, and standard psychopathologic symptom rating scales. We found several significant positive correlations between performance on cognitive tests and decisional capacity. The bivariate correlation between overall cognitive test performance and understanding was r=.489 and that between overall cognitive performance and appreciation was r=.444 (both ps<.001). In contrast, with the exception of a modest negative correlation between severity of negative symptoms and level of understanding (r=-.295, p=.004), neither severity of psychopathology nor demographic characteristics were significant correlates of decisional capacity. Among clinically stable patients, cognitive test performance appears to be a stronger predictor of the level of capacity than other clinical characteristics. Efforts to improve research consent procedures may benefit from focusing on the cognitive barriers to meaningful informed consent.

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L. MAUCIERI, R. HANLON & J.L. STRAUS. Characteristics of Acute Medical Inpatients Referred for Assessment of Mental Competency.

Assessment of decision-making capacity (i.e., mental competency) concerning medical treatment and/or independent living is a frequent request of neuropsychologists and psychiatrists in acute medical inpatient settings. Factors involved in such determinations are complex and vary by individual. We retrospectively examined the records and test data of 68 inpatients that underwent such evaluations, to explore possible predictors of mental competency. Medical records and neuropsychological data of 68 inpatients assessed for mental competency during 2002-2004 were retrospectively reviewed. Variables, including demographics, neuropsychological test results and medical diagnoses, were analyzed using one-way ANOVA's and appropriate measures of association. We found that 62.5% of acute medical patients referred for competency assessments were determined to be incapable of making independent and informed decisions regarding their medical care and/or discharge plans.

RBANS immediate memory index, $F(1,54) = 32.778$, $p < .01$, RBANS language index, $F(1,54) = 21.004$, $p < .01$, RBANS delayed memory index, WAIS-III or WASI Similarities, and WMS-III Information-Orientation scores were statistically significant predictors of mental competency. Decision-making capacity appeared most strongly associated with the WASI Similarities T-score ($h^2 = .648$). Contingency coefficients indicated that demographics and medical diagnosis were not generally correlated with decision-making capacity. We found that a majority of the assessed acute medical inpatients were considered to have compromised decision-making capacity, and that specific neuropsychological measures involving memory, language, orientation and verbal reasoning were statistically significant predictors of decision-making capacity. Implications of these findings are considered.

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M. BASSO, C. GHORMLEY, N. LOWERY, R. PURDIE, J. NEEL, D. COMBS & R. BORNSTEIN. Presence of Psychotic Features in Acute Mania: Neuropsychological Effects.

A growing body of research indicates that neuropsychological deficit occurs commonly in bipolar disorder. For instance, acute mood disturbance, be it depression, mania, or mixed features corresponds with neurobehavioral dysfunction (e.g., Basso et al. (2000)). Yet, only some patients with bipolar disorder display significant impairment. In patients with unipolar depression, presence of psychotic features corresponds with greater cognitive dysfunction (Basso & Bornstein, 1999). Possibly, presence of psychotic features may likewise correspond with greater morbidity in bipolar disorder. To address this issue, 15 manics without psychotic features, 21 manics with psychotic features, and 24 control subjects were administered a brief but broad battery of neuropsychological tests. They also were administered the MMPI-2. The groups were equivalent in composition, except the control group had a higher number of women than the patient groups. Neuropsychological performance was compared across the three groups, and sex served as a covariate. Sex failed to emerge as a significant covariate, but the two manic groups performed significantly worse than the control group across the battery. They also had more impaired scores than the control group. There were no differences between the two patient groups, and effect size estimates were negligible between these patients. There were no significant difference in overall distress as indexed by the MMPI-2. Consistent with prior research, neuropsychological impairment corresponded with presence of mania. In contrast to expectations, these findings imply that presence of mania may overshadow the detrimental effects of psychosis on higher cognitive function. Notably, however, these findings are based only on inpatients with mania. It remains uncertain whether depressed or mixed-feature bipolar patients might display a similar pattern of function. Implications of these findings for future research and clinical practice are discussed.

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J.E. JONES, B. BELL, M. SEIDENBERG & B.P. HERMANN. DSM-IV Axis I Diagnoses in Individuals with Temporal Lobe Epilepsy Compared to Healthy Controls.

While there is considerable interest in psychiatric co-morbidity in epilepsy, few controlled investigations have used contemporary standardized psychiatric diagnostic procedures to characterize current and lifetime-to-date episodes of DSM Axis I disorders. The purpose of this investigation was to characterize the nature and rates of DSM-IV psychiatric co-morbidity in individuals with temporal lobe epilepsy (TLE) versus an age, gender and SES matched control group. Selection criteria for individuals with TLE included age 18 or older, temporal lobe

epilepsy, no MRI abnormalities other than atrophy, and no other neurological disorders. Selection criteria for the controls included age 18 or older, no history of seizures, no neurological disorders, no current substance abuse or learning disabilities, and no history of LOC > 5 minutes. Standardized psychiatric interviews were conducted using the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) to identify current and lifetime Axis I disorders. To date, 32 individuals with TLE and 51 controls have been interviewed. These subjects were seen as part of a larger investigation examining changes in brain structure and neuropsychological status. The major findings are as follows: 1) individuals with TLE exhibited higher rates of current Axis I disorders compared to controls (46.9% v. 19.6%) ($p = .008$), including current major depressive episodes (15.6% v. 3.9%) ($p = .062$), and anxiety (28.1% v. 13.7%) ($p = .012$); 2) lifetime-to-date Axis I disorders (75% v. 45.1%) ($p = .007$) and major depressive episodes (45.8% v. 31.4%) were also more common in individuals with TLE. DSM-IV Axis I disorders occur more frequently in individuals with epilepsy when compared to healthy controls. This is evident when examining current and lifetime-to-date rates of co-morbid psychiatric disorders. Mood and anxiety disorders are the most common diagnoses.

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S. GALLOWAY-SHARP, C.A. NOGGLE, A.S. DAVIS & R.S. DEAN. Evaluating the Effectiveness of the Dean-Woodcock Emotional Status Examination .

The structured neuropsychological interview is a technique for evaluating the presence of psychopathology in a prearranged, ordered fashion. The content of the questions control for human influences while focusing on behavior. One such structured interview that is new to the field of neuropsychology is the Dean-Woodcock Emotional Status Examination (D-WESE), which is an individual component of the Dean-Woodcock Neuropsychological Battery (D-WNB). The D-WESE is a well-constructed instrument that enables the clinician to gain a comprehensive view of what the patient is experiencing without having to use an assortment of different instruments. The present study evaluated the utility of the D-WESE as a measure of pathology while also assessing its predictive ability as compared to the MMPI-2. Participants ($n = 207$) included individuals that had been referred for neuropsychological evaluations in regard to neurological or psychiatric concerns (mean age = 56.53). An exploratory factor analysis, rather than a confirmatory factor analysis, was chosen because the underlying structure of the D-WESE had not yet been hypothesized and/or statistically analyzed. Analysis of the data indicated that an 11-factor solution emerged. Pearson r correlations indicated each D-WESE factor was significantly correlated with the MMPI-2 clinical scales. Stepwise multiple regression indicated that the derived D-WESE factors were able to account for a moderate degree of the variance in the MMPI-2 scales. The findings of this study provide good evidence regarding the concurrent validity of the D-WESE.

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H.A. BERLIN, E.T. ROLLS & S.D. IVERSEN. Borderline Personality Disorder, Impulsivity, and the Orbitofrontal Cortex .

Orbitofrontal cortex (OFC) lesions produce disinhibited or socially inappropriate behavior and emotional irregularities. Characteristics of Borderline Personality Disorder (BPD) include impulsivity and affective instability. We investigated whether aspects of BPD, in particular impulsivity, are associated with OFC dysfunction. Measures of personality, emotion, impulsivity, time perception, sensitivity to reinforcers, and spatial working memory (SWM), were administered to BPD, OFC

lesion, non-OFC prefrontal cortex lesion control, and normal control participants. OFC and BPD patients performed similarly in that they were more impulsive, reported more inappropriate behaviors, BPD characteristics, anger, and less happiness than both control groups. They were less open to experience and had a faster perception of time (underproduced time) than normal controls. They performed differently on other tasks: BPD patients were less extraverted and conscientious and more neurotic and emotional than all other groups. OFC patients had deficits in reversing stimulus-reinforcer associations and a faster perception of time (overestimated time) than normal controls. OFC dysfunction may contribute to some of the core characteristics of BPD, in particular impulsivity. Other characteristics of BPD, such as high emotionality and personality irregularities, do not appear to be related to the type of dysfunction produced by OFC damage. The similarities and dissociations found between BPD and OFC patients may lead to a better understanding of the aetiology of BPD and the functions of the OFC. These findings could have significant implications for treatment.

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A.J. SEIBLES, J. GALLO, K.S. SCHMIDT & D.J. LIBON. An Itemized Approach to Assessing Behavioral and Psychological Symptoms in Dementia.

A new scoring system for the Neuropsychiatric Inventory (NPI) was developed to obtain a more detailed clinical profile regarding behavioral and psychological symptoms in dementia (BPSD). Ninety-four caregivers of patients with mild to moderate dementia (age=80, MMSE=22.6, education=12.4) were administered a modified version of the NPI and asked to rate the frequency of 79 symptoms divided among 12 domains of BPSD. The frequency for each of the 79 symptoms was rated on a 5-point scale (i.e., 0-not present to 4-once or more per day). Internal reliability and factor structures for all 12 domains were analyzed. Internal consistency for each domain ranged from .67 to .92, with an alpha reliability of .96 for the total inventory. When separate factor analyses were run for each of the 12 NPI domains, 5 yielded a single factor solution (depression, anxiety, apathy, irritability, aberrant motor behavior) accounting for an average of 59.8% of variance. The remaining 7 domains yielded 2 or 3 factor solutions accounting for an average of 71.2% and 76.9% of variance, respectively. These data suggest that many individual NPI domains are capturing multiple features of BPSD rather than merely the presence or absence of a specific neurobehavioral problem. Although there is an established system of scoring the NPI, our alternative scoring method is reliable and appears to elicit a richer behavioral profile. This approach to scoring the NPI has the potential to enhance diagnostic accuracy and interventional strategies (i.e., pharmacological, behavioral) of neuropsychiatric symptoms among patients with dementia.

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N. CARLOZZI & D.G. THOMAS. Neuropsychological Correlates for Memory and Hippocampal Deficits in PTSD.

The hippocampus is central in memory consolidation and is thought to be essential to creating configural, but not elemental, associations (Rudy & Sutherland, 1992). Patients with PTSD show memory deficits that have been associated with hippocampal damage (Horner & Hammer, 2002). The purpose of this study was to examine the relationship of the transverse patterning task (used to assess configural learning) (a) to PTSD and (b) to other tasks sensitive to hippocampal function. PTSD patients (N = 21), combat controls (N = 21), and non-combat controls (N = 25) completed four hippocampal-related tasks (transverse pat-

terning, Rey Auditory Verbal Learning Test (RAVLT), Verbal Paired Associates (VPA) and mental rotation); two hippocampal-independent tasks (word priming and the backward digit span); and six covariate tasks assessing depression, anxiety, intelligence, metamemory, attention, and alcohol use. ANCOVAs showed no differences between any of the three groups on any of the hippocampal-dependent or independent tasks (all $p > .20$). Correlational analyses examining showed a trend between PTSD symptom severity and mental rotation ($r = -0.38$, $p = .09$), but not with other hippocampal-dependent or independent tasks. PTSD symptom clusters (reexperiencing, avoidance and arousal) were not significantly correlated with performance on either hippocampal-dependent or independent tasks. Intercorrelations revealed that the transverse patterning task was significantly correlated with mental rotation ($r = -0.36$, $p = .003$), the RAVLT ($r = -0.31$, $p = .01$), VPA ($r = -0.30$, $p = .01$), and backward digit span ($r = -0.31$, $p = .01$), but not with word priming ($r = -0.06$, $p = .61$). Transverse patterning, although significantly related to other tasks of hippocampal function, was not reliable in identifying participants with PTSD. Implications will be discussed. Correspondence: *Noelle Carlozzi, M.S., Oklahoma State University, 306 White Church Lane, Summerville, SC 29485. E-mail: carlozzi@musc.edu*

Schizophrenia

J. O'GRADY, B.A. MARCOPULOS & J.F. MANLEY. Psychomotor Performance in a Persistently Psychiatrically Disabled Patient Population.

Psychomotor deficits in schizophrenia-spectrum disorders have been well documented, with effect sizes ranging .89 to 1.42 (Heinrichs & Zakzanis, 1998). Past studies have suggested that antipsychotic medications, especially typical medications, may impair motor function (Gold, et al., 1999; Bilder, et al., 2000). However, recent findings suggest that motor deficits may be explained by neurodevelopmental factors and overall level of impairment and executive dysfunction (Sautter, et al., 1997; Lehoux, et al., 2003). The present study characterized the nature and extent of psychomotor deficits and the relationship with executive function tests, and the effect of medications on motor performance (Grooved Pegboard) in a sample of persistently psychiatrically disabled patients. Data was analyzed from 596 adults referred for neuropsychological assessment at a large state psychiatric hospital, with separate analyses conducted in a subset of patients diagnosed with schizophrenia-spectrum disorders (SD group). As expected, Pegboard performance was significantly impaired for the entire sample, and the SD group were significantly slower on the Pegs than patients with affective disorders. There was an overall effect of anticholinergic medications, but not type of antipsychotic medication on motor performance for the entire sample. Hierarchical multiple regressions with the SD group which entered demographic variables first, then tests of executive function found that Age, Full Scale IQ, and Trails B time best predicted Pegboard performance. Thus, in persistently psychiatrically disabled patients, Grooved Pegboard performance may be predicted by general cognitive status rather than specific executive dysfunction, and deficits are exacerbated by anticholinergic medications, but not by antipsychotic medications.

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J.K. JOHANNESSEN & W.P. HETRICK. Reduced Auditory Suppression Relates to Working Memory Impairment in Schizophrenia.

Attenuation of the auditory evoked response (AER) to the second of two identical acoustic stimuli is thought to index the integrity of a sensory gating mechanism, shown to be deficient in schizophrenia. The AER is characterized by time locked gamma band activity, followed by a shift

to low frequency activity. While the gamma band response (GBR) is associated with initial sensory registration, the low frequency response (LFR) reflects early stages of cognitive processing related to selective attention and working memory. This study sought to determine which frequency band accounts for the observed AER abnormality in schizophrenia and to investigate correlates of each with respect to cognitive function. Thirty-eight schizophrenia (SZ) and 38 age-matched healthy control (HC) participants were examined using EEG spectral power in the GBR (20-50 Hz) and LFR (1-20 Hz) frequency bands. Correlations were investigated in a subgroup of SZ participants ($n = 18$) who had completed WAIS-III digit symbol (DSy) and digit span (DSp) subtests. SZ participants demonstrated less LFR attenuation ($p = .01$), but were comparable to HC with respect to the GBR. SZ participants scored significantly lower on both measures of cognitive function ($p < .001$). While LFR attenuation was positively correlated with DSp ($p < .001$), the GBR was unrelated to either measure of cognitive function. Although reduced attenuation of the AER has long been associated with sensory gating in schizophrenia, low frequency activity accounts for this effect, suggesting an impairment that is also cognitive in nature.

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H.B. CLEAVINGER, R.M. ROTH, L.A. FLASHMAN, T.W. MCALLISTER, A.C. MAMOURIAN & A.J. SAYKIN. Structural MRI Correlates of Executive Variables During Verbal Learning in Schizophrenia.

Patients with schizophrenia often show deficits in episodic memory and executive functions. Several variables on the CVLT, a common test of episodic memory, have been interpreted as reflecting executive functioning including semantic clustering during encoding, perseverative and intrusion errors during recall, and false positive errors during recognition memory. In the present study, we investigated whether there is a relationship between these CVLT executive variables and frontal and temporal lobe volumes in patients with schizophrenia. Participants included 30 patients with schizophrenia (assessed with the SCID, BPRS, SANS/SAPS) and 13 healthy comparison subjects. Groups were equivalent for age, gender, handedness, and WRAT Reading scores. Participants completed the CVLT, WAIS-R, and WCST. T1-weighted SPGR MRI scans were obtained and left and right frontal and temporal lobar volumes were calculated, controlling for total intracranial volume. Patients showed smaller frontal and temporal lobar volumes bilaterally. Within the patient group, significant inverse correlations were found between CVLT perseverative errors and both left and right frontal volume; intrusion errors and right frontal volume; and between semantic clustering and right temporal volume. By contrast to executive measures, the CVLT total word acquisition score was unrelated to frontal or temporal lobar volumes. These findings indicate that specific measures of executive dysfunction on the CVLT are related to lateralized frontal and temporal lobe volume reductions in patients with schizophrenia.

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S. HAN, P.G. NESTOR & C.G. WIBLE. Semantic Priming in Schizophrenia: An fMRI Investigation.

Previous studies have characterized the schizophrenia illness as a breakdown in semantic association networks often affecting language and formal thought disorder. As of yet, few studies have investigated this breakdown using functional magnetic resonance imaging and an auditory lexical-decision semantic priming paradigm. Thus, the present study served to functionally map brain activation to word pairs that differed with respect to relatedness and a concept called connectivity in a group of schizophrenic patients and demographically-matched control sub-

jects. Connectivity refers to the number of semantic associations that exist between semantically associated words of a particular target word. It is thought that word pairs that are high in connectivity may show a greater priming effect due to the increased number of shared associations within the semantic network. It was thus hypothesized that schizophrenic subjects would show a less pronounced pattern of activation than control subjects in response to the differing word pair conditions. Ten schizophrenic patients and ten control subjects were aurally presented with a cue word and were asked to make speeded lexical decisions to target words presented shortly afterwards in an event-related fMRI paradigm. Analyses revealed a strikingly significant group difference with respect to the expected step-wise modulation of activation such that high connectivity < low connectivity < unrelated word pairs, with control subjects showing significantly greater areas of modulation than schizophrenic subjects in regions classically implicated in language. These results further support the characterization of schizophrenia as a breakdown in lexico-semantic association networks. Clinical and research implications are discussed.

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M.M. KURTZ & B.E. WEXLER. Differences in Learning Proficiency on the Wisconsin Card Sorting Test in Schizophrenia: Do They Reflect Distinct Neurocognitive Subtypes?

A growing body of evidence suggests that patients with schizophrenia differ in both their ability to successfully perform the Wisconsin Card Sorting Test (WCST) and their ability to benefit from verbal instruction (Green et al., 1990; Weidl et al., 2001). The significance of this inter-patient heterogeneity is not well understood. Performance on a neuropsychological test battery was compared in 30 patients with schizophrenia between three experimental groups: group 1 had intact performance on the WCST (5 or more categories achieved), groups 2 and 3 had impaired performance on the WCST (less than 5 categories achieved). Group 2 had "good" learning proficiency, while group 3 had "poor" learning proficiency on the task as defined by degree of improved performance after step-by-step instruction. A series of one-way ANOVAs revealed main effects of group on measures of divided attention, working memory, and verbal learning. Post-hoc comparisons showed that patients with intact WCST performance were significantly different from the two WCST impaired groups on measures of working memory and verbal learning. Interestingly, measures of divided attention were significantly different between the "poor" vs. "good" WCST learner groups, with no differences between intact performers on the WCST and "good" WCST learners. These findings were specific: measures of speeded visual sequencing, verbal prose recall, and non-verbal memory were not different between the three groups. These findings suggest that differences in overall performance and learning proficiency on the WCST may reflect distinct and stable cognitive subtypes of the disorder. It may be profitable to determine if these subgroups respond to different treatments or are sensitive to different etiological and course-modifying factors.

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D.J. MOORE, T. MOLLAH, G.V. NAYAK, D.V. JESTE & B.W. PALMER. Clustering and Switching on Verbal Fluency Tasks Among Middle-Aged and Older Schizophrenia Patients.

Scores of clustering and, to a larger extent, switching on verbal fluency tasks are impaired among younger patients with schizophrenia (SCs) as compared to healthy comparison participants (NCs) indicating a disrupted semantic network among SCs. Studies of older SCs have confirmed verbal fluency impairment, but have not used clustering and

switching scores to assess semantic deficits. We hypothesized that middle-aged and older SCs would have poorer clustering and switching abilities as compared to age comparable NCs on both phonemic (FAS) and semantic (animals) fluency tasks. Using Troyer et al.'s (1997) criteria, we examined clustering and switching among 163 community-dwelling, middle-aged and older SCs and 92 age comparable NCs. SC patients produced significantly fewer words than NCs on both phonemic and semantic fluency conditions. Patients also evidenced fewer switches on both the phonemic (SC: mean = 22.8, SD = 9.3 v. NC: mean = 27.7, SD = 8.3; $p < 0.001$) and semantic (SC: mean = 6.5, SD = 3.1 v. NC: mean = 8.2, SD = 2.8; $p < 0.001$) conditions, but the mean cluster size of the two groups was similar. Analyses were repeated using education as a covariate and the findings remained unchanged. Impaired verbal fluency performance among middle-aged and older SCs may be a function of reduced switching ability rather than the ability to generate words within a given cluster. In addition to mental flexibility, other potential mediators of cluster switching ability may include mental processing speed and general cognitive abilities. These possibilities warrant further research attention.

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S.A. MCDERMID VAZ & R. HEINRICHS. The Stability and Validity of the Cortical/Subcortical Dementia Typology of Memory Functioning in Schizophrenia.

To investigate the stability, construct validity, and clinical validity of the cortical/subcortical/unimpaired dementia profile proposed by Turetsky et al. (2002), 102 schizophrenia patients were partitioned into subgroups using a k-means cluster analysis of California Verbal Learning Test (CVLT) performance on three standardized indices: (1) Trials 1 to 5, (2) cued intrusion errors and (3) Discriminability/Trial 5 difference score. As outlined in the Turetsky et al. study, the number of clusters was set to three to reflect the theoretical distinction between cortical/subcortical dysfunction and normal performance. The same procedure was used to subtype a sample of 55 patients from a follow-up assessment. The stability of the resultant subtypes across the two time periods (mean time = 36.3, SD = 8.2 months) was assessed with kappa. Performance on the WAIS-R, Wisconsin Card Sort, Purdue Pegboard, and two memory indices from a Release from Proactive Inhibition paradigm were used to assess construct validity. Demographic and illness variables, as well as symptom ratings were used to evaluate the clinical validity of the typology. Moderate agreement in cluster assignment at the initial and follow-up assessments was demonstrated (kappa = .57, $p \leq .001$). The construct and clinical validity of the typology were weak. The modest stability and weak construct and clinical validity of the cortical/subcortical typology suggest that this approach may not accurately describe and organize the heterogeneous memory functioning of schizophrenia patients.

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R.C. CHAN, R.Y. CHEN, E. CHEN, T. HUI, E. CHEN, H. CHEUNG, P. SHAM, T. LI & D. COLLIER. The COMTSNP genotypes in schizophrenia: relationships to clinical and neurocognitive manifestations.

To examine the differential clinical and neurocognitive profiles of catechol-O-methyltransferase (COMT) single-nucleotide polymorphisms (SNPs) genotypes in patients with schizophrenia. A cross-sectional design was adopted. A total of thirty-six patients with COMTSNPs genotypes A/A (n=11), A/G (n=13) and G/G (n=12) were recruited. Patients with COMTSNP G/G genotype exhibited the most severe negative symptoms as compared with those with COMTSNP A/A. Such difference re-

mains after controlling for age, duration of illness, and medication dosage. In general, this group demonstrated a trend of more severe symptomatology and neurological signs than the other groups, particularly the COMTSNP A/A. General impairments were observed in different subgroups of COMTSNP genotypes. In particular, memory impairments and prefrontal executive function impairments were more pronounced in patients with COMTSNP G/G genotype. Notwithstanding with the small sample and other methodological limitations, the present study provides preliminary data on the impact of the COMTSNP genotypes upon the clinical manifestations and neurocognitive performance in a group of patients with schizophrenia.

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N.S. KOVEN, L.A. FLASHMAN, R.M. ROTH, T.W. MCALLISTER & A.J. SAYKIN. Parietal Lobe Volume and Cognition in Schizophrenia.

Patients with schizophrenia commonly show abnormal executive functions and sustained attention. These domains of functioning are partly subserved by distributed frontal-parietal circuitry. Previous research has observed structural changes in the frontal lobe in schizophrenia, but the contribution of parietal changes to cognitive performance in this population has not been investigated. In the present study, we sought to determine whether parietal lobe volume is associated with performance on tests of executive function and sustained attention in patients with schizophrenia. Participants included 30 patients with schizophrenia (assessed with the SCID, BPRS, SANS/SAPS) and 13 healthy comparison subjects. Groups were equivalent for age, gender, handedness, and WRAT Reading. Participants completed tests of executive functions (WCST, Trail Making Test, Stroop Test, PASAT) and sustained attention (CPT), as well as WAIS-R Performance subtests and graphesthesia. T1-weighted SPGR whole brain MRI scans were obtained and total, left, and right parietal lobe volumes calculated, controlling for total intracranial volume. Patients showed significantly larger left, right and total parietal lobe volume than controls (all P s < .001). Cognitively, relative to the controls, patients showed significantly lower Performance IQ, as well as worse performance on the WCST (categories, perseverative errors), Trails B, and Digit Span forwards and backwards. However, no significant correlation was observed between the increased parietal volume and any neuropsychological measure. These findings suggest that parietal lobe volume is not associated with executive functions and sustained attention in schizophrenia.

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A.P. JONES, R. THOMA, F. HANLON, N. SANCHEZ, H. PETROPOULIS, L. LUNDY, L. PARKS, M. WEISEND, G.A. MILLER & J.M. CANIVE. MRI Assessed Hippocampal Morphology and Neuropsychological Factors in Control and Schizophrenia Subjects.

Hippocampal abnormalities and deficits across cognitive domains have been well documented in schizophrenia. The current study was conducted to investigate how relationships between hippocampal volumes and cognition may differ between schizophrenia and control subjects. 20 normal control subjects and 20 patients with schizophrenia, matched for age, sex and education, underwent MRI scans and cognitive testing. Intracranial volume was computed, as were hippocampal volumes for left and right, anterior, posterior, and total hippocampus. A brief neuropsychological test battery was administered, which included the Shipley Institute for Living Scale, providing an IQ estimate, and the WMS-R Logical Memory and Visual Reproduction subtests, allowing assessment

of memory. Bilateral anterior and left hemisphere total hippocampal volumes were significantly smaller in the schizophrenia group. No group differences were found for any other hippocampal measures, or for intracranial volume. The schizophrenia group was impaired across all neuropsychological measures (all p -values $< .002$). In both groups, estimated IQ was positively correlated with intracranial volume, but there was no relationship with any hippocampal volume measures. In control subjects, left posterior and left total hippocampal volumes correlated with Logical Memory scores ($p < .04$, directed tests). In the schizophrenia group, all memory measures were significantly correlated with bilateral posterior hippocampal volumes. These data suggest abnormal lateralization of structure/function relationships in schizophrenia subjects.

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K.F. PAGULAYAN, P.K. SHEAR, S.R. HOWE, S. MOHAMED & M. FOSTER. The Relationship Between Receptive and Expressive Emotional Skills and Social Functioning in Schizophrenia.

Social functioning impairments are widespread in people with schizophrenia. One possible contributor to this is the deficit that these individuals exhibit in receptive emotional skills (ability to accurately perceive facial and vocal displays of emotion) and expressive emotional skills (ability to appropriately express emotion), which are essential components of interpersonal communication. This study evaluated the relationship between these emotional skills and three social functioning domains. It was hypothesized that receptive and expressive emotional skills would be significant independent predictors of Interpersonal Relationships and Vocational Functioning, but not Independent Living. 43 outpatients with schizophrenia completed affect recognition and social functioning measures as well as a facial expressivity task. *The results revealed differential relationships between the emotional skills and the specific domains of social functioning. On a bivariate level, each functional domain was related to at least one aspect of emotional functioning. After controlling for symptoms, only two significant relationships were found: Sad Facial Expressivity was an independent predictor of Interpersonal Relationships ($R^2 = 0.49$, $F_{(3,42)} = 12.22$, $p < .05$) and Facial Affect Recognition was an independent predictor of Independent Living ($R^2 = 0.26$, $F_{(3,42)} = 4.45$, $p < .05$). Emotional skills did not predict Vocational Functioning after accounting for symptoms. These results suggest the importance of examining specific subdomains of social functioning. Further, the differential relationships between the affect recognition (facial and vocal) and facial expressivity (happy and sad) variables and the social functioning domains suggests that these emotional skills should be investigated separately instead of as a combined construct.*

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E.K. HILL, L.J. SEIDMAN, W.S. KREMEN, S.V. FARAONE & M.T. TSUANG. Neuropsychological Profiles and Psychiatric Disorders in Relatives of Schizophrenics.

Relatives of individuals with schizophrenia have higher rates of psychiatric illnesses than the general population. In addition, cognitive deficits have also been identified in this population. This study investigates the relationship between neuropsychological functioning and psychiatric illness in 54 nonpsychotic relatives using a unique, clinically-oriented approach to data analyses that may overcome some of the limitations associated with group analyses of test data. First, each individual's test profile was rated on the severity of deficits using established criteria, comparing their performance in each of ten cognitive domain to the control ($N=72$) mean performance. Next, based on the pattern of deficits, the most severe group was further divided into neuropsychological profile type (e.g., widespread, frontal, etc.), reflecting a case-based approach

used in clinical neuropsychology. Relatives showed significantly greater severity of cognitive deficits compared to controls (e.g., 25 relatives were designated to the most severe group and represented 5 profile types). Based on standardized interview, 32 of the 54 relatives met criteria for a nonpsychotic, psychiatric disorder; 19 of these individuals received more than one diagnosis. Chi-square analyses showed that relatives' severity of cognitive deficits and degree and nature of psychopathology (e.g., affective disorder, anxiety disorder, etc.) were unrelated. Moreover, the multiple diagnoses and diagnostic category did not differ among neuropsychological profile types. Thus, neuropsychological functioning observed in relatives of schizophrenics reflects more than underlying psychopathology. Future investigation using this case-based approach is hoped to elucidate the nature of neurocognitive deficits in this population (e.g., whether cognitive deficits impact level of functioning). Correspondence: Erin K. Hill, PsyD, Harvard Medical School, 208 Green-dale Ave, Needham, MA 02494. E-mail: erinkhill@comcast.net

D.R. ROALF, B.I. TURETSKY, C.C. BALDERSTON, R.L. DOTY, R.E. GUR & P.J. MOBERG. Family Ties: Odor Identification Impairments in Patients with Schizophrenia, First-Degree Family Members, and Extended Family Members.

Deficits in olfactory functioning, including odor identification, detection threshold sensitivity, discrimination, memory, and hedonic valence have been reliably demonstrated in patients with schizophrenia. Prior studies extend deficits in odor identification to first-degree family members. Current studies are investigating more extensive familial relationships with potential genetic or behavioral implications. This current study examined odor identification ability in patients with schizophrenia, first-degree family members, as well as extended family members. Odor identification ability was assessed using the University of Pennsylvania Smell Identification Test (UPSIT) in 32 patients with a diagnosis of schizophrenia (19 men and 13 women) 23 healthy volunteers (13 men and 10 women), 10 first-degree family members (6 men and 4 women), and 22 extended family members (11 men and 11 women). Patients, first-degree family members, and extended family members all significantly differed from controls ($F(3,81)=5.28$, $p=.003$) on the UPSIT. Post-hoc comparisons revealed that patients ($p<.0001$), first-degree family members ($p<.05$) and extended family members ($p<.0001$) showed highly significant differences in UPSIT performance relative to controls. These differences were not explained by sex, age, smoking or cognitive impairment. These data demonstrate that olfactory deficits in schizophrenia may in fact extend beyond direct family relationships. In addition, assessment of olfactory ability may aid in future genetic linkage studies of schizophrenia or other neurological disorders.

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Invited Symposium/8:45–10:45 a.m.

Recent and remote spatial and non-spatial memory: When is the hippocampus needed?

Chair: R Shayna Rosenbaum

R. ROSENBAUM, L. Recent and remote spatial and non-spatial memory: When is the hippocampus needed?

The hippocampus is the structure most implicated in memory disorders and is correspondingly central to memory theory. However, the specific

types of memories affected by hippocampal damage and the mechanisms responsible for the change in their neurological status have been the subject of considerable debate. Cognitive map theory distinguishes between different types of memory, and specifies that allocentric spatial memory (flexible, viewer-independent knowledge of the spatial relations among objects) is uniquely dependent on the hippocampus, whether the memories were formed recently or in the remote past. Consolidation theory holds that, with time, all declarative memories, spatial or otherwise, become independent of the hippocampus. Multiple Trace theory attaches less significance to temporal factors and argues that memories that become schematic or “semanticized” no longer depend on the hippocampus, whereas memories that are episodic in nature always rely on hippocampal-neocortical interactions. Consistent with cognitive map theory, animal and human studies converge on the finding that the hippocampus is needed for the formation and storage of recent spatial memories. Less certain, however, is whether the hippocampus is always involved in allocentric spatial memories for as long as they exist, and whether its role is even limited to spatial memory or involved more generally in other forms of associative memory. In this symposium, we will revisit competing theories of hippocampal function in the context of new experimental findings involving animal models and humans. These findings underscore the importance of integrating electrophysiological, lesion, and functional neuroimaging research strategies in efforts to better characterize memory loss following neural insult. Correspondence: *R Shayna Rosenbaum, Baycrest Centre for Geriatric Care, Rotman Research Institute, 3560 Bathurst Street, Toronto, ON M6A 2E1, Canada. E-mail: srosenbaum@rotman-baycrest.on.ca*

L. NADEL. The Hippocampus as a Cognitive Map.

The question of whether the hippocampus is specialized in some way for space, or is instead an all-purpose “associator” and “relational memory” device, has been at the center of the hippocampal debate for over 25 years. I will frame that debate historically and bring it up to date with some recent findings that support the “space is special” position. The related question of whether the hippocampus plays its memory role “temporarily” or “permanently” has also been debated, much more vigorously in recent years with the advent of new data and a theoretical framework (“multiple trace theory”) that has challenged traditional consolidation theory. I will briefly outline these two approaches, discuss recent data from our lab (and some others) and suggest a way to understand the often confusing literature in this field.

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G. WINOCUR. Preserved Spatial Memory Following Hippocampal Lesions in Rats.

In animals, lesions to the hippocampus produce severe loss of pre-operatively acquired spatial memories that can extend for long periods of time. This pattern contrasts with reports that humans with extensive hippocampal damage exhibit considerable sparing of remote spatial memory associated with familiar neighbourhoods. A crucial difference between the human and animal studies is that the humans had extensive experience with the environments before sustaining brain damage. To assess the importance of familiarity and working knowledge as factors in the preservation of premorbid spatial memories following hippocampal lesions, a complex environment (i.e., neighbourhood) was created in which rats were reared prior to surgery. In post-operative testing, rats with hippocampal lesions exhibited preserved memory for spatial locations in the environment. By altering different aspects of the environment, we showed that rats’ memory was not dependent on sensory cues, landmarks, or specific routes, but on allocentric topographical representations that preserved sufficient distal cues to enable navigation. The hippocampal rats were impaired, however, when required to learn

new spatial relationships in either the same or an unfamiliar environment. The results parallel those reported in humans, and suggest that, with extensive experience, the spatial layout of a premorbid environment becomes represented outside the hippocampus, and in a schematic form that is capable of supporting spatial memories. These results, combined with those from related studies using other paradigms, raise questions about traditional views of hippocampal function.

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R. ROSENBAUM. The Hippocampus is Needed for Remote Memory of Episodic-Spatial Details but not Schematic-Spatial Layouts: Evidence from Amnesic Patients and fMRI.

Hippocampal amnesia is often associated with loss of recent spatial memory, but more systematic study of remote spatial memory in amnesic patients suggests that representations of old environments that are adequate for navigation are retained, even when specific details are lost. Findings of spared memory may reflect the function of intact extra-hippocampal brain structures that have been implicated in recent spatial memory, whereas impaired memory for spatial details may reflect hippocampal dysfunction. We explored these possibilities in 1. fMRI studies of healthy young adults, 2. behavioural studies of Alzheimer’s disease and hippocampal amnesia, and 3. A combined lesion-fMRI study of the amnesic patient K.C. The results of these experiments converge on the view that the hippocampus is not needed for the maintenance and recovery of memories for very familiar environments established long ago. Instead, a host of medial temporal and neocortical structures located outside of the hippocampus that are known to be involved in spatial acquisition, including parahippocampus, retrosplenial cortex, and posterior parietal cortex, are differentially recruited based on the processing demands of each remote spatial memory task. Recovering spatial details in ways that allow one to re-experience the unique context of a personal episode continue to rely on the hippocampus, regardless of the age of the memory. Our findings suggest that it may be useful to distinguish between schematic spatial representations (corresponding to semantic memory), which can survive hippocampal damage after they have been assimilated, and detailed perceptual-spatial representations of environments (corresponding to episodic, autobiographical memory), which are impaired no matter how long ago they were acquired. This “semantic-episodic” distinction in spatial memory holds the promise of a unified view of hippocampal-neocortical interaction that cuts across all declarative memories.

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N. COHEN. The hippocampus and declarative memory: Providing a unique solution to representation of arbitrary or accidentally occurring relations among the elements of experience.

Theory and data concerning the particular role of hippocampus in declarative memory will be presented in order to explain a variety of phenomena of normal memory and of amnesia, both in humans and in animals, as well as to explain findings from single-cell recording studies in the hippocampus of behaving animals and functional imaging studies in humans performing various memory tasks. The central thesis is that hippocampal-dependent declarative memory is a fundamentally relational system, critical for representations of all manner of relations among the constituent elements of scenes, events, and other structured domains of experience. It provides the essential support for acquiring memory of accidental or arbitrary relations, including both spatial and non-spatial relations, whether episodic or semantic. The system is critical both in forming new relational memories and in gaining access to recently stored relational memories, through hippocampal-neocortical

interactions supporting the processes of relational memory binding and relational network activation. Finally, it provides the relational database on which various other brain systems can operate to support the flexible, cognitively mediated use of declarative memory in inferential reasoning, spatial navigation, explicit remembering, and conscious awareness.

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Symposium 3/8:45–10:45 a.m.

Interactions between Child and Family Factors for Children with Developmental and Acquired Brain Insult

Chair: Vicki Anderson
Discussant: Keith Yeates

V.A. ANDERSON. Interactions between Child and Family Factors for Children with Developmental and Acquired Brain Insult: .

Clinical reports indicate that children sustaining brain insult, either pre- or post-natally frequently present with significant emotional and behavioral problems, which may interrupt ongoing development and reduce quality of life into adulthood. While physical and cognitive sequelae of brain insult often show significant recovery in the months post-injury, emotional and behavioral problems may be exacerbated with time since insult, as children and families experience difficulties adjusting to and coping with the various consequences of brain insult. This recovery pattern suggests that other factors, independent of injury severity, may underpin outcome in these functional domains. In order to better understand risk and resilience factors for psychological sequelae this symposium will examine the complex interactions among injury factors, child characteristics, family function and outcome in a range of common childhood conditions, including epilepsy, head injury and prematurity.

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K. GANESALINGHAM, V.A. ANDERSON & A. SANSON. Effects of paediatric traumatic brain injury on self-regulation and social functioning.

Social functioning difficulties are often reported following paediatric traumatic brain injury (TBI). This study investigated the effects of paediatric TBI on children's behaviours and social skills. These social difficulties are believed to reflect the relative vulnerability of the prefrontal cortex to damage. The present study examined the contention that impaired self-regulation may be an underlying mechanism that contributes to children's social functioning difficulties. Self-regulation is a biologically based attribute that is governed by the prefrontal cortex. Self-regulation is the modulation and management of individuals' own thoughts, feelings, and actions; thus comprising cognitive, emotional and behavioural domains. Children, 6 to 11 years of age, two to five years following moderate to severe TBI ($n=65$), and age and gender matched control participants ($n=65$) were assessed for levels of self-regulation using the Matching Familiar Figures Test, Test of Everyday Attention for Children, Emotion Regulation Checklist, and a Delay of Gratification Task. The Eyberg Child Behavior Inventory, Sutter-Eyberg Student

Behavior Inventory Revised, and the Social Skills Rating System were used to assess social functioning. Results highlighted that children with TBI had significantly lower levels of cognitive ($p<.01$), emotional ($p<.01$), and behavioural ($p<.01$) self-regulation, and higher levels of social functioning difficulties ($p<.01$) than their non-injured peers. Significant relations were further identified between self-regulation and social functioning ($p<.05$). This pattern of results supported a mediational model with self-regulation mediating the effects of TBI on children's social behaviours. Present results are discussed in terms of the theoretical and clinical significance of the mediating role of self-regulation.

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L. GONZALEZ, V.A. ANDERSON, S. HARVEY & S. WOOD. Objective and Observer Ratings of Memory Function in Children with Temporal Lobe Epilepsy and their Peers.

Functional memory measures have received little attention in the paediatric literature, despite adult studies to suggest that these questionnaires capture information overlooked by standard neuropsychological assessment. This study introduces the Observer Memory Questionnaire - Parent Form (OMQ-PF) and examines everyday memory function in children with temporal lobe epilepsy (TLE) and their peers. Although hypotheses were largely exploratory, it was expected that parents' ratings would be poorer in the TLE group relative to controls. Two hundred healthy children and 42 with TLE (22 right; 20 left) participated in this study. All were aged between 5-16 years. Neuropsychological measures of memory were administered together with the OMQ-PF. The OMQ-PF had high internal consistency in the normative and clinical groups. Parents of clinical subjects reported heightened functional memory impairment relative to controls ($z = 1.01$). There were no differences between ratings for left and right TLE groups. Whilst the OMQ-PF yielded a meaningful factor structure in the normative group, less-specific factors were extracted in the clinical group. Further, the OMQ-PF was predicted by standard verbal memory tasks in the control group, but no neuropsychological predictors were identified in the clinical sample. Seizure variables did not predict OMQ-PF ratings. The OMQ-PF is a reliable measure of everyday memory function. The differential results for clinical and control groups indicate that parental perception of functional memory is a complex construct. Whilst it seems that such ratings enhance standard neuropsychological assessment, further work is required to understand more fully the factors that influence parental perceptions.

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P.J. ANDERSON & L. DOYLE. Behavior problems in school-aged children born very preterm or with extremely low birthweight: Relationship with IQ and school achievement.

More very preterm and extremely low birthweight (ELBW) infants are surviving due to recent advances in perinatal intensive care. However, approximately 70% of these survivors have white matter abnormalities on neuroimaging and 55% display a neurobehavioral impairment such as cerebral palsy, deafness, blindness, intellectual impairment or learning disability. With more high-risk infants surviving the frequency of behavior problems in this population may have increased. The aim of this study was to examine the frequency and nature of behavioral problems in school-aged children born very preterm (<28 weeks gestation) or extremely low birthweight (<1000 grams). The ELBW/very preterm cohort comprised of 298 consecutive survivors born in the state of Victoria, Australia in 1991-92, and was compared to a normal birthweight (NBW: >2499 grams) cohort which comprised of 262 children. At 8-years of age children had a neuropsychological assessment, which in-

cluded measures of IQ (WISC-III) and educational skills (WRAT-3), while the child's mother and teacher completed the Behavior Assessment System for Children (BASC). The ELBW/very preterm cohort exhibited significantly more behavior problems than the NBW cohort ($p<.01$), especially internalizing behavior problems ($p<.01$). More specifically, the ELBW/very preterm cohort had high rates of attention problems (32%), hyperactivity (26%), anxiety (23%), and social withdrawal (24%). In the ELBW/very preterm cohort, children with an intellectual impairment or a specific learning disability in mathematics were 2.5 times more likely to exhibit significant behavior problems. The relationship between cognitive functioning, educational achievement, and social and emotional development in this high-risk population will be discussed.

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V.A. ANDERSON, C. CATROPPA, F. HARITOU, S. MORSE & J. ROSENFELD. Identifying Factors Contributing to Child and Family Outcome at 30 Months Following Traumatic Brain Injury in Children.

The aim of this study was to examine the contributions of injury severity, physical and cognitive disability, child and family function to outcome 30-months post-traumatic brain injury (TBI) in children. The study was a prospective, longitudinal, between-group design, comparing pre- and post-injury function across three levels of injury severity. The sample comprised 150 children, 3.0 to 12.11 years, admitted to hospital with a diagnosis of TBI. The sample was divided, according to injury severity: mild ($n=42$), moderate ($n=70$), severe ($n=38$). Children with a history of neurologic, developmental and psychiatric disorder were excluded from participation. Main outcome measures: post-injury physical function, cognitive ability (incorporating intellect, memory and attention), behavioral and family functioning and level of family burden. A dose-response relationship was identified for injury severity and physical and cognitive outcome, with significant recovery documented from acute to 6 months post-TBI. Behavioral functioning was not related to injury severity, and where problems were identified, little recovery was noted over time. Family functioning remained unchanged post-injury, although level of burden was high, and predicted by injury severity, functional impairment and post-injury behavioral disturbance. These results suggest ongoing problems for the child with TBI and significant family burden 30 months post-TBI. The nature and severity of physical and cognitive problems are closely related to injury severity, with child and family function predicted by psychosocial and pre-morbid factors.

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Paper Session 2/8:45–10:45 a.m.

Dementia

N. BELFOR, J.H. KRAMER, A. BOXER, S. AMICI, H. ROSEN, M. GESCHWIND & B.H. MILLER. Can Neuropsychological Assessment and Imaging Differentiate Corticobasal Degeneration and Frontotemporal Dementia?

Although Corticobasal degeneration (CBD) has traditionally been thought to be a movement disorder, recent research recognizes cognitive changes, that place CBD within the spectrum of frontotemporal dementia (FTD). Our objective was to provide the first direct

neuropsychological and neuroimaging comparison between CBD and FTD. 14 CBD patients and 14 FTD patients matched on age, education, and Mini Mental State Exam were compared on measures of verbal and visual memory, confrontation naming, executive functioning, verbal and design fluency, calculation, and praxis. Imaging included 80 control subjects. Patterns of regional brain atrophy on T1-weighted MRI scans were identified using voxel-based morphometry (VBM). Both groups were impaired on measures of executive functioning with relatively spared memory. The only neuropsychological difference was that CBD patients made significantly fewer errors on a set-shifting task than FTD. Analysis of the imaging data indicated that relative to controls, both groups had bilateral medial frontal, caudate, putamen and insular atrophy. However, FTD patients had significantly more atrophy in the right orbitofrontal region than CBD patients. Results suggest that: 1) FTD and CBD present with similar cognitive profiles, confirming that that CBD can be viewed as an FTD-spectrum disorder. 2) FTD presents with greater right orbitofrontal atrophy than CBD. The right orbitofrontal region has been implicated in regulating inhibition and social judgment, two areas of functional impairment associated more with FTD than with CBD. 3) The greater number of set-shifting errors in FTD may be associated with their more pronounced right orbitofrontal atrophy. 4) The lack of more widespread differences between the two groups may reflect the relative insensitivity of traditional neuropsychological testing to orbitofrontal injury, arguing for the inclusion of behavioral measures in evaluations of FTD-spectrum disorders.

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K.P. RANKIN, C.M. STANLEY, H.J. ROSEN & B.L. MILLER. FTLD Patients Fail to Discriminate Emotions Despite Dynamic, Multimodal Input.

Emotion comprehension deficits have been demonstrated in frontotemporal lobar degeneration (FTLD), but to date, only static pictures of faces or isolated audioclips have been used for testing. We investigated whether these deficits persisted if patients were given reinforcing information from dynamic facial, voice prosody, and body language cues. Thirty-one subjects (15 frontotemporal dementia [FTD], 7 semantic dementia [SD], and 9 healthy older controls [NC]) were tested with Part 1 of the Awareness of Social Inference Test (TASIT), in which actors display 7 basic emotions (happiness, surprise, sadness, anger, revulsion, fear, and neutral) in 20-second video clips comprised of FACS-coded facial affect, matching upper body language, and matching voice prosody with neutral semantic content. Subjects were asked to select the emotion from choices on a printed card. Subjects' mean age was 63 ± 8.1 , education 17.1 ± 2.5 years, Clinical Dementia Rating score SD: 0.9 ± 0.6 , FTD: 1.4 ± 0.7 . Controlling for age, sex, and education, both FTLD groups showed significant deficits identifying negative emotions (sadness, anger, revulsion, fear) compared to NCs ($p<0.001$) (NC: 6.9 ± 0.6 , FTD: 4.7 ± 2.5 , SD: 3.0 ± 1.7). Though SDs were no different from NCs identifying positive emotions (happiness, surprise, neutral), FTDs showed a trend towards worse performance ($p=0.62$) (NC: 4.4 ± 1.1 , FTD: 3.2 ± 1.1). This study replicates previous data suggesting SD patients fail to identify negative but not positive facial emotions, while FTD patients show deficits for both types. It augments existing research by showing that neither FTD nor SD patients benefited from cue reinforcement from dynamic facial, voice prosodic, or body language modalities, suggesting broader deficits than previously demonstrated.

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J. TSCHANZ, C. CORCORAN, L. TOONE, R. PFISTER, K. WELSH-BOHMER, M. NORTON, J. BREITNER & C. LYKETOSOS. Head Injury and Trajectory of Cognitive Decline in Dementia. The Cache County Study.

Head injury (HI) has been associated with late-life cognitive decline or the development of Alzheimer's Disease, but less studied is its effects on the clinical trajectory of dementia. In a population panel of individuals with dementia, we examined whether HI influenced rate and expression of cognitive decline, hypothesizing that HI would have greater impact on measures of memory and executive functions. We focused these preliminary analyses on global cognitive ability and executive functions. 227 individuals with dementia (34 with history of HI prior to dementia evaluation, 148 without and 45 with unknown history) were followed over an average of 38 months. All received a standard neuropsychological test battery including tests of global cognition (Mini-Mental State Exam, MMSE) and executive functions. To examine the influence of HI on the MMSE and executive functions, we ran linear mixed models using random intercepts. Covariates included dementia onset age, severity at diagnosis, dementia type, APOE E4 allele, and health status. All individuals exhibited decline on the MMSE (mean=2.19, s.d.=3.33 points/year). Those with HI scored worse on average at the time of dementia diagnosis on lexical fluency (but not on the MMSE), and exhibited less decline on lexical fluency ($p=.10$) and Trail Making Test A ($p<.03$) than those without HI. These results show that HI exerts a detrimental effect on cognition in dementia but not on decline for the domains examined. These results may reflect differential survival. Subsequent analyses will examine the influence of HI on other cognitive domains.

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S. CORREIA, T. BRENNAN-KROHN, S. ZHANG, D. LAIDLAW, P. MALLOY & S. SALLOWAY. Diffusion-Tensor Imaging and Executive Function in Subcortical Ischemic Vascular Disease and Mild Cognitive Impairment.

To examine white matter microstructural integrity using diffusion-tensor imaging (DTI) and to determine its association with executive cognitive function in non-demented patients with subcortical vascular disease (SIVD), mild cognitive impairment, and normal controls (NC). DTI provides measures of white matter microstructural integrity that can detect changes in white matter that appears normal on T2-weighted MRI (normal-appearing white matter, NAWM). Participants included 9 subjects with SIVD, 9 subjects with MCI, and 8 NC. Four subjects in the SIVD group had CADASIL (cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy), a genetic form of SIVD. All participants had DTI and completed a battery of cognitive tests. The SIVD group was younger than the MCI group ($p=.003$). Region-of-interest (ROI) analysis revealed significant age-adjusted DTI changes in NAWM in the SIVD group relative to the MCI and NC groups. The MCI and NC groups did not differ significantly on DTI parameters. Correlation analyses revealed an association between psychomotor processing speed and DTI in NAWM ($r=-.418$, $p=.034$). This may be the first report using DTI to measure white matter health in patients with SIVD vs. MCI. Compared to normal controls, patients with SIVD have subtle changes in the microstructural integrity of NAWM; however, this effect is not seen in patients with MCI. There appears to be an association between the integrity of NAWM and psychomotor processing speed. The results are limited by the small sample size and ROI placement. We are continuing to recruit subjects and explore alternative approaches to analyzing DTI data.

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M.R. POWELL, G.E. SMITH, D.S. KNOPMAN, J.E. PARISI, R.J. IVNIK, B.F. BOEVE & R.C. PETERSEN. Cognitive Measures Predict Clinical and Neuropathologic Criteria of Alzheimer's Disease.

In an attempt to further document the diagnostic utility of neuropsychological measures, cognitive indices were used to predict highly relevant clinical and neuropathologic criteria of Alzheimer's disease (AD). A total of 113 prospectively followed AD and cognitively "normal" participants who received cognitive testing as well as neurological and neuropathological evaluation were available for this investigation. The Mayo Cognitive Factor Scale (MCFS; Smith et al., 1984) age- and education-adjusted standard scores obtained at subjects' initial cognitive evaluation were used to predict final clinical diagnosis of AD (American Psychiatric Association, 1987), final neuropathological diagnosis of AD (Hyman & Trojanowski, 1997), and degree of AD-related neurofibrillary tangle burden (NFT; Braak & Braak 1991). All criteria were ascertained approximately 5 years after initial cognitive testing. Of note, NFT burden represents an independent and highly objective criterion. This study's inclusion of an objective neuropathologic criterion represents a methodological improvement over previous research. Logistic Regression models including MCFS verbal comprehension and memory indices (learning or retention factors) were significant and yielded high positive predictive value with moderate sensitivity and specificity for clinical and pathologic criteria. As expected, classification rates were marginally superior for clinical diagnosis of AD compared with neuropathologic diagnosis of AD or extensive NFT burden. Low aggregated MCFS scores (e.g., sum of verbal comprehension and retention standard scores) for individuals were associated with substantially larger likelihood ratios (i.e., increased risk) for all AD-related criteria (diagnoses and NFT burden). Cognitive measurement appears useful for predicting clinical and more objective neuropathological AD-related criteria.

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N.S. FOLDI, S. VEDRODY, L. HORN-LEVINSON, K.I. LOMBARDI, R.E. WHITE & J. REDFIELD. Visual Attention Measures Detect Early Changes of an Acetylcholinesterase Inhibitor (AChE-I) in Alzheimer Disease (AD).

Acetylcholine directly mediates attention, but attentional measures have conventionally not been used to assess AChE-I efficacy in AD. We propose that higher-order visual attention measures could be more sensitive indicators of treatment response compared to global or cognitive domain measures, and could detect drug effect earlier during treatment. In an open-label longitudinal design, 13 AD patients (CDR 0.5-1.0) were assessed before (T1) and after 6-8 weeks (T2) de novo AChE-I treatment (donepezil). Assessment included: selective attention (target detection in sparse or dense arrays); covert orienting (target detection after valid or invalid spatial cue); domains of attention, memory, language and visuospatial-function; global measures (ADAS-Cog, MMSE, DRS, CDR, CDR-SB). T1-T2 changes in global and domain scores were non-significant, $p>.05$, corroborating that these measures poorly detected early drug effect. Covert orienting showed a main effect of Validity, $F(1,12)=41.94$, $p<.001$, and Time x Validity interaction, $F(1,12)=5.95$, $p=.031$, indicating differential improvement. Selective Attention showed improvement with faster detection speed $F(1,11)=7.44$, $p=.020$: at low density accuracy was maintained, $\chi^2(1)=1.65$, $p=.199$, but at high density accuracy decreased, $\chi^2(1)=7.68$, $p=.006$. Visual attention measures detected change early in the course of AChE-I treatment, better than domain or global scores. Covert orienting response times showed that the drug limited slowing on the more difficult invalid condition than the valid condition. Selective attention yielded a speed-accuracy trade-off at low density, but at high density, patients could not sustain load demands. To detect these AChE-I effects, attentional measures need to include differential levels of load that challenge attentional resources.

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Paper Session 3/8:45–10:45 a.m.

Medical Illness

R.H. BENEDICT, D. COX, L.L. THOMPSON, F. FOLEY, B. WEINSTOCK-GUTTMAN & F. MUNSCHAUER. Alternate Forms Preserve Validity without Compromising Reliability in MS.

Serial testing gives rise to practice effects because patients learn test material and become more familiar with testing-taking procedures. Alternate forms prevent the learning of specific stimuli, but do not obviate procedural learning. Changing forms may also diminish reliability coefficients. Our objective was to examine test-retest effects in MS patients randomly assigned to same- (SF) or alternate-form (AF) conditions. We evaluated 32 MS patients with the California Verbal Learning Test - II (CVLT-II) and the Brief Visuospatial Memory Test - Revised (BVMTR), tests recommended by a recently convened consensus panel. Patients were assigned randomly to SF or AF groups and then tested at baseline and one week later. Reliability was assessed via Pearson *r* and the groups were compared using mixed-factor ANOVAs. SF and AF groups were matched on demographics and baseline memory and executive function testing. Reliability coefficients ranged from 0.11 to 0.69 for the SF group, and 0.50 to 0.88 for the AF group. ANOVAs revealed significant group x time interactions with SF patients showing greater gain. SF practice effects were often dramatic, compromising test validity. For example, on the CVLT-II, SF patients recalled 10.4±3.3 words on Trial 1 at follow-up, approximating the asymptote of learning at baseline. Use of alternate forms is critical to the preservation of test validity when serial testing is emphasized. Employing alternate forms with MS patients can be done without compromising test-retest reliability, at least for the CVLT-II and BVMTR presented at one-week intervals.

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L.A. MORROW, M. HAUT, A. DUCATMAN, E. PARSONS, M. PARSONS, K. METHENEY & A. SCOTT. Neuropsychological Deficits in Railroad Workers with Long-Term Solvent Exposure.

Exposure to organic solvents in the workplace has been associated with lower scores on neuropsychological indices and increased mood disorder. This study evaluated neurobehavioral function in subjects who had all been exposed to similar solvents for more than 10 years in a similar setting - machinists and laborers in the railroad (RR) industry. A matched group of blue-collar controls was also evaluated. Thirty-six RR workers (mean age & education = 54 & 12.4) were evaluated with a battery of neuropsychological tests and compared to 35 non-exposed blue-collar controls (mean age and education = 52 & 13). Test scores were converted to z-scores and five cognitive domains were computed (e.g., learning and memory, motor speed, general IQ, spatial ability, executive function). Between group comparisons demonstrated significantly lower performance in the exposed group on measures of learning and memory ($p < .03$) and executive function ($p < .03$). No differences were noted on the other three domains. An estimate of past exposure was significantly correlated with scores on both learning and memory and executive function ($ps < .05$). There was no association between cognitive test scores and depression. A sample of workers with past exposure to organic solvents was found to have significantly poorer per-

formance on measures of learning and memory and executive function compared to matched controls. There was no association between cognitive scores and depression, indicating mood changes were not causally related to lower test scores. There was, however, a significant correlation between cognitive performance and estimates of past exposure.

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B.J. DIAMOND & J. DELUCA. Information Processing Speed in Anterior Communicating Artery Aneurysm .

The goal of this study was to examine changes in processing speed in ACoA's as a function of task demand and modality using n-back tasks. Seven patients with a mean age of 56.5 (SD = 8.4) were given computer-administered, adaptive visual (VTSAT), auditory (ATSAT) and Dual Threshold programs (DTSAT) that employed PASAT-like tasks requiring subjects to add the current number to the previous number and say aloud the sum. The ATSAT used a voice synthesizer; the VTSAT presented numbers on the screen and the Dual task consisted of the VTSAT and a simple auditory reaction time task. ACoA's were significantly slower in auditory ($M = 3002$ ms) versus visual ($M = 1970$ ms) processing speed ($t(5.7)$, $p = .001$). In the Dual task ($M = 3006$), the introduction of a simple reaction time component (i.e., response to a tone) resulted in a 43% reduction in visual (VTSAT) processing speed. Decrements in speed may be related to impairments in executive function with disproportionate auditory impairment attributable to a greater degree of verbally-mediated interference. While slower dual task performance may emphasize impairments in the operation of a central executive and a diminished capacity to perform multi-tasking, levels of accuracy across tasks were comparable suggesting that working memory and computational skills did not explain differences in performance. Future work should examine the impact of impairments in speed on everyday tasks. Correspondence: *Bruce J. Diamond, Ph.D, Psychology, William Paterson University, Box 43592, Upper Montclair, NJ 07043. E-mail: diamondb@wpunj.edu*

A. MEIDINGER, A. THURSTIN, C.M. SOURATHATHONE, A. MADAN, J. MASON, K.L. NETSON, V. ALLEN, B. MCGUIRE & B.A. BUSH. Hepatic Encephalopathy and Post-Transplant Cognitive Recovery.

Emerging evidence suggests deficits associated with hepatic encephalopathy (HE) may not be completely reversible after liver transplantation (LTX). This study sought to examine cognitive recovery in patients who experienced HE prior to LTX using a pre-post design. Participants were 19 adults (age 19-69) with severe liver disease at time of LTX (25.4±6.6 MELD score) who completed repeat assessment at least 6-months post-LTX. Etiological classification consisted of 4 categories: hepatitis C virus (HCV, $n=4$), alcoholic cirrhosis (ETOH, $n=3$), combined HCV and ETOH ($n=3$), and all other etiologies ($n=9$). Pre vs. post-LTX performance on measures of attention and executive functions (TMT-A and TMT-B), visuoconstruction (Block Design), multiple aspects of verbal memory (CVLT-2), and psychomotor speed (Digit Symbol) were compared. Paired t-tests revealed improved performance with regard to psychomotor speed, attention, speed of processing, visuomotor skills, short delay free recall of verbal information, and both long delay free-recall and cued recall for verbally presented information ($p \leq .042$). Pre to post performance on short-delay cued recall and recognition scores for verbal information did not vary significantly. Each significant t-test result was followed by a separate hierarchical multiple regression to evaluate the relative contributions of demographics, pre-LTX performance, time since LTX, disease severity, and etiology in predicting post-LTX performance. Results indicated pre-LTX performance and demographics were the only consistent contributors to post-LTX performance. The occurrence of HE prior to transplantation does

not preclude cognitive recovery on the selected measures; however, only pre-transplant performance and demographics consistently accounted for a significant amount of variance in post-LTX performance. Findings suggest cognitive recovery is not a function of disease severity at LTX, time since LTX, or disease etiology.

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A.L. JEFFERSON, A. POPPAS, K. MACGREGOR, A. FREEMAN, R.H. PAUL & R.A. COHEN. Cardiac Output and Cognitive Functioning: Evidence for a Relationship Between Systemic Perfusion and Executive Dysfunction.

Changes in cerebral perfusion are associated with observable changes in cognitive function. The present study examines the relationship between a measure of systemic perfusion, cardiac output (CO), and performances on neuropsychological tests among older adults with cardiovascular disease. Outpatients with treated, stable cardiovascular disease and no history of neurological illness ($n=45$, ages 56-85) were administered a comprehensive neuropsychological protocol. Echocardiogram findings were used to stratify participants into two groups: low CO (<3.5 L/min) and normal CO (>3.5 L/min). Group comparisons were made using ANCOVAs controlling for age. The low CO group performed significantly worse on tests of global cognition (MMSE, $F(2, 42) = 3.32$, $p<.05$), fluency (Animals, $F(2, 42) = 5.54$, $p<.007$; FAS, $F(2, 42) = 9.43$, $p<.0001$), non-verbal visuospatial memory indices (Biber immediate recall, $F(2, 42) = 3.42$, $p<.04$; Biber short delay, $F(2, 42) = 7.04$, $p<.002$; Biber long delay, $F(2, 42) = 6.02$, $p<.005$), inhibition (DKEFS color/word naming, $F(2, 42) = 4.14$, $p<.02$), sequencing (DKEFS Letter-Number Sequencing, $F(2, 42) = 8.12$, $p<.001$), working memory (PASAT, $F(2, 42) = 4.24$, $p<.02$), and motor functioning (Pegboard dominant, $F(2, 42) = 5.38$, $p<.008$; Pegboard nondominant, $F(2, 42) = 4.43$, $p<.02$; Finger Tapping nondominant, $F(2, 42) = 5.79$, $p<.006$). No significant differences were observed for verbal memory performances. Reduced CO, a measure of systemic perfusion, is associated with poorer cognitive functioning among geriatric outpatients with stable cardiovascular disease. The cognitive profile consists predominantly of executive dysfunction, suggesting a relationship between decreased systemic perfusion and problems with generation, inhibition, sequencing, and working memory.

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S. REMINGER, R.J. THEILMANN, A. LOPEZ, T. DRAGOVICH, R.S. KROUSE & K.L. KAEMINGK. Neuropsychological Correlates of Diffusion Tensor Imaging Measures in Breast and Colon Cancer Survivors.

Cancer patients treated with adjuvant chemotherapy often show persistent weaknesses in neuropsychological function, including weaknesses in memory, mental flexibility, processing speed, attention, visuospatial ability, and motor function. The underlying mechanisms for potential changes in cognitive function in this population are currently being investigated. In the present study, ten breast cancer survivors, six colon cancer survivors, and six normal control subjects participated in structural magnetic resonance imaging (MRI), diffusion tensor imaging (DTI), and a neuropsychological assessment. Whole brain volumes obtained via structural MRI were segmented into regions of white matter, gray matter, and cerebral spinal fluid. DTI measures of white matter integrity, including fractional anisotropy (FA), relative anisotropy (RA), and apparent diffusion coefficient (ADC), were calculated for white matter regions. Analysis of variance demonstrated a trend toward a significant difference between the ADCs of the three groups, with normal control subjects showing the lowest ADCs, breast cancer survivors showing higher ADCs, and colon cancer survivors showing the highest ADCs. A strong negative relationship was found between white matter ADC and performance on the Digit Symbol subtest of the Wechsler Adult Intelligence Scale – Third Edition. Lesser positive correlations were also found between the anisotropy measures and Digit Symbol performance. These results suggest that weaknesses in psychomotor speed in cancer survivors may be related to changes in white matter integrity. Longitudinal research is needed to determine if chemotherapy may cause white matter changes that negatively impact cognitive performance in cancer survivors.

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THURSDAY AFTERNOON, FEBRUARY 3, 2005

Poster Session 3/12:30–2:00 p.m.

Emotion

M.J. LARSON, D. STIGGE-KAUFMAN, C. MAUER, K.G. KELLY & W.M. PERLSTEIN. Affect-Related Modulation of Error-Related Neural Processing.

Several studies have shown that the error-related negativity (ERN) covaries as a function of motivational factors (i.e., reward) and is overactive in certain anxiety states (i.e., obsessive-compulsive disorder). The current study examined the effects of viewing exogenous, emotional stimuli on error-related processing. We acquired high-density event-related potentials (ERPs) while 20 neurologically- and psychologically-normal participants performed a modified version of the Eriksen Flanker Task during which flanker stimuli were superimposed on pictures from the International Affective Picture System (IAPS). On each trial congruent or incongruent flanker stimuli, to which participants made a manual response, were superimposed over simultaneously presented IAPS pic-

tures. Pictures were of neutral, pleasant (i.e., approach, engage), and unpleasant (i.e., avoid) valences, with the latter equated for arousal. Participants also viewed pictures without flanker stimuli and provided valence and arousal ratings. Behaviorally, participants exhibited greater errors and slower response times to incongruent than congruent flankers ($ps<.02$), but no effects of picture valence. Electrophysiologically, however, a mid-frontal ERN was larger following incorrect than correct trials and varied as a function of picture valence: ERN was larger in the context of pleasant than neutral ($p<.05$), or unpleasant ($p<.03$) pictures. Conversely, P3 amplitude to post-task picture-viewing was greater to unpleasant than neutral ($p<.03$) or pleasant ($p<.03$) pictures. Findings are consistent with the hypothesis that error-related neural processing is influenced by motivational factors. Increased amplitude ERN on pleasant trials may indicate engagement toward the stimulus and increased subsequent response-conflict on error-trials, while decreased ERN amplitude on unpleasant trials may reflect disengagement from the stimulus and decreased response-conflict.

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U.S. SPRINGER, J. NORTON, A. ROSAS, J. MCGETRICK & D. BOWERS. Modulation of Emotional Reactivity via Semantic Knowledge of Famous Faces.

The amygdala plays a role in detecting danger and priming the subcortical startle circuitry. It has strong reciprocal projections to extensive cortical and neocortical areas that underlie the processing of emotional contextual information. We wanted to investigate whether emotional semantic knowledge derived from faces of famous individuals would modulate the intensity of the human startle response. We predicted that the perception of famous people judged to be 'evil' would result in larger startle responses than those judged to be 'neutral' or 'good'. Twenty-eight normal college students judged pictures of well-known individuals as good, evil, or neutral. A custom slideshow was created for each subject depending on their subjective responses, with equal representation of pictures from each moral category. White noise bursts induced startle eye blinks while subjects viewed these pictures. The data were analyzed using an Affect (Good, Neutral, Evil) x Gender (M, F) repeated-measures ANOVA. In accordance with our prediction, startle eye blinks were significantly larger ($p < 0.01$) when subjects viewed faces of people who represented evil versus neutrality or goodness, and responses were also significantly larger ($p < 0.01$) for faces judged to be neutral versus good. These data indicate that emotional semantic knowledge derived from the human face modulated emotional reactivity in normal individuals. Faces of 'evil' people exerted more powerful priming effects on startle reactivity possibly because the perception of an evil person represents more direct threat than those judged to be neutral or altruistic, thus more effectively inducing a motivational propensity to withdraw or escape. These findings highlight the influence of semantic emotional stimulus processing on motivated behavior.

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S.D. CHRISTMAN & P. STEIBER. Bilateral Eye Movements Lead to a Neutralization of Affective State.

Engaging in bilateral eye movements (EM) leads to increases in Stroop interference, improvements in episodic memory, and decreases in false memories in a converging semantic associates paradigm. These results are interpreted as reflecting EM-induced equalization of cortical activation and subsequent enhancement of interhemispheric interaction. Since increased right versus left hemisphere activation is associated with negative versus positive affect, respectively, it was hypothesized that EMs following a mood-induction procedure should result in neutralization of affect. Seventy three right-handed participants engaged in happy or sad mood induction procedures, providing mood ratings on a 1-9 scale, followed by 30 seconds of either bilateral EMs or, as a control, watching a dot change color repeatedly. Participants then supplied a second mood rating. Analyses of the Happy condition showed no mood differences after mood induction, with all participants yielding scores significantly happier than neutral. After administration of the visual condition, participants in the Colored Dot condition showed no change in mood. In the EM condition, however, participants showed a significant reduction in positive affect. Analyses of the Sad condition showed that the mood induction procedure failed, with participants reporting neutral moods after mood induction. Post hoc analyses of only those participants reporting sad moods after induction showed that participants in the EM condition exhibited a marginally greater neutralization of affect than in the Colored Dot condition. The results provide tentative support for the hypothesis that bilateral EMs result in neutralization of emotional states, reflecting an equalization of cortical activation in the left and right hemispheres.

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K. BURTON, A. KASZNAK & M. MENCHOLA. Psychophysiology of "Biologically Prepared" Emotion Stimuli in Healthy Older Adults and Alzheimer's Disease.

Emotional experience and behavior in persons with Alzheimer's disease (AD) and healthy older adults (OA) were assessed, in response to emotion stimuli that are biologically relevant to survival (e.g., nudes, faces, babies, snakes, etc.), versus those that are not. 11 individuals with mild AD and 21 OA participated. Emotionally positive and negative stimuli were classified as either biologically prepared (BIO) or not (NBIO) on the basis of consensus ratings. Self-report of emotional experience, corrugator and zygomatic facial EMG, and eye-blink startle reflex EMG were recorded. Both groups demonstrated the predicted linear relationships in emotional valence ratings and quadratic relationships in arousal experience ratings. Corrugator EMG activity increased while viewing negative images for both image groups, but tended to be stronger while viewing BIO images in both groups. Zygomatic EMG activity increased while viewing positive images, as expected, only for the OA group. Further analysis revealed a trend for the AD group to demonstrate the expected zygomatic pattern, but only for the BIO images. The expected pattern of startle reflexes was observed in the OA group while viewing the BIO images, but not while viewing NBIO images, and the AD group did not display the expected pattern regardless of valence or biologic preparedness. While preliminary, the present findings suggest a possible explanation for the variability in AD performance on emotion tasks, and provides a potential framework for future investigation of biologically relevant emotion stimulus processing in both AD and healthy aging.

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G.A. MOLLET & D.W. HARRISON. Affective Auditory Verbal Learning: Evidence for a Negative Emotional Bias in Hostility.

Neuropsychological investigations of hostility suggest that high hostiles have increased activation of the right hemisphere relative to low hostiles. This increased activation is hypothesized to produce differential behavioral and cognitive patterns for high and low hostile individuals. Data also indicate that the left and right hemispheres may be specialized for positive and negative emotion. In order to test and extend these ideas, the current experiment measured the effects of hostility and the influences of a cold pressor stressor on affective verbal learning. Participants were right-handed men classified as high or low hostile and randomly assigned to a cold pressor or a non-cold pressor group. The subsequent effects on acquisition of the Auditory Affective Verbal Learning Test (AAVLT; Snyder & Harrison, 1997) were measured. A significant three-way interaction ($F(8,352) = 2.47, p < .02$) indicated that high hostiles learned negative emotional words significantly better than they learned positive words. Additionally, high hostiles were impaired in their acquisition of verbal material relative to low hostile participants. A significant primacy effect for negative emotional words ($F(4,176) = 13.79, p < .0001$) and an overall better recall of negative information was also found ($F(2,88) = 5.90, p < .004$). The negative emotional bias and verbal learning deficits in high hostile participants support increased activation of the right hemisphere in hostility and the lateralization theory of emotional processing.

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A. JORDAN, D.E. EVERHART & H.A. DEMAREE. Luteal and Follicular Phase Related ERP Changes During the Perception of Affective Faces and Emotional Prosody.

The phases of the menstrual cycle may be associated with changes in the perception of emotional stimuli. Thus, emotion perception during the high and low estrogen phases of the menstrual cycle was examined

among ten college-aged women. Participants were tested two times on two tasks that were designed to elicit the P300. During the first task participants were required to keep count emotional utterances that depicted happy or fear, while the second task required participants to count faces that depicted happy or fear. Half of the participants were initially tested during the high estrogen phase; the remaining were tested during the low estrogen phase. ERPs to emotional stimuli were recorded from 10 scalp sites (F3, F4, T3, T4, T5, T6, C3, C4, P3, P4). ANOVA for auditory P300 data revealed a significant phase \times hemisphere interaction. Post hoc analyses revealed greater auditory ERP amplitude over right versus left hemisphere scalp sites during the high estrogen phase; symmetry was displayed during the low estrogen phase. Regarding visual ERP P300 data, phase \times affect \times site interaction was observed for latency. Post hoc analyses revealed earlier P300 latency for happy versus fear affective phases during the high estrogen phase only. Similar findings were observed for auditory and visual stimuli for the late negative component N3. These ERP differences suggest that changes in emotion perception occur within auditory and visual channels during the phases of the menstrual cycle. The differences may be partially attributable to the changes in levels of sex hormones.

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M. HARCIAREK, L. KINGERY & K. JODZIO. Emotional Perception Impairment after Right Hemisphere Stroke: Relationship and Dissociation between Auditory and Visual Modalities.

Although emotion perception impairments observed after right hemisphere damage have received much attention in the literature, little is known about the ability to recognize specific emotions by right hemisphere stroke (RHS) patients. The purpose of the present study was to examine both facial and prosodic emotion recognition for three primary emotions (happiness, sadness, and anger) in right hemisphere stroke (RHS) patients compared to healthy controls. The Facial Affect Recognition Test of Ekman and Friesen (1978) and the Emotional Prosody Test (Bryan, 1995) were administered to 30 RHS patients (mean age = 64 years) and 31 demographically matched healthy controls. For each modality, five recognition trials for each emotion were presented. Correlation analyses revealed a significant relationship between the facial and prosodic emotion recognition tasks ($r = .46$). Between-group comparisons revealed a significant group effect, with RHS patients demonstrating impairments in both modalities across all three emotions. However, two significant interactions emerged. Whereas recognition of prosodic happiness by the RHS group was severely impaired, they recognized happy faces at a near-normal level. In addition, RHS patients showed relatively worse recognition of sad faces vs. prosodic sadness. Anger recognition was impaired across both modalities in RHS patients. This study supports previous findings showing that right hemisphere brain damage impairs emotion recognition. However, modality differences were observed for different emotions. Relative to prosodic happiness and anger, prosodic sadness may be characterized by acoustical features that underlie this emotion recognition dissociation among patients with RHS.

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M. MCKINNON, A. FEINSTEIN, H. MAYBERG, S. KANAGASABAI, P. SENGDY, J. SKOCIC & B. LEVINE. Autobiographical memory for a life-threatening traumatic event and September 11th in survivors of an airline accident.

We examined autobiographical memory performance in a group of participants who experienced a shared traumatic event, the near ditching of a passenger aircraft at sea. This event occurred proximate in time to

the terrorist attacks of September 11th, 2001. We compared memory for a personally experienced traumatic event with memory for a highly negative public event (September 11th) and an everyday event. The participants were 6 of the airline passengers and 10 control participants. Memory was assessed using the Autobiographical Interview (Levine et al., 2002), a highly reliable tool capable of dissociating episodic and semantic recall, as well as different categories of event retrieval. Skin conductance response (SCR) was used to measure autonomic arousal. In contrast to previous investigations that revealed impoverished memory for traumatic events, passengers showed heightened recollection of the traumatic event relative to their memories of both September 11th and an everyday event. Memory for the events of September 11th, and, in particular, emotional recollection, was enhanced in these passengers relative to controls. SCR was highest during recollection of the traumatic event, followed by September 11th and, finally, everyday memory. Survivors of a life-threatening, traumatic event were able to recall many of details associated with this episode. Moreover, this heightened recall extended to another highly arousing, negative event that occurred around the same time period as the trauma itself.

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Hemispheric Asymmetry/Laterality/Callosal Studies

D. VOYER & L. BIGGAR. Target Localization with Fused Dichotic Words.

Previous research suggests that the Fused Dichotic Words Test (FDWT) produces reliable and valid laterality effects. However, it has been claimed that findings obtained with this task are contaminated by retrieval and attention deployment strategies due to the use of a free recall procedure. The present study attempted to assess the influence of these strategies with a target localization task using stimuli drawn from the FDWT. Twenty right-handed participants were presented with dichotic pairs of words. The words "beer", "deer", "pier", and "tear" pronounced by a male speaker and drawn from the FDWT were used as stimuli. Participants were required to identify the ear to which a target word was presented by circling "left", "right", or "neither" on a response sheet. Correct left and right responses (LL and RR outcomes, respectively) produced a large and reliable right ear advantage (REA). Right responses to left targets (LR outcomes) were more frequent than left responses to right targets (RL outcomes). A combination of LL+LR compared to RR+RL resulted in a smaller and less reliable REA than the LL and RR outcomes. Finally, cases where participants incorrectly responded left or right when the target was absent produced no systematic differences, reflecting no generalized response bias. The discussion emphasizes the usefulness of the localization approach in producing a score that minimizes the attentional component of laterality effects. The results support the notion that laterality effects obtained with fused stimuli are affected by attentional factors, contrary to the common claim in the literature.

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C. TECHENTIN & D. VOYER. Dichotic Listening with Consonant-Vowel Pairs: An Examination of the Categorization Hypothesis.

The present study examined the right ear advantage found in a dichotic listening task in terms of whether it is indicative of the lateralization of speech as proposed by the structural view, or the categorization of speech components by their voice onset times. Forty-one participants were pre-

sented dichotically with consonant vowel syllable pairs that were either matched or mismatched in terms of their voicing. Participants were instructed to indicate the presence or absence of a target syllable by pressing one of two designated computer keys. All possible pairings were used and each syllable was a target in separate blocks of trials. As predicted by both hypotheses, an overall REA was found. However, there was no finding of a main effect of voicing in that there was no difference in participants ability to discriminate CV syllables based on their VOT. As well, there was no voice by ear interaction found. Results do not support the categorization hypothesis that CV syllables are discriminated based on categorical perception of VOT's. Instead, they suggest that, when speech varies along more than one dimension, it is perceived as continuous. Findings are discussed in terms of their support for the hypothesis that the REA found in DL reflects lateralization of speech perception.

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V. DRAGO, G.P. CRUCIAN, F. PISANI & K.M. HEILMAN. Distribution of attention as a function of spatial location: right-left; up-down.

Attention influences estimates of magnitude. Thus, patients with neglect generally err to the right of the center. In patients with left sided neglect, performance on the line bisection task can be altered by placing the line in right versus left viewer centered hemispace. Healthy young people transect lines slightly to the left, a phenomenon known as pseudoneglect. In this study we want to learn if placement of lines also influences the performance in normal subjects. However because in humans there is a dorsal (where) and a ventral (what) functional dichotomy, we want to learn if vertical displacement also influences line bisection. 14 normal adult, right handed, right eye dominant subjects were instructed to perform horizontal line bisection using three different line lengths (50-160-240mm) in five different space position: up-left, down-left, center, up-right, down-right. Participants erred leftward in down-left condition ($X = -.01673$ $SD = .029202$) relative to down-right condition ($X = .02192$ $SD = .038406$; $p = .003$). No statistical significant differences were found between up-left ($X = -.00893$ $SD = .028604$) and up-right conditions ($X = .01094$ $SD = .040488$; $p = .138$). Our results are consistent with selective hemispatial activation of "where" system, with right hemisphere activation when performing a spatial location task in down-left hemispace, and left hemisphere activation when performing a spatial location task in down-right hemispace, but no asymmetries in the up (what) conditions.

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T.D. PARSONS, A.A. RIZZO, J. MCGEE & J.C. BURKWALTER Gender Differences using Neuropsychological Measures and a Crossed-Uncrossed Differences (CUD) Task in a Virtual Environment.

Neuropsychological assessment of gender differences and hemispheric differences is a widely studied, and controversial, topic. Some studies suggest that females have a greater degree of bilateral processing for spatial tasks, whereas males may have more specialized hemispheric lateralization. Virtual reality technology offers an environment that may aid attempts at elucidating the controversy. The current study utilizes a virtual environment and a neuropsychological battery to compare performance of 15 males and 15 females on a standard neuropsychological battery and a crossed-uncrossed differences task (CUD). The CUD was used to measure the differences in reaction time between responses that must be transferred across the corpus callosum versus responses that are not transferred. Our results indicated that the differences between males and females in reaction time between two crossed and two

uncrossed conditions were not significant. However, there was a trend toward significance on left visual field to right hemisphere favoring the males. Analysis of the correlations between neuropsychological assessments and crossed-uncrossed differences for reaction time revealed significant relations for JLO, Digits forward, Animals, Matrix Reasoning, and Arithmetic. However, after separating these correlations into male and female groups only females still revealed significance on: JLO, Digits forward and Back, Arithmetic, and Trails B. Males showed no significant relations. Current results do not suggest that male crossed-uncrossed differences are related to neuropsychological performance. However, female crossed-uncrossed differences do appear to be related to neuropsychological performance. As a result, females may rely more on bilateral processing of information.

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J. LEE & L. BUCHANAN. Investigation of Hemispheric Asymmetry in the Perception and Memorization of Verbal, Visual, and Tactile Stimuli.

We investigated the hemispheric lateralization of perceptual-cognitive processes in different sensory modalities. To our knowledge, this is the first direct contrast of lateralization of memory in auditory, visual, and tactile modalities. Participants included 30 right-handed undergraduate students from the University of Windsor. In the auditory domain, participants were dichotically presented with two different word lists simultaneously and asked to pay attention to and memorize only the list presented to one ear. Then, a recall, a short-delay recognition, and a long-delay recognition tests were given. The test was repeated with the other ear using new word lists. In the visual domain, participants made same/different judgments after seeing two figures rapidly presented either to their left or right visual field. Then, a recognition memory test was given after the task was completed. In the tactile domain, participants were instructed to feel and memorize textures that were presented to one hand only. Following the presentation, immediate and delayed recognition tests were given. The test was repeated using the other hand using a new set of stimuli. Better performance was observed with the words presented to the right ear and figural designs presented to the left visual field. No difference was found for the tactile stimuli. This suggests that the left hemisphere specializes in processing verbal information, the right hemisphere specializes in processing visual information, and both hemispheres contribute equally in processing pure tactile information. The use of different lateralization tasks in research and clinical practice are discussed.

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P.S. FOSTER & D.W. HARRISON. Baseline Cardiovascular Activity: Covariation with Electrophysiological Asymmetry.

Research has indicated that the magnitude of cerebral asymmetry is related to baseline cardiovascular activity, providing support for a division of responsibility between the two hemispheres in their regulation of cardiovascular functioning. The present investigation sought to investigate this relationship further by using a sample of women, as opposed to a sample of men as the previous investigation had used. Cerebral asymmetry was calculated by subtracting the alpha (8 to 13 Hz) magnitude of each right hemisphere electrode from the homologous left hemisphere electrode. Based on previous research indicating lateralization of the parasympathetic and sympathetic nervous systems to the left and right hemispheres, respectively, and that the frontal lobes are inhibitory and the temporal lobes excitatory, baseline cardiovascular functioning was hypothesized to be negatively correlated with cerebral asymmetry at the frontal lobe electrode sites and positively correlated with cerebral asymmetry at the posterior electrode sites.

Quantitative electroencephalography and cardiovascular activity were measured from 20 women while they sat quietly relaxing. Correlational analyses indicated that baseline heart rate was negatively correlated with alpha magnitude asymmetry at the F1-F2 ($r = -.421$), F3-F4 ($r = -.691$), and C3-C4 ($r = -.588$) electrode sites. Further, alpha magnitude asymmetry was positively correlated with baseline systolic blood pressure at the T3-T4 ($r = .471$) electrode site and with diastolic blood pressure at the T3-T4 ($r = .401$) and C3-C4 ($r = .469$) electrode sites. Thus, the results provide further support for the existence of a division of responsibility between the two cerebral hemispheres in the regulation of cardiovascular activity.

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P. MOES, M. MINNEMA & J. GRIFFEN. Gender Differences in ERP Measures of Interhemispheric Transfer Time.

Several studies have documented asymmetric interhemispheric transfer time (IHTT) as measured by event related potentials (ERP's). Many of these studies used letter pairs presented to each visual half-field and then measured the latency of ERP response in the hemisphere contralateral and ipsilateral to the stimulus field. The latency difference between the contralateral hemisphere and the ipsilateral hemisphere is presumed to be a reliable gauge of IHTT. Using this method, several studies have found significantly faster right-to-left than left-to-right transfer time, and at least one study found similar results for dot-pattern stimuli. Several studies have also documented a slightly larger posterior corpus callosum for females, and others have documented differing patterns of hemisphere asymmetry for males and females. Therefore, using the previous paradigm, the hypothesis was that females would show faster and more symmetrical transfer time than males. Twenty female and eighteen male right handed individuals made match decisions for briefly presented letter pairs while ERP measures were collected. Latency for the N1 component of the ERP wave, measured at parietal leads was the primary dependent measure; field of presentation and hemisphere were the independent variables. A Field X Hemisphere X Gender ANOVA confirmed both hypotheses, with females showing a significantly faster IHTT overall, and females showing greater symmetry of transfer. Specifically, males and females had similar right-to-left transfer time, but the left-to-right transfer time for males were much slower, while for females the left-to-right time was not significantly slower than the reverse direction. Implications for functional implications are discussed.

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C. ABEARE, L. HILL, V. ZUVERZA-CHAVARIA, E. GEENEN & R. WHITMAN. Time Course Differences in Semantic Priming in the Hemispheres and Level of Creativity.

Research in the area of visual half-field semantic priming is only recently beginning to examine the time course of semantic processing in the hemispheres. In general, the common finding in such studies is that the pattern of priming in the hemispheres differs depending upon the time given for processing, or the stimulus onset asynchrony (SOA). Thus, the determination of word meaning is beginning to be viewed as a process which unfolds over time. Research on individual differences in visual half-field semantic priming which has found a left visual field advantage for groups of creative individuals. However, little is known about individual differences in the time course of semantic processing. To address this issue, the current study was designed to investigate differences in the time course of semantic priming in the hemispheres for high and low creative groups. Participants consist of 85 neurologically intact, native English speaking Wayne State University undergraduates ranging from 18-40 years of age. Participants performed a lexical decision task

to high, low and unassociated prime-target pairs at four SOAs (35 ms, 50 ms, 200 ms, 400 ms). Participants also completed the Torrance Test of Creative Thinking (Verbal and Figural). A 2x2x2x2 mixed factorial ANOVA was computed on semantic priming indices. There was a significant association strength x visual field of prime x visual field of target x SOA (stimulus onset asynchrony) x creative group interaction. Results support the hypothesis that there are differences between the high creative and low creative groups in the time course of semantic priming in the cerebral hemispheres. Differences between the two groups may be indicative of different automatic semantic processing styles or biases, such that the high creative group had both high and low associate priming active and available for controlled processes in the right hemisphere whereas the low creative group did not.

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D. BADARUDDIN, G. ANDREWS, K.J. SCHILMOELLER, S. BOELTE, L.K. PAUL & W.S. BROWN. Social and Behavioral Deficits in Children with Agenesis of the Corpus Callosum.

Reports of the social behavior of individuals with partial or complete agenesis of the corpus callosum (ACC) and normal IQs are similar to high-functioning autism. Parent behavioral ratings were used to determine the social and behavioral characteristics of younger and older children with ACC, as compared to normal controls and individuals with autism. Children with ACC ($N = 61$, ages 2-11; presumed by parent report to have normal intelligence) were assessed using the Child Behavior Check List (CBCL) and a Survey of Behavioral Traits. Results were compared to the means and standard deviations of the test normative sample, and to children with autism ($N = 52$, $IQ > 70$, ages 6-11). Younger children with ACC (ages 2-5) were rated as more impaired in Attention ($p < .05$). Older children with ACC (ages 6-11) were more impaired than controls on all 8 symptom scales and both broad-band scales of the CBCL ($p < .01$), and more impaired than children with autism on 3 scales — Somatic Complaints ($p < .001$), Social Problems ($p < .05$), and Thought Problems ($p < .01$). Children with ACC were reported to have autistic-like symptoms for the DSM diagnostic domains of Social Interaction and Social Communication, but not for Repetitive and Restricted Behavior. Children with ACC show a wide range of behavioral difficulties that manifest most notably in later childhood. Many of these deficits are similar to those found in autism. Fourteen of 61 children with ACC would likely receive a diagnosis of autism.

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J.E. DEJONG, L.K. PAUL, M. SYMINGTON, A.A. TURK, S.R. GARRELS & W.S. BROWN. Sensory-motor Interhemispheric Transfer in Children with Callosal Agenesis.

Agenesis of the Corpus Callosum (ACC) impairs performance of adults on tasks requiring interhemispheric transfer (IT). Myelination of the corpus callosum is not complete until late adolescence, reducing efficiency of IT in normal children. Nevertheless, it was hypothesized that children with ACC would show less IT than controls, and that differences between groups would increase with task difficulty. Fifteen acausal children (ages 7-15, $IQ > 80$) were compared to 8 matched control children (ages 7-15, $IQ > 80$) on the Tactual Performance Test (TPT; 6-, 8-, or 10-block versions) and Finger Localization Task (FLT; 2-, 3-, and 4-finger trials). TPT: A three-way ANOVA analyzing difficulty (number of blocks), group, and hand (dominant versus non-dominant) resulted in a significant interaction between group and hand ($p < .05$), and trends toward significant main effects of hand ($p = .13$) and group ($p = .08$). Children with ACC showed significantly less improvement in dominant to non-dominant hand performance, particularly on the 10-block task ($p < .01$). FLT: A similar ANOVA yielded a significant inter-

action between hand (same versus opposite hand response) and difficulty (number of fingers), demonstrating decreased transfer with increasing difficulty ($p < .05$). An interaction of hand-by-difficulty-by-group ($p < .05$) resulted from significantly worse interhand transfer for participants with ACC on 3-finger trials ($p < .05$), but nonsignificant differences for 2- and 4-finger trials. Although callosal myelination is not complete until late adolescence, children with ACC nevertheless show relatively impaired IT, particularly for more complex spatial and tactile information.

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K.O. MUELLER, S.D. MARION, L.K. PAUL & W.S. BROWN. Bimanual Coordination in Individuals with Agenesis of the Corpus Callosum.

Previous studies indicated deficits in bimanual motor coordination among individuals with agenesis of the corpus callosum (ACC). This study tested individuals with ACC on the computerized Bimanual Coordination Test (cBCT) that allows for more precise measurement of response time and errors. cBCT performance (time and errors) was assessed in individuals with ACC ($N=11$, ages 7 to 55; IQ 78 to 122) and normal controls ($N=25$, ages 8 to 51, IQ 85 to 115). Performance was tested on unimanual (0o and 90o) and bimanual (22.5o, 45o, 67.5o, 112.5o, 145o, and 167.5o) target angles. Time: Groups did not differ in unimanual response speed. On bimanual trials, a group by angle-type (angles requiring symmetric vs. asymmetric hand responding) ANOVA resulted in a significant main effect of group; individuals with ACC responded more slowly across angles ($p < .01$). Groups did not differ on angles requiring mirrored hand movements (i.e. both hands moving in opposite directions), but the ACC group was slower ($p < .01$) on angles requiring parallel movements (hands moving in the same direction). The ACC group displayed equally slow performance on asymmetric angles that required relatively faster right- versus left-hand speed ($p < .05$). Errors: There were no significant group differences in cBCT errors. The results for speed are consistent with previous reports of difficulty in bimanual coordination in ACC. Differences were most salient when required to move hands in different directions relative to the midline of the body (parallel movements). Differences for response speed but not errors reflect choices regarding speed-accuracy trade-offs in favor of accuracy. Correspondence: *Warren S. Brown, Ph.D., Fuller Graduate School of Psychology, Travis Research Institute, 180 N. Oakland Ave, Pasadena, CA 91101. E-mail: wsbrown@fuller.edu*

D.B. EFROS, J.W. TSAO, Y. JEONG, T. MIZUNO, G.R. FINNEY & K.M. HEILMAN. Callosal Apraxia and Tactile Anomia with Normal Pressure Hydrocephalus.

Urinary incontinence, dementia and gait apraxia in an adult suggest a diagnosis of normal pressure hydrocephalus (NPH). Pathological changes associated with NPH also include bowing and thinning of the corpus callosum. Although the callosum is altered in NPH, the signs of hemispheric disconnection, including ideomotor limb apraxia and tactile anomia of the left forelimb, have not been previously reported. Thus, we describe a patient with NPH who demonstrated these signs of hemispheric disconnection. An 82-year-old right-handed woman with a 5-year history of memory decline, urinary incontinence and gait apraxia, symptoms consistent with a diagnosis of NPH, underwent neuropsychological assessment and brain imaging. The Mini-Mental Status Examination and Boston Naming Test were normal. Her performance on the Controlled Oral Word Association Test was poor but semantic fluency was normal. On the Hopkins Test of Verbal Learning-Revised, she had abnormal learning, very poor delayed recall, but normal recognition. When blindfolded she had more difficulty recognizing objects in her left than right hand and when asked to perform transitive move-

ments she made more apraxic errors with her left than right hand. Her brain MRI showed severe bilateral ventricular dilation with extreme bowing and thinning of the corpus callosum. The presence of asymmetric (left-sided) ideomotor apraxia and impaired tactile naming is consistent with functional callosal disconnection induced by the bowing and stretching of the corpus callosum. Supported by the Memory Disorder Clinics, State of Florida and the Research Service of the Veterans Affairs Medical Center, Gainesville, FL.

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S.H. OFTE, M. SKOGLUND & S. CHRISTIE. Laterality in Male Monozygotic Twins with Language Impairments. Case Descriptions.

The objective of this study was to assess the twins, exemplify and discuss issues on language functions and lateralization according to theories on brain lateralization and language. The twins, who are now ten years old, did not walk or talk until two and a half years old. Genetic tests were performed. The twins were assessed with the Halstead-Reitan battery, Raven, WISC-R, ITPA, Aston Index, and the movement ABC Test, and a dichotic listening procedure (DLCV-108). The twins are monozygotic. One of the twins is right-handed, and the other is left-handed. Both twins had WISC-R results that were below the normal range, and both had significant difference between the results on the verbal and performance tests ($p < .01$), and a normal spread on the verbal scores, but a significant spread on the performance scores. The right-handed twin stutters increasingly. On the DLCV-108, the right-handed twin showed a right ear advantage, while the left-handed twin showed a left ear advantage. Both twins have language impairments, however, the impairments of the right-handed twin seems to be more specific compared to the left-handed. He also has expressive language impairments. The left-handed twin has more cognitive impairments totally. The right-handed twin seems to have the language lateralized to the left hemisphere, and the left-handed twin seems to have language lateralized to the right hemisphere.

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T. MIZUNO, G.R. FINNEY, G.P. CRUCIAN, Y. JEONG, V. DRAGO, B.V. SHENAL, R.D. RHODES & K.M. HEILMAN. Limb Impersistence in Right Hemisphere Injured Patients Using the Blind Line-Drawing Task.

Motor impersistence is the loss of the ability to maintain an action or sustain a series of actions. Previous studies have suggested that a right hemisphere stroke (RCVA) impairs the ability to sustain midline postures. The purpose of this study is to learn if right hemisphere injury also induces progressive hypometria (PH), a progressive inability to sustain each movement in a series of limb actions. Subjects were 8 patients with RCVA, who did not show impersistence of midline structures, and 4 matched controls. All subjects, while blindfolded, underwent 20 trials of a line-drawing test in which they were instructed to draw ten horizontal lines, connected with short vertical lines, without interruption or by taking the pen off the paper. Before the subjects were blindfolded and tested, they were shown a line segment of 278mm and were asked to make the horizontal segments this same size. For vertical segments, no size instructions were given. Four of 8 patients with RCVA exhibited a significant PH. No control subject exhibited PH. All patients who showed PH had lesions that involved the basal ganglia. PH, defined here as the gradual decrease in the length of horizontal limb movements that are intended to be the same magnitude, was observed in right hemisphere injured subjects. A possible association of this form of limb-impersistence with injury to the right hemisphere basal ganglia is suggested.

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C.L. DIRKSEN, B.L. ROPER & M.D. JACEWICZ. Widespread Right Medial Cerebral Involvement Associated with Persistent Alien Hand Syndrome: Case Report.

A case of enduring alien hand syndrome (AHS) is reported, including results of neuropsychological evaluation. We present a 76-year-old man who developed left homonymous hemianopia and persistent alien hand syndrome after strokes involving the right ACA and PCA distributions. MRI revealed a 10 cm infarct involving the medial frontal and parietal lobes including cingulate gyrus and the genu, body, and splenium of the corpus callosum. Intermanual conflict and utilization behavior were the primary manifestations of his AHS; the patient's left hand often grabbed body parts, clothing, bedcovers, and bedrails. While dressing, his left hand interfered with his right and unbuttoned buttons. On one occasion, the patient's hand grasped his bedrails and pulled him out of bed onto the floor. In an effort to control his alien hand, the patient frequently restrained and hit it. The patient also demonstrated moderate hemi-neglect for left extrapersonal space. Results of neuropsychological evaluation are described, including impairments in visuospatial processing, memory, and executive function. Feinberg, et al., (1992) have proposed frontal and callosal subtypes of AHS, and this patient's AHS includes features of both subtypes. Whereas alien hand syndrome often resolves within a several months or sooner, this patient's syndrome has persisted at least nine months. The persistence of his AHS may be associated with the presence of both callosal and broad medial frontal lobe pathology.

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A. YAMAMOTO, K. SHAIKH, W. BOLING, S. BLOOMFIELD & M. PARSONS. Lateralized FMRI Activation of the Supplementary Motor Area During Productive Language Tasks: Comparison with Wada and Intraoperative Mapping.

Although the supplementary motor area (SMA) is not considered a primary language structure, resection of the dominant SMA produces language deficits. Krainik and colleagues (2003) examined SMA functional MRI (fMRI) lateralization indices (LI) during productive language tasks and assessed language deficits following resection of the SMA in six medial frontal lobe glioma patients. The current study is the first to compare SMA LI obtained with fMRI to standard techniques used to determine language lateralization, namely Wada testing and intraoperative mapping. Using an fMRI verbal fluency task, SMA LI were obtained for seven patients prior to surgery for epilepsy or tumor. Findings were compared to results of patients' Wada evaluations and/or intraoperative mapping of language functions. fMRI Data from one subject was unreliable due to excessive movement artifact. Of the remaining six patients, three demonstrated left hemisphere LI and two demonstrated right hemisphere LI, consistent with their Wada and intraoperative mapping findings. One patient demonstrated bilateral SMA fMRI activation but had left hemisphere language dominance on Wada and intraoperative mapping. The study validated SMA LI obtained by fMRI against traditional measures of language lateralization in a small sample. The relationship between SMA fMRI activation and other measures is complex, reflecting the complex role of the SMA in language production. fMRI LI's provide a noninvasive means of determining language lateralization in patients at risk for language disturbance following brain surgery. This information has clinical usefulness in predicting surgical risk and improves our understanding the role of the SMA in language.

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T. HELLAND & A. HUSHOVD. Degree of Hemispheric Dominance Varies with Degree of Severity of Dyslexia.

The literature on hemispheric dominance in dyslexia is inconclusive. The aim of the present study was to assess hemispheric dominance in different groups of dyslexia, defined by their severity. The Norwegian school system allows for two levels of professional assessment of this impairment. Initially, the subjects are referred to the local school logoped. If needed, the logoped will refer further to a second, more specialised level of assessment. A dichotic listening (DL) task with CV-syllables were administered to two groups of 12 year old dyslexics with 20 subjects in each group, and 20 Controls matched by age and sex, all within normal range of intelligence. The first group (Dys 1) was assessed by the school logoped only; the second group (Dys 2) was assessed at the specialised level also. DL task demands were free recall, then attention to the right ear, respectively to the left, in random order. It was hypothesised that both dyslexia groups would exhibit reduced responses to stimuli given to the right ear compared to Controls, but that Dys 2 would perform significantly lower than Dys 1. 2-way ANOVA (Group, 3 x task DL, 3 conditions) showed no difference between the scores of Controls and Dys 1. However, Dys 2 showed a significantly lower right ear score ($p < .05$) compared to both Controls and Dys 1. The results are discussed in light of the differences seen in the literature on hemispheric dominance in dyslexia, suggesting that these differences may be explained by differences in subject selection and dyslexia severity.

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P.A. TAYLOR-COOKE, R. RICCI, J.H. BANOS, X. ZHOU & M.S. MENNEMEIER. Estimates for Contralateral Strength and Stimulus Intensity are Correlated Following Unilateral Brain Injury of Both Hemispheres.

This pilot study aimed to learn whether the ability to estimate physical strength is governed by similar brain mechanisms as that for estimating stimulus intensity (magnitude estimation). Patients with right hemisphere lesions (RHL) are often unaware of contralateral limb weakness and demonstrate altered power functions in magnitude estimation studies (i.e., overestimating lesser and underestimating greater stimuli in a range of sensory magnitudes). In contrast, patients with left hemisphere lesions (LHL) may not be similarly affected, suggesting the left hemisphere plays a limited role in magnitude estimation. The relationship between estimates of both limb strength and stimulus intensity (line length) was examined in patients with RHL and LHL. Inpatients, 13 with RHL and 6 with LHL, were tested upon intake at a rehabilitation center following stroke. Strength estimation accuracy (SEA; patient's self rating - physician rating) was correlated with the exponents and constants of power functions calculated for estimates of line length. The two groups demonstrated opposite patterns on the strength estimation tests. The RHL group overestimated contralateral strength in the upper limb ($M = 1.15$, $SD = 2.59$), whereas the LHL group underestimated contralateral strength in the lower limb ($M = -0.42$, $SD = 1.43$). The power function exponent for length estimation was negatively correlated with contralateral SEA for both groups (RHL $r_s = -.74$, $p < .01$; LHL $r_s = -.81$, $p = .05$) but not ipsilateral SEA. The data show a relationship between strength estimation and estimation of stimulus intensity, providing evidence for a common "estimation system." In general, patients who were less able to estimate stimulus intensity were less accurate estimating contralateral strength. Furthermore, the two hemispheres may make different contributions to strength and magnitude estimation because two groups made errors in the opposite directions when estimating their physical strength.

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Multiple Sclerosis/ALS

J.H. KALMAR, E.A. GAUDINO, N.B. MOORE, J. HALPER & J. DELUCA. Cognitive Deficits and Functional Status in Multiple Sclerosis.

A substantial body of literature indicates that cognitive dysfunction and impairments in everyday life activities are common in Multiple Sclerosis (MS). However, the relationship between these cognitive difficulties and functional impairments has not been thoroughly investigated. The purpose of the present study was to examine the role of cognitive dysfunction in the functional status of individuals with MS. A between subjects design was used to examine differences in functional status between the groups of interest: individuals with MS with and without cognitive impairment and healthy controls (HC). Additionally, a correlational design was used to investigate the relationship between cognitive performance and functional status in individuals with MS. Participants were 74 adults with clinically definite MS and 35 HCs who underwent neuropsychological testing and completed the Executive Functions Performance Test (EFPT), an objective measure of everyday life activities. One-way analysis of variance revealed significant differences between individuals with MS with and without cognitive impairment and HCs on the EFPT. Pearson product moment correlations indicated that in individuals with MS performance on some cognitive constructs was related to performance on the EFPT. Furthermore, linear regression analysis indicated that a model comprised of indices of cognitive functioning in several areas explained a significant portion of the variance in everyday life activities. Findings suggest that individuals with and without cognitive impairment differ in functional status and that aspects of cognition are predictive of functional status in MS. EFPT tasks that were more cognitively complex had the strongest relationship to cognitive constructs, relative to tasks that incorporated minimal cognitive demands. Correspondence: *Jessica H. Kalmar, Ph.D., Psychiatry, Yale University School of Medicine, 85 Stevenson Road, New Haven, CT 06515. E-mail: jhkalmar@kmrrec.org*

B. PARMENTER, J. SHUCARD, R. CHO, D. MCCABE, R. BENEDICT & D. SHUCARD. Working memory deficits in Multiple Sclerosis: a comparison between PASAT and n-back measures.

Deficits in working memory (WM) are common in multiple sclerosis (MS). The Paced Auditory Serial Addition Test (PASAT) is frequently used to measure WM in clinical settings, whereas the n-back paradigm is often used in experimental studies. Unlike the PASAT, the n-back includes a measure of reaction time (RT), providing an additional behavioral index of task difficulty. Despite the use of both tasks to measure WM, their common variance has not been documented. In the current study, 15 MS patients were tested (mean age 44 years; 5 males, 10 females; 13 relapsing-remitting, 2 secondary progressive) using both the PASAT and n-back tasks. Scores derived from the PASAT were total correct, number of chunking responses (items intermittently skipped in order to pair the numbers into manageable units), and number of dyads (correct consecutive responses). Scores derived from the n-back were the same as for the PASAT with the addition of RT. Data from MS patients were compared with healthy controls. RTs on the n-back significantly increased with load from 0- to 2-back for both patients and controls ($p = .001$), indicating greater task difficulty with increased load. Further, MS patients had slower RTs than controls ($p = .03$), irrespective of load. In addition, there was a pattern of significant correlations between PASAT (2.0 and 3.0 rates), and 1- and 2-back measures indicating a high correspondence between performance on these two tasks. These data are the first to show that the PASAT and n-back tap similar WM processes.

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D.A. CARONE, F.E. MUNSCHAUER, I. FISHMAN, B. WEINSTOCK-GUTTMAN & R. BENEDICT. Interpreting Patient/Informant Discrepancies on Reported Cognitive Symptoms in Multiple Sclerosis: Correlation with Cognitive and Emotional Disorder.

Although it is known that impaired awareness of neuropsychological (NP) deficits is a consequence of many neurological conditions, few researchers have explored this topic in multiple sclerosis (MS). A greater understanding of this phenomenon in MS is necessary since impaired awareness is known to complicate treatment and rehabilitation efforts. We endeavored to create a measure that could identify MS patients with impaired awareness, and investigate its cognitive and emotional correlates. We compared patient self-report and informant-observed ratings of NP functioning in 111 MS patients and 37 normal controls using the Multiple Sclerosis Neuropsychological Questionnaire (MSNQ). Discrepancy scores were calculated by subtracting patient from informant report scores. Participants also underwent NP testing (Minimal Assessment of Cognitive Function in MS battery), and assessment of depression (Beck Depression Inventory), personality (NEO Personality Inventory), and neuropsychiatric symptoms (Neuropsychiatric Inventory). Based on normative data, 41 patients had abnormally low or high (± 1.5 SD) informant-patient discrepancy scores. ANOVAs showed that the high discrepancy group had more cognitive impairment, less depression, and significantly more euphoria and disinhibition than their low-discrepancy counterparts. Regression analysis showed that within the entire MS sample, MSNQ discrepancy scores were associated with similar discrepancies in NEO conscientiousness, NPI euphoria, and lower BDI scores. MS patients with impaired awareness of NP deficits are significantly more cognitively impaired, euphoric, disinhibited, and less depressed than patients who perceive more impairment than do their caregivers. Results support the validity of MSNQ discrepancy scores as a measure of impaired awareness in MS.

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K. RYAN, L. RAPPORT, T. ERGH, R. HANKS & R. WHITMAN. Predictors of psychological distress among individuals with multiple sclerosis.

The present study examined disease-specific predictors of psychological distress among individuals with multiple sclerosis (MS), and the extent to which neuropsychological functioning, unawareness of deficit, and perceived social support influence distress. Seventy-four pairs of MS patients who were not experiencing an acute exacerbation of the illness and their significant others participated. Distress was assessed by the Brief Symptom Inventory. Objective disease-related indices were obtained from patient medical records and cognitive functioning was assessed using a neuropsychological test battery. Unawareness of deficit was measured as the discrepancy between patient self-report of their functional abilities and significant other report of the patient's abilities. Results indicated that a substantial proportion of patients experienced clinically-elevated distress, whereas disease severity and neuropsychological impairment were not directly related to distress. In the context of a combined predictive model, unawareness of deficit and social support showed powerful and beneficial effects, providing unique information in predicting distress, beyond that accounted for by disease characteristics. The findings suggest that patients who are more aware of their functional deficits appeared more distressed by them. Although unawareness of deficits in persons with MS is associated with better psychological for the patients, prior research indicates that it is particularly distressing for their significant others. This paradoxical finding raises an important dilemma regarding the goal of psychological interventions for persons with MS and their family members.

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D.A. CARONE, R. ZIVADINOV, B. WEINSTOCK-GUTTMAN, J. GAINES, C. MAGGIORE, J. SHARMA, M. TOMASSI, R. BAKSHI & R. BENEDICT. Learning Inconsistency is Associated with Frontal Lobe Atrophy in Multiple Sclerosis (MS).

In recent MS studies, measures of whole brain atrophy were strongly correlated with neuropsychological (NP) testing, explaining more variance than lesion burden. Memory is often impaired in MS, commonly due to poor learning consistency. This study evaluated which structural magnetic resonance imaging (MRI) parameters were best associated with learning consistency in MS. We evaluated 31 MS patients with brain MRI and NP testing. Thirty-four controls had NP testing and 16 had brain MRI. Learning consistency was evaluated over recall trials of the California Verbal Learning Test - II (CVLT-II) and Brief Visuospatial Memory Test - Revised (BVMT-R). MRI measures included lesion volume, general atrophy (brain parenchymal fraction), central atrophy (lateral ventricle volume), and lobar atrophy (parenchymal fraction for each lobe in each hemisphere). Associations between learning consistency and MRI were investigated using linear regression models controlling for age and depression (Beck Depression Inventory). MS patients were impaired on learning consistency indices from the CVLT-II and BVMT-R. Regression models predicting learning consistency retained left frontal parenchymal fraction for CVLT-II ($R^2 = .20$, $p = .03$) and left frontal and temporal parenchymal fraction for BVMT-R ($R^2 = .55$, $p < .0001$). Regional atrophy accounts for more variance than lesion burden, whole brain atrophy, or central atrophy in predicting deficient consistency during new learning in MS. Previous studies have associated frontal lobe function with semantic clustering, and such organizational schemes are associated with better learning consistency. That visual learning was associated with left frontal and temporal volume suggests that such encoding consistency partly depends on verbal mediation.

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J.H. KALMAR, N.D. CHIARAVALLOTTI, J. LENGENFELDER, N.B. MOORE & J. DELUCA. Information Processing Deficits Impact New Learning in Multiple Sclerosis.

Considerable data indicate that impaired processing speed (PS) is the major contributor to information processing dysfunction in individuals with Multiple Sclerosis (MS), with a secondary contribution of working memory (WM). Additionally, we have demonstrated that the episodic memory disturbance in MS is due primarily to difficulty acquiring information. The purpose of the present study was to examine the relative contributions of PS and WM to the acquisition of new information in individuals with MS. Participants were 60 adults with clinically definite MS who underwent neuropsychological testing. WM was assessed using the Letter Number Sequencing (LNS) subtest of the WAIS-III and the Digits Backward portion of the Digit Span subtest of the WAIS-R. The Symbol Digit Modalities Test (SDMT) and the Pattern and Letter Comparison Tests designed by Salthouse, Babcock, and Shaw (1991) were used to measure PS. New learning was measured via the Open-Trial versions of the Selective Reminding Test (SRT) and 7/24. Hierarchical linear regression analyses indicated that both PS and WM account for a significant portion of the variance in new learning in the verbal domain. With regard to the acquisition of visual information, PS contributes significantly to the model, while the contribution of WM is not statistically significant. Findings suggest that impaired PS and WM impact upon the learning of new verbal information in MS, while learning in the visual domain is primarily driven by PS. Interventions should target PS and WM in order to improve the acquisition of information and subsequent recall in individuals with MS.

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G.J. CHELUNE & L. STONE. Relative Risk of Cognitive Impairment Is Mediated by Disease Course and Sex in Multiple Sclerosis.

While the prevalence of cognitive dysfunction in multiple sclerosis (MS) is 45-65 percent, it varies depending on disease course. Recent studies also suggest that this difference may be sex-linked. We examined the estimated relative risk (OR: odds ratio) of neurocognitive impairment on six cognitive dimensions defined by the joint factor structure of the Wechsler-III Intelligence and Memory Scales. Participants were 391 patients with clinically definite MS: 303 relapsing remitting MS (RRMS) and 89 secondary progressive MS (SPMS). The female:male ratio was 2.76:1, and there was no difference in the sex distribution between disease courses. The groups were also comparable on age of onset and disease duration. Using the new Wechsler demographic norms corrected for age, education, gender, and ethnicity, impairment was defined as T-scores falling below the 5th percentile of the normal population. As expected, patients with SPMS versus RRMS were at significantly greater risk of impairment on all measures, with ORs ranging from 2.7 for Verbal Comprehension to 8.3 for Processing Speed. Men and women were equally at risk for impairment, except for Auditory Memory where men were nearly twice as likely to be impaired as women ($OR=1.76$). However, sex interacted with disease course. Men and women with RRMS were equally at risk for impairment, whereas men were specifically at greater risk ($OR=5.2$) for Auditory Memory deficits if they had SPMS. Even after correcting for expected sex-linked differences, men appear to have a selective vulnerability for auditory verbal memory deficits with disease progression in MS.

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C. CHRISTODOULOU, L.B. KRUPP, P. MELVILLE, W.F. SCHERL, T. MORGAN, W.S. MACALLISTER, Z. LIANG, W. HUANG, L. LI, L.A. TUDORICA, R. PEYSTER, C. ROQUE, P. ROCHE, D.M. CANFORA, S.A. BERRY & M. KEHN. Predicting Neuropsychological Change with Baseline MRI Measures in Multiple Sclerosis Patients with Initial Cognitive Dysfunction.

To examine the degree to which magnetic resonance imaging (MRI) measures predict change in neuropsychological performance in multiple sclerosis (MS) patients with initial cognitive dysfunction. Participants were 32 individuals with definite MS, with a mean age of 44.8 years ($SD = 8.3$) and 14.9 ($SD = 2.5$) years of education. Most were women (75.0%). Their disease course was relapsing remitting (56.3%), secondary progressive (40.6%), and primary progressive (3.1%). Subjects were tested as part of a 24 week randomized clinical trial to enhance cognition with an acetylcholinesterase inhibitor. There were no baseline differences between the placebo and active medication treatment groups. Inclusion criteria included at least mild cognitive impairment on the Rey Auditory Verbal Learning Test. A modified Brief Repeatable Battery formed the core of the neuropsychological protocol, which was administered at baseline and 24 weeks. Baseline neuroimaging measures included central (ventricular) cerebral atrophy and lesion volume. Partial correlations examined the relation between baseline MRI measures and changes in neuropsychological performance over 24 weeks, controlling for drug group. At baseline most correlations were significant between each of the MRI measures and the various neuropsychological measures. However, only baseline lesion volume significantly predicted change in overall neuropsychological performance over the 24 week period ($pr = -.39$, $p = .029$), especially among those with relapsing remitting disease ($pr = -.82$, $p < .001$). Larger lesion volume at baseline predicted relatively poorer cognitive prognosis over six months in MS patients with initial cognitive dysfunction.

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M.M. SMITH & P.A. ARNETT. Other vs. Self-Ratings of Executive Dysfunction in MS Patients and Healthy Controls .

Executive dysfunction has been widely reported in the multiple sclerosis (MS) literature. The Dysexecutive Questionnaire (DEX) is a 20-item measure of executive dysfunction available as self-report or other-report. In the present study we examined the accuracy of DEX self-ratings versus other-ratings in MS versus control participants. 101 MS patients, 27 controls, and their significant others completed the DEX. Participants were administered the Controlled Oral Word Association Test, Animal Naming, 10/36 Spatial Recall, the Visual Elevator Task, the Symbol Digit Modalities Test-Oral Form, a verbal selective reminding task, and an affective reading span task. ANOVA revealed significantly greater executive dysfunction reported by MS patients versus controls on DEX self-ratings ($F=4.57$, $p<.05$), but not on other-ratings. T-tests revealed that within the MS group, DEX self-ratings were significantly higher than other-ratings ($p<.05$). Within the controls, no significant differences between self and other-ratings were found. Additionally, other-rated DEX scores for the MS group did not significantly correlate with cognitive performance ($r=-.16$, $p>.05$), while self-rated DEX scores did ($r=-.40$, $p<.001$). The greater self vs. other-ratings observed in our MS sample are similar to previous reports on control samples and contrast with prior reports on *clinical* (e.g., traumatic brain injury) samples. Considering that MS self-rated DEX scores were correlated with cognitive performance and MS other-rated DEX scores were not, these data suggest that the significant others of individuals with MS may not be aware of the full extent of their loved ones' executive dysfunction.

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L.J. JULIAN, M.A. METCALF, R. HENRY, D. PELLETIER & D.C. MOHR. Diffusion Tensor Imaging correlates of executive functioning in early stages of multiple sclerosis.

To investigate Diffusion Tensor Imaging (DTI) markers of microstructural changes in normal appearing white matter (NAWM) as predictors of executive functioning among patients in the earliest stages of MS. Participants included 21 patients enrolled in a larger, prospective study of cognitive functioning and DTI in early stages of MS. These participants consisted of 17 patients with Clinically Isolated Syndrome (CIS), (i.e., patients with the first clinical and neuroradiological signs and symptoms characteristic of MS), and 4 recently converted patients with a new diagnosis of MS. Neurocognitive measures of executive functioning included Fluency, Digit Span, Delis-Kaplan Executive Function System (D-KEFS) Card Sorting Test, and D-KEFS Color-Word Test. Using stepwise hierarchical regression analyses, whole brain DTI markers of fractional anisotropy (FA) predicted 23% ($p<.05$) of the variance in the D-KEFS Color-Word Inhibition Contrast Index, and 38.4% ($p<.01$) of the variance in the Switching/Inhibition Contrast Index, after accounting for the effects of age, education, gender, and estimated IQ (NAART). FA was not a significant predictor of performance on other executive tasks. There were differences among the CIS vs. converted patients on DTI markers or executive indices. DTI markers are associated with performance on executive functioning tasks. These results suggest that cognitive changes are present even at the earliest stages of MS, and are associated with microstructural changes in NAWM.

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J. BURHART, R. GAVETT, R. BAKSHI, J. SHUCARD, R. ZIVADINOV, J. BRAUN, B. WEINSTOCK-GUTTMAN & R.H. BENEDICT. Comparison of Alternative and Traditional Scoring Methods for the Paced Auditory Serial Addition Test (PASAT) in MS.

The PASAT is a frequently used test of processing speed recommended by a recently convened international panel for MS. It has been suggested

that many MS patients adopt a chunking strategy during PASAT performance that lessens the test's sensitivity. An alternative score, consecutive dyad responses, is a proposed measure that may enhance the sensitivity of the PASAT in MS. Our objective was to examine the validity of this measure in comparison to traditional scoring methods, using a larger and more representative sample than in prior research. The Rao version of the PASAT was administered to 191 MS patients and 67 age- and education-matched controls. Various scores were calculated and compared between groups (MS/control; RR/SP course). We then examined correlations between the PASAT and measures of cognition (Symbol Digit Modalities Test; SDMT), depression (Center for Epidemiologic Studies of Depression Scale; CESD-10), and T1 and FLAIR MRI lesion burden. PASAT scores distinguished patients from controls and sensitivity was similar for total # correct and consecutive dyads. There were no significant correlations between PASAT and CESD-10. SDMT correlations were of similar magnitude for total correct and dyad score ($r=.65$, $.67$, respectively), as was the case with lesion burden (T1 $r=-.49$, $-.51$; FLAIR $r=-.41$, $-.41$). Both scoring methods distinguished RR and SP patients. While MS patients generate a higher proportion of chunking vs dyad responses on the PASAT, we find that such alternative scoring methods do not enhance the validity of the test.

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P. ARNETT & J. RANDOLPH. Fatigue in MS is Very Stable Longitudinally Over a Three-Year Interval.

Fatigue is often reported by multiple sclerosis (MS) patients to be their most debilitating disease symptom. However, the longitudinal course of fatigue in these patients is not well understood. Better understanding of the stability of fatigue in MS will provide greater insight into the long-term magnitude of its impact on patients and the need for treatment of this disabling symptom. In the current study, we examined the stability of fatigue in a sample of MS patients over a three-year interval. 53 definite MS patients were administered the Fatigue Severity Scale (FSS) and the Fatigue Impact Scale (FIS) at two time points three years apart. The correlation for the FSS total score between time points was $.70$ ($p<.001$) and $.79$ ($p<.001$) for the FIS total score. The FIS at time 1 also correlated with the FSS at time 2 at $.63$ ($p<.001$) and the FSS at time 1 correlated with the FIS at time 2 at $.63$. ($p<.001$). Examination of the FIS subscales revealed similarly large correlations. The FIS-Cognitive, FIS-Social, and FIS-Physical subscales had correlations between time points of $.81$, $.75$, and $.71$ (all $p's<.001$), respectively. Our data suggest that self-reported fatigue in MS is remarkably stable over time. Regardless of the measure used or the type of fatigue (i.e., cognitive, physical, or social) measured, our MS participants displayed great consistency in their report of fatigue across a significant time interval. Based upon prior reports of fatigue often being reported as MS patients' most debilitating symptom, the great stability of fatigue over time suggested by our data indicates that fatigue may be even more disabling in these patients than has previously been appreciated. Such data further underscore the need for developing effective treatments for MS fatigue.

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C.M. BAILEY & P.A. ARNETT. Response Speed on the Computerized Assessment of Response Bias and Its Relationship to Motivation in Multiple Sclerosis .

Research has suggested that response speed on the Computerized Assessment of Response Bias (CARB) is related to motivation. Given the possible impact on neuropsychological testing, a measure that is sensitive to decreased motivation can provide greater precision to the interpretation of neuropsychological tests. The current study evaluated the

relationship of CARB response speed to self-reported measures of motivation and other possibly related constructs in a sample of multiple sclerosis (MS) patients. 95 definite MS patients were administered the CARB, Symbol Copy (SC), the Fatigue Severity Scales (FSS), and Fatigue Impact Scale (FIS). A hierarchical regression predicting the CARB average correct response time was conducted by entering age and education, SC, the FSS with the motivation item removed, and then a summary index consisting of the self-reported motivation items on the FIS (#14-I'm less motivated to do anything requiring physical effort; #15-I'm less motivated to engage in social activities; #21-I'm less motivated to think). The demographic variables did not account for significant CARB variance ($\Delta r^2 < .01, p > .10$). However, controlling for both rudimentary motor response speed and visual scanning, the SC at step 2 accounted for significant unique variance ($\Delta r^2 = .13, p < .01$). The FSS at step 3 did not account for significant unique variance ($\Delta r^2 < .01, p > .10$), but the FIS motivation item index at step 4 resulted in a significant increment in CARB variance accounted for ($\Delta r^2 = .05, p < .05$). These results support research on traumatic brain-injured populations and suggest that CARB response speed might be a reflection of subject motivation in MS patients.

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C.J. BOYS, K.J. BJORAKER, S. PONGONIS, L. CHARNAS, D. LOES, C. PETERS, W. KRIVIT & E. SHAPIRO. Markers of Disease Progression in Late-Onset Metachromatic Leukodystrophy.

MLD is a rare, autosomal recessive, lysosomal, neurodegenerative disease caused by the deficiency of the enzyme arylsulfatase-A (locus chromosome 22q13.31). The accumulation of sulfatide leads to progressive demyelination, dementia, and death. The purpose of this study was to identify disease stage markers (historical, neuropsychological, and neuroradiological) in order to better characterize the natural history of the disease to enable early identification and correlated these with MRI findings. 31 subjects (18 females) >10 years old were evaluated between 1989 and 2004 for consideration of hematopoietic cell transplant. History: Age of initial symptom onset, initial psychiatric diagnosis, diagnosis prior to MLD diagnosis, years from symptom onset to psychiatric diagnosis, and years from symptom onset to MLD diagnosis. Neuropsychological: Cognition, attention, verbal memory, visual spatial, language, executive functions. MRI Baseline: MRI severity score (Loes Score) with a range of 0 to 26. Significant deficits were found in adaptive behavior, verbal memory, and verbal fluency. Relationship between MRI severity score and neuropsychological variables were significant in memory, spatial perception, attention, reaction time, and math skills. Historical data indicate progression of behavioral abnormalities from attention deficits to severe psychopathology. The long period from initial clinical presentation to MLD diagnosis results in decreased benefit from treatment. Therefore, identifying evidence of a pattern of onset of attention and psychiatric symptoms in previously healthy individuals together with deficits in memory, attention, and spatial perception signals the need for a thorough medical investigation.

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M. BRADSHAW, P. MASSMAN & D. MOSNIK. Differential Verbal Fluency Deficits in Alzheimer's Disease and Amyotrophic Lateral Sclerosis.

Verbal fluency tasks are regularly used to assess language and executive functioning in neurological patients with either Alzheimer's Disease (AD) or Amyotrophic Lateral Sclerosis (ALS). Different verbal fluency tasks impose both shared and unique cognitive demands and

performance reflects the integrity of the cognitive processes tapped and their neural substrate. It is therefore hypothesized that AD patients will display greater relative impairment on verbal fluency tasks placing higher demands on semantic network functioning, as compared to verbal fluency tasks placing higher demands on executive functioning, while ALS patients will display the opposite pattern. MANOVA and follow up analyses were employed to examine the performance of AD patients ($n = 38$), ALS patients ($n = 55$) and controls ($n = 26$) across verbal fluency tests with either greater executive demands (FAS & Alternate Uses/Creative Fluency) or greater semantic demands (Animals, Produce, Tools & Breeds of Dog). AD patients were significantly worse than controls for both semantic and executive tasks, while ALS patients were significantly worse than controls only for FAS. AD patients were significantly worse than ALS patients on semantic fluency tasks and Alternate Uses. ALS patients were not significantly different than AD patients on FAS and displayed a pattern indicative of greater relative difficulty on FAS. These results indicate that verbal fluency deficits in AD and ALS reflect the unshared task demands in a manner consistent with their characteristic neuropathological and cognitive profiles. The clinical utility of different verbal fluency tasks varies as a function of these unshared demands.

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A. GROSSMAN, B. LEVIN & W.C. BRADLEY. Premorbid Personality Characteristics in Patients with Amyotrophic Lateral Sclerosis: Preliminary Findings.

ALS patients have gained a reputation for demonstrating unusual resilience in the face of the lethal and debilitating illness. Results of an earlier study suggested that this stoicism may be based in premorbid personality characteristics. The purpose of the present study was to further investigate whether a characteristic premorbid personality profile is associated with ALS. Thirty-nine caregivers of newly diagnosed (within 6 months) ALS patients were assessed. The control group consisted of caregivers of patients newly diagnosed with lung cancer ($n=11$), multiple sclerosis ($n=12$), and brain glioma ($n=7$). Caregivers completed the NEO-Personality Inventory and were asked to rate the patient's personality characteristics as they were before receiving their current medical diagnoses. Results of a MANOVA indicated no significant differences between individual disease control subgroups on any of the NEO personality domains. An ANOVA was conducted between ALS caregiver ratings and the total combined control group caregiver ratings. Results indicated that ALS patients were rated as being significantly lower in Openness ($p = 0.01$) than other medical patients. Preliminary findings suggest the response pattern often observed in ALS patients may be related to premorbid personality traits. These results suggest that a patient's ability to suppress overwhelming affect may be a premorbid feature of the ALS patients, and may represent a relationship between psychological factors and motor neuron pathology.

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Neglect

Y. JEONG, D.B. EFROS, J.W. TSAO, T. MIZUNO, G.R. FINNEY, D.B. FITZGERALD & K.M. HEILMAN. Callosal Neglect in Hydrocephalic Patients.

Patients with hydrocephalus often show thinning of the corpus callosum. Although patients with callosal disconnection might demonstrate elements of neglect syndrome, neglect has not been reported to be as-

sociated with hydrocephalus. Thus, we tested two patients with hydrocephalus to learn if they demonstrated callosal neglect. The subjects were two right-handed patients with both the clinical symptoms and imaging signs of hydrocephalus. Both subjects showed evidence for callosal disconnection (e.g., tactile anomia for objects placed in their left hands). These subjects were assessed for neglect by performing the line bisection task. Subjects performed this task with their right and left hands, and the lines to be bisected were randomly presented in their left, right or center space. Neither subject demonstrated an overall bias on the line bisection task nor any systematic bias in the traditionally tested right-hand center-space condition. When the line was placed in left hemispace, however, the right hand deviated rightward and when working in right hemispace the left hand deviated leftward. In addition, independent of hand, when the lines were placed in their right hemispace, both subjects showed a strong leftward bias. These results support the hypothesis that patients with hydrocephalus might show callosal neglect such that when working in the opposite body-centered hemispace each hand deviates toward its own hemispace. In addition, these results suggest that interhemispheric disconnection induces disinhibition of the attentionally and intentionally dominant right hemisphere that causes a leftward bias when stimuli are presented in right hemispace. Supported by the Memory Disorder Clinics, State of Florida and the Research Service, Veterans Affairs Medical Center, Gainesville, FL.

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A.J. WOODS & V.W. MARK. Severe Executive Dysfunction is a Component of Left but Not Right Neglect on Cancellation.

We evaluated 21 hospitalized non-neurologic controls, 11 right-hemisphere neglect (RHL+), 8 right-hemisphere non-neglect (RHL-), 3 left-hemisphere neglect (LHL+), and 5 left-hemisphere non-neglect (LHL-) subjects to assess executive vs. spatial attentional aspects of cancellation. Participants performed a video-taped, modified version of the Star Cancellation Test. Video play back enabled calculating dependent measures, which included time on task, number of perseverated markings, errors of commission (non-targets marked), and several executive variables (inter-target marking distance, "best-r", and pathway intersections [Mark et al Neurology 2004]). We used a general linear model to construct a k-matrix to contrast controls vs. patient populations. RHL+ were significantly worse on all variables except best-r ($p=.12$). LHL+ took significantly longer for task completion ($p<.01$) and had significantly greater inter-target distances ($p<.01$) than controls. Patients without neglect did not differ from controls, except LHL- had longer time on task ($p=.03$) and RHL- had a higher number of intersections ($p=.04$). Right hemisphere lesions leading to neglect appear to result in a more consistent deficit in tasks requiring executive ability than do other kinds of brain lesions. Although neglect appears to be associated with an increased likelihood of severe executive dysfunction, it is neither necessary nor sufficient to produce neglect, as is evident by our LHL+.

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A.J. WOODS, G. JEWELL, T. KRETZMER, H. MURPHY, A. MEIDINGER, S. LIEM, T. NUNN, V.W. MARK, A. CHATTERJEE, B. ANDERSON & M. MENNEMEIER. A Broad Spectrum of Cognitive Deficits in Neglect.

Neglect is typically described as a heterogeneous disorder. Few studies, if any, report on neuropsychological examinations of patients with neglect. The purpose of this study was to examine if cognitive deficits represent a potential source of performance heterogeneity in patients with neglect. Patient groups with and without neglect following right and left hemisphere lesions due to stroke (RHL+ $n=10$, RHL- $n=17$ and LHL- $n=9$, respectively) were compared to age-matched normal controls

($n=42$) on twenty cognitive measures to assess the extent of cognitive dysfunction in neglect. Compared to normal subjects, a broad spectrum of cognitive deficits was present in the RHL+ group, including poorer performances on non-spatial, as well as, spatial reasoning tests. Deficits were observed in word fluency ($p<.01$), animal naming ($p=.03$), similarities ($p=.02$), matrix reasoning ($p<.01$), block design ($p<.01$), parts A and B of the Trail Making Test ($p's<.01$), and visual reproduction immediate ($p<.01$) and delayed recall ($p<.01$). Individual subjects with neglect varied with some showing deficits on all cognitive tests and others showing relatively few deficits. Compared to the LHL- and RHL- groups, the severity of cognitive deficits in neglect appeared to correspond with larger lesion volume. In general, neglect is associated with a broad spectrum of cognitive deficits, on both non-spatial and spatial processing tasks. Variation in cognitive ability among individual patients with neglect could represent an important source of performance heterogeneity.

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A.M. BARRETT, A.T. WRIGHT & K.M. HEILMAN. Neglect allokinnesia on the line bisection task.

To learn if neglect may be associated with both directional akinesia and allokinnesia. A patient, 73, had spatial neglect after right parietal, occipital and (small) right cerebellar strokes. He had abulia and rightward line bisection (LB) bias. He performed 22- and 24-cm line bisections 1) on a video monitor under right-left normal and right-left reversed conditions (20 trials) and 2) in free view, in the midline, with the examiner sitting on either his left, his right, or directly in front of him (90 trials). 1) Rightward line bisection errors (LB; 240-mm line, mean 78.3 mm, SD 7.73) did not reverse with horizontal video reversal of his hand and the line (mean 74.1 mm rightward, SD 24.36), suggesting he had leftward directional akinesia. 2) Rightward LB errors were greater when the experimenter sat in left space (mean = 77.6 mm, SD 14.23) than with the examiner in mid- (mean = 54.3 mm, SD 15.43) or right space (mean = 20.8, SD 10.81; $p<0.001$). Errors were greater with 22-cm lines ($p=0.009$), and with the examiner in mid- or right space ($p=0.03$). The patient's LB errors were feedback-independent, suggesting leftward directional akinesia. In free view, however, he moved away from the examiner on LB, exhibiting allokinnesia. We suggest three possible explanations for his performance: 1) an avoidance response induced by the examiner's presence 2) social motor facilitation reducing directional akinesia when the examiner was in mid- or right space 3) differences in the patient's internal representation of line length or line position, induced by the position of the examiner administering the test (allesthesia).

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G.R. FINNEY, T. MIZUNO, Y. JEONG, V. DRAGO, R.D. RHODES, B.V. SHENAL, G.P. CRUCIAN & K.M. HEILMAN. Co-occurrence of Ipsilesional Neglect and Progressive Hypometria .

Both ipsilateral neglect (IN) and impersistence have been associated with right frontal-basal ganglia injury, but the co-existence of these disorders has not been investigated. Thus, the purpose of this study is to learn if progressive hypometria (PH), a form of motor impersistence, and IN occur together. Eight patients with right hemisphere damage (RHD) and four age-matched controls participated. They performed twenty-four horizontal line bisections of line segments 240 mm long, and deviation from the midpoint was measured. After being shown a 279mm line and asked to draw this same line, they were blindfolded and performed a line drawing test where they drew ten horizontal lines back and forth continuously without interruption or

lifting the pen, making nine linking vertical lines to in order to turn. Each subject performed twenty trials of this task. When compared to controls, three RHD subjects showed no PH or IN. Three others demonstrated both PH and IN, and these subjects had injury to their right hemisphere's basal ganglia. However, there was one RHD subject who had solely PH and one who had solely IN. Although ipsilesional neglect on horizontal line bisection and PH often coexist in patients with injury to the right hemisphere's basal ganglia, the dissociation of these two abnormal behaviors suggests that, at least in part, damage to different networks are responsible for these behaviors.

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J. ROYAN & R.E. GRAVES. The Visual Imagery Transformation Questionnaire (VITQ): A New Measure of Mental Transformation.

The purpose of this study was to develop a unidimensional and psychometrically sound measure of visual imagery transformation. The Visual Imagery Transformation Questionnaire (VITQ) was developed because most existing visual imagery questionnaires are multidimensional and lack item variability resulting in ceiling effects and low correlations with objective measures of visual imagery. The 32 item, Likert scale VITQ was developed and given to 58 participants (ages 17 to 27). The questionnaire included several imagery transformation tasks (e.g. mental rotation) ranging in difficulty. For example, participants rate 'how difficult' it is to determine whether two geometric figures can be rotated to match on a set of Shepard and Metzler (1971) type tasks. A Rasch analysis (Winsteps; Linacre & Wright, 2001) was conducted to determine participant and item fit. The VITQ was found to have high person and item reliability (.91 and .95 respectively) and there was a good range of scores when summed across items and participants (i.e. no ceiling or floor effects). Cronbach's alpha was .92 and a principle components analysis suggested that the VITQ was a unidimensional measure (ratio of first to second factor variance = 3.51). The results from this study suggest that the VITQ is a reliable and unidimensional measure and has sufficient item variability to reduce ceiling/floor effects. The next step is to examine correlations with objective measures of visual imagery transformation. The VITQ has the potential to be used as an easy to administer measure of spatial processing in research and clinical settings.

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P. MCMONAGLE, F. DEERING, Y. BERLINER & A. KERTESZ. Examination of Posterior Cortical Atrophy (PCA) Using the Object, Face and Color Agnosia Screen (OFCAS).

Posterior cortical atrophy (PCA) is a progressive dementia characterized by prominent abnormalities in higher order visual processing and patients typically show signs of Balint's syndrome (simultanagnosia, optic ataxia and ocular apraxia). PCA is sometimes described as a "visual variant of Alzheimer's disease (AD)" but other pathologies are recognized. The aims of this study were: 1) to describe the findings in a cohort of patients with PCA, 2) to use a new test of visual processing, the Object, Face and Color Agnosia Screen (OFCAS) to examine for differences between PCA and AD patients and 3) to identify the most valid items in the OFCAS for diagnosis. 15 patients with PCA and 15 matched AD patients were identified on clinical grounds and evaluated using the OFCAS as part of their neuropsychological examination. PCA patients were examined 4.4 (SD 1.7) years after symptom onset at age 59.4 (SD 8.8). MMSE then was 16.2 (SD 6.62, range 8 to 25). At initial assess-

ment 12/15 had evidence of Balint's syndrome, 13/15 apperceptive visual agnosia, 12/15 apraxia, 9/15 dressing apraxia, 7/15 alexia, 6/15 prosopagnosia, 6/15 elements of Gerstmann's syndrome, 5/15 environmental disorientation and 3/15 transcortical sensory aphasia. These patients represent a typical cohort with PCA. The data suggest that neurocognitive testing using the OFCAS contributes to the differentiation of PCA from AD.

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C. NIKI, T. KUMADA, T. MARUYAMA & Y. MURAGAKI. Motor Images and Body Schema in Patients with Parietal Brain Tumor: Comparison Between Pre- and Post Operational Stage.

We investigated motor imagery deficit in the pre- and post-operative stages of two patients with parietal brain tumor. Participants: Fifteen right-handed normal subjects took part in this study as controls. Patient GY, 30-year-old man and patient HT, 45-year-old woman who suffered brain tumor in the parietal lobe were also participated. Methods: Pictures of a real hand rotated from 0 to 315 (with a 45 step) were presented as target stimuli. Participants discriminated the target hand (left or right) by pressing one of two keys assigned to two fingers of their left or right hand. Normal right-handed subjects showed that response times to right hand stimuli were shorter than those of left irrespective of response hands (referred to as "right-hand stimulus superiority"). Results of preoperative patients showed that, when they responded with the contralesional hand, the right-hand stimulus superiority was not found. Although when the ipsilesional hand was used for making responses, they showed the right-hand stimulus superiority, the effect was vanished after operation. Results suggest that motor imagery of the contralesional hand would have been already impaired in the preoperational stage. In post operation, since the right hand stimuli superiority was eliminated even when an ipsilesional hand was used, it was considered that in addition to impairment of motor imagery, body-schema in the parietal lobe would be impaired in the patients after operation.

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T.D. BALL, Y. NEMIROVSKAYA, S. MEHTA, J. JEE, H. FERRET & P.J. DONOVICK. Associations Between Neuropsychological Measures and Performance on the Benton Facial Recognition Test Based on the Hypothesized Encoding Strategies Employed.

The Benton Facial Recognition Test (BFRT) was developed as an assessment of an individual's capacity to discriminate and identify unfamiliar faces. Impairments in the processing of facial characteristics have been associated with lesions of the right cerebral hemisphere. Factors influencing performance on the BFRT other than right hemisphere brain damage and aphasia, such as differences in encoding strategy utilization, have not been evaluated previously. In an attempt to elucidate the potential underlying perceptual mechanisms involved in performance on the BFRT, we assessed the relationship between this measure and other visual tasks hypothesized to encompass configural (i.e. Judgment of Line Orientation and Mental Rotation Test) or featural (i.e. Hooper Visual Organization Test) encoding properties. The sample consisted of 80 undergraduate participants, of which 40 were female, who were enrolled in psychology courses. Correlational analyses were conducted to determine if performance on the BFRT was significantly related to measures hypothesized to employ configural or featural encoding strategies. Results indicate that BFRT performance for males was related to performance on the JLO ($r = .366, p < .05$), while BFRT performance for females was related to performance on the MRT ($r = .409, p < .01$) and the HVOT ($r = .314, p < .05$). Overall, results suggest that the BFRT performances of males and females are differentially related to measures with configural or featural encoding properties.

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S. DAVIDSDOTTIR & A. CRONIN-GOLOMB. Qualitative analysis of visuospatial dysfunction in Parkinson's disease.

Parkinson's disease (PD) is a progressive neurodegenerative disorder that impacts fronto-striatal and parietal systems and, consequently, affects visuospatial functioning. The aim of this study was to characterize the nature of visuospatial deficits in PD by means of qualitative error analysis of classic neuropsychological tests, rather than using global error scores. The study included 16 non-demented patients with PD and sixteen age and education-matched normal control participants (NC). Pentagon drawing scores from the Mini-Mental State Examination (MMSE) were correlated with types of errors on the Judgment of Line Orientation test (JLO) and with number of errors on the Money Road-Map test. Participants with PD performed significantly worse than NC on the JLO and Road-Map. Although global pentagon scores of PD patients were similar to those of the NC group, qualitative analysis revealed performance differences (size and spatial relations within the figure). Whereas global JLO error scores did not correlate with reproduction of pentagons' spatial dimensions, JLO compression errors were associated with compression of the left (relative to right) MMSE pentagon. PD patients' Road-Map score was correlated neither with error scores on the JLO nor with qualitative performance on pentagon reproduction. Left hemiparkinsonian patients (greater right than left basal-ganglia dysfunction) performed worse than left hemiparkinsonian patients on Road-Map. The results indicate the usefulness of qualitative error analysis when assessing visuospatial deficits in PD. These findings also underscore the importance of considering separately the data from left and right hemiparkinsonian patients when characterizing the nature of visuospatial function.

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Symposium 5/1:15–3:15 p.m.

Early Detection of Preclinical and Early Stage Alzheimer's Disease

Chair and Discussant: David Johnson

D.K. JOHNSON. Early Detection of Preclinical and Early Stage Alzheimer's Disease.

The Alzheimer Disease Research Center at Washington University is part of an ongoing NIH initiative to characterize and diagnose preclinical and early stage Alzheimer's disease (AD). A major objective of the center is the development of diagnostic measures that identify early neuropsychological markers of disease onset and progression before significant neuronal death occurs. Early detection not only provides psychosocial benefits such as advanced treatment and care planning options, but also gives disease-modifying therapies the best opportunity to arrest progression. This symposium summarizes key findings from 4 clinical initiatives that refine differential diagnosis of AD and healthy aging. Anne Fagan, PhD, will review data on biomarkers in the cerebrospinal fluid that may signal the presence of early AD pathology or risk for its development in the future. Denise Head, PhD, will review quantitative changes in human brain integrity as measured by structural MRI and discuss the neuropsychological implications of these changes. Mark Mintun, MD, will review recent advances in PET imaging of amyloid plaques using newly developed radiotracers. Finally, Martha Storandt, PhD, will review personality changes that precede symptomatic onset of the disease.

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D.K. JOHNSON & A.M. FAGAN. CSF and Proteomic Biomarkers for AD in Human Subjects.

There is currently no proven treatment for Alzheimer's disease (AD), but many are being developed. It is critical to have disease biomarkers that can identify individuals at high risk for AD in order to target them for entry into therapeutic trials and to monitor therapy. Since AD pathology appears to begin 10-20 years prior to cognitive symptoms, identification of antecedent biomarkers would allow us to identify individuals likely to have AD pathology but who are still cognitively normal (preclinical AD), a group in which targeted therapies would likely have the greatest clinical impact. At present, a few AD biomarkers in cerebrospinal fluid (CSF) have been identified that may differentiate individuals with clinical disease (i.e., dementia) from those who are cognitively normal. However, there are no validated antecedent biomarkers for predicting dementia risk in asymptomatic individuals. We hypothesize that changes taking place in the brain during the development of AD pathology is reflected in the CSF, and that these biochemical changes can be detected in cognitively normal individuals many years prior to the onset of cognitive decline, and thus can be used as antecedent biomarkers predictive of future dementia. Although antecedent biomarker validation will require longitudinal clinical assessment of individuals over many years to determine who ultimately develops dementia, as a first step, we are investigating the ability of AD-related biomarkers to discriminate cognitively normal individuals (age 45-75) as a function of AD risk defined by family history of AD or apoE genotype, the strongest genetic risk factor for AD. In addition, unbiased proteomics techniques are being employed to probe for novel proteins that may change as a function of AD risk and putative preclinical AD pathology. Results from these experiments will be discussed.

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D.K. JOHNSON & D. HEAD. Structural Neuroimaging in Nondemented Aging and AD.

Advancing age leads to global and regional alterations in brain structure. Structural neuroimaging, using visual inspection, semiquantitative and quantitative techniques, provides a critical window onto these changes and a multiple factors view of aging is emerging. Early magnetic resonance imaging (MRI) studies observed global atrophy, ventricular enlargement and "dirty white matter" in the brains of older adults. As more quantitative techniques developed, evidence that frontal-striatal regions show greater age-related changes than posterior regions has accumulated. White matter damage, as measured in terms of white matter hyperintensities on MRI and with diffusion tensor imaging (DTI), increases in aging and also tends to be more prevalent in anterior brain regions. Interestingly, these changes may not be accelerated by Alzheimer's disease (AD) and instead represent processes that occur in typical aging. The magnitude of age effects on medial temporal lobe structures is variable across studies, but AD does emerge as an important determinant of hippocampal atrophy. The degree to which the progression of pathology in AD represents accelerated aging rather than a discrete disease process has also been informed through study of structural change. Recent studies suggest dissociable processes underlying nondemented aging and AD and provide strong support for a multiple-component model of brain aging. Looking into the future, advances in automated techniques for structural measurement hold the promise of rapid, large-scale, across-site assessments that will likely facilitate the integration of multiple levels of analyses, such as understanding how structural alterations relate to personality, cognition, genetics, and environmental shaping.

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D.K. JOHNSON & M. MINTUN. Imaging Human Brain Amyloid Plaques with PET.

New radiotracers, such as C11-PIB, have been developed that bind to amyloid plaques with very high affinity. These tracers can be injected and their distribution in the human brain imaged with positron emission tomography, or PET. Early experience with this technique has shown dramatic increased uptake of tracer in subjects with Alzheimer's disease compared to subjects without dementia. The theory, applications and limitations of in vivo amyloid imaging with PET will be discussed. Correspondence: *David K. Johnson, PhD, Neurology, Washington University in St. Louis, 4488 Forest Park, St. Louis, MO 63108. E-mail: johnsond@abraxas.wustl.edu*

D.K. JOHNSON & M. STORANDT. Personality Change Precedes Clinical Diagnosis of Dementia of the Alzheimer Type.

Of the 108 participants described here, all were nondemented at entry into a longitudinal study of healthy aging and Alzheimer's disease; 68 received a clinical diagnosis of dementia of the Alzheimer type at some point after entry. The other 40 participants died and came to autopsy with a clinical diagnosis of no dementia; however, 14 received a neuropathological diagnosis of Alzheimer's disease. Initial personality changes reported by a collateral source (usually a spouse or adult child) often occurred early in the course of the disease, even earlier than clinical diagnosis. Individuals without a clinical diagnosis who showed presence of the disease at autopsy experienced personality changes comparable to individuals who received a clinical diagnosis. Personality changes may aid early detection of dementia of the Alzheimer type.

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Paper Session 4/1:15-3:15 p.m.

Adult TBI-Outcome Studies

M. SHERER, M.A. STRUCHEN, R. NAKASE-THOMPSON & S.A. YABLON. Comparison of Indices of Severity of Traumatic Brain Injury.

Initial level of responsiveness (Emergency Room Glasgow Coma Scale [GCS]), time to follow commands (TFC, also called duration of unconsciousness), and duration of posttraumatic amnesia (PTA) are commonly used indices of severity of traumatic brain injury (TBI). While there is a generally agreed upon schema for classifying TBI severity based on GCS, there is less agreement on classification of TBI severity with TFC and PTA. Further, there has been little research comparing these 3 indices. The present investigation examined relationships among these 3 indices. Participants were 259 consecutive patients with TBI admitted to an inpatient rehabilitation program. Participant sex was 185 (74%) male and 74 (29%) female. Medians (lower, upper quartiles) for age and education were 29 years (21, 45) and 12 (10, 13), respectively. Thirteen participants were not following commands at rehabilitation discharge and 72 participants had not resolved PTA at discharge. For all these values, total hospital length of stay plus 1 day was entered. Using standard GCS severity criteria, there were 160 (62%) severe, 51 (20%) moderate, and 46 (18%) mild injuries. Median (lower, upper

quartiles) for TFC and PTA duration were 7 (2, 20.5) and 32 (19, 59), respectively. Correlations (Spearman coefficients) between GCS and TFC and PTA were -0.49 and -0.48, respectively. The correlation between TFC and PTA was 0.80. All $p \leq 0.001$. For participants with severe, moderate, and mild TBI, medians (lower, upper quartiles) for TFC were 13 (5, 29), 3.5 (1, 9), and 1 (0, 2). For PTA, these values were 44 (26, 73), 29 (16, 36.5), and 15 (5, 26.5), respectively. Current findings provide tentative guidance for determination of TBI injury severity when TFC or PTA is available and GCS is not. Based on our finding that over 85% of persons with mild TBI using GCS criteria have PTA duration greater than 24 hours, classification schemes characterizing such patients as having severe injuries should be re-examined.

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C.M. BAILEY, R.J. ECHEMENDIA & P.A. ARNETT. Visual Memory Predicts Concussion Status Independent of Verbal Memory and Post-Mild Traumatic Brain Injury Symptoms in College Athletes.

Self-reported symptoms, as well as verbal memory, are frequently used to evaluate the impact of sports-related mild traumatic brain injury (MTBI). However, limited research has been conducted on the sensitivity of visual memory to MTBI. The current project was undertaken to evaluate the sensitivity and incremental validity of the Brief Visuospatial Memory Test-Revised (BVM-T-R) in detecting the repercussions of MTBI. Data were taken from the Penn State Concussion Program where collegiate athletes are tested serially both pre and post-injury. Athletes ($N=55$) and controls ($N=19$) were administered the BVM-T-R, Post-Concussion Symptom Scale (PCSS), and the Hopkins Verbal Learning Test (HVLT) among other measures at both baseline and 24-48 hours post-injury. Logistic regression analyses predicting concussion status were conducted first to determine if the BVM-T-R was sensitive to MTBI status, and next to determine if the BVM-T-R increased predictive power over the PCSS and HVLT. Pre-model analyses indicated that the BVM-T-R total recall, the PCSS total, and the HVLT recall total learning and percent retained scores differed between athletes and controls at the required $p < .25$ level. A logistic regression model containing the BVM-T-R total recall alone demonstrated its sensitivity to MTBI ($\chi^2(1)=5.22, p < .05$). Also, the incremental validity and predictive efficiency of a model containing PCSS ($R^2_L=.09$) and HVLT ($R^2_L=.16$) indices was significantly increased (Likelihood $G=6.33, p < .05$; $R^2_L=.08$; Binomial $d=2.22, p < .05$) with the addition of the BVM-T-R total recall. Our results suggest that visual memory is sensitive to the impact of sports-related MTBI above and beyond verbal memory and self-reported symptoms.

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J.B. CANTOR, T. ASHMAN & W.A. GORDON. Cognitive Performance and Fatigue after TBI.

The study examined the impact of mental exertion and fatigue on cognitive function post-TBI. It was hypothesized that, compared to a group of non-disabled persons, participants with TBI would a) perform worse on neuropsychological tests; b) experience greater increases in subjective fatigue after several hours of cognitive exertion; and c) experience greater declines in test performance over time. A group of 116 individuals with documented mild to severe TBI and a group of 25 persons with no disability underwent a test battery that lasted several hours. Performance on computerized neuropsychological measures was compared between groups at three time points (Baseline, T1, T2). Repeated measure ANOVAs indicated that participants with TBI performed worse on tests of memory, reaction time, and processing speed than the comparison group ($p=.038-.001$) at all time points. Between-group differences

in executive functions and self-reported fatigue were apparent at T2 ($p=.049-.010$) but not at earlier time points. The TBI group reported a significant increase in fatigue by the end of testing ($t=-9.15$, $p>.001$) and evidenced greater declines in neuropsychological test performance. These changes were not observed in the non-disabled group. Declines were more evident on tests of accuracy than tests of speed. Mean scores on tests measuring only speed were extremely low in the TBI group (>2 sd below the mean). The results suggest that cognitive exertion is more likely to result in cognitive fatigue and impaired performance in persons with TBI than individuals with no disability. Cognitive fatigue appears to reduce accuracy of performance more markedly than processing speed. Correspondence: *Teresa Ashman, PhD, Rehabilitation Medicine, Mount Sinai School of Medicine, 222 East 80th Street, 9B, New York, NY 10021. E-mail: teresa.ashman@mountsinai.org*

M.J. LARSON, V.M. DOTSON, K.G. KELLY & W.M. PERLSTEIN. Temporal Dissociation of Components of Cognitive Control Dysfunction in Chronic Moderate-to-Severe TBI: An ERP Analysis.

Several studies have demonstrated that TBI patients show deficits in cognitive control—the ability to align thought and action in accord with internal intentions. We used event-related potentials (ERPs) and a novel Stroop task to temporally-dissociate regulative and evaluative components of cognitive control in patients with chronic moderate-to-severe (M/S) TBI. We acquired high-density ERPs while 11 chronic M/S TBI patients and 11 demographically-matched controls performed a cued, single-trial Stroop task that temporally dissociated instruction-related regulative processes (i.e., representing and maintaining attentional demands of the task), from evaluative processes (i.e., conflict processing) of cognitive control. Each task trial comprised an instructional cue, followed 1s or 5s later by the Stroop stimulus to which participants provided a vocal response. Behaviorally, TBI patients showed disproportionately greater error rates than controls for the color-naming task and, more importantly, greater errors at the long- but not short-delay incongruent color-naming task condition. ERP analyses revealed that implementation of regulative control processes in both groups was associated with left frontal slow wave activity following task instruction that differentiated the more attentionally demanding color-naming task from the word-reading task. Reflecting evaluative processes, a mid-frontal N450 differentiated congruent and incongruent color-naming conditions in controls, but was significantly attenuated in TBI participants. Lastly, a negative slow wave following the N450 in the color-naming task was observed for controls that was also significantly attenuated in TBI participants. Findings indicate that deficits in detection of response conflict and, perhaps, subsequent recruitment of cognitive resources for conflict resolution contribute to cognitive control dysfunction in TBI.

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Y. GOVEROVER, N.D. CHIARAVALLI, J. DELUCA & M.V. JOHNSTON. Self-generation to Improving Learning of Everyday Functional Tasks in Multiple Sclerosis and Traumatic Brain Injury.

This study examined the utility of using self-generation to improve new learning of everyday functional tasks. Using a within subjects' design, participants with traumatic brain injury (TBI) and multiple sclerosis (MS), as well as a group of healthy controls (HC), completed two cooking and two financial management tasks. One task in each area was presented in the "provided" condition, in which all instructions were provided and read by the participants, and the other task in each area was presented in the "generated" condition, in which participants were asked to generate (fill in the blank) the necessary items needed to perform each step of the task. A more complex cooking task was examined via a between subjects design, in which half of the participants were asked to perform a novel cooking task in a gen-

erated condition and half in a provided condition. The dependent variables were the correct recall of task items and step sequence immediately, 30 minutes and 1 week following initial learning. In all groups, tasks learned in the generated condition enhanced memory performance for the tasks employed when compared to similar tasks learned in the provided condition. Self-generation during learning can significantly improve subsequent recall and performance of activities of daily living for individuals with MS and TBI.

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Poster Session 4/2:15–3:45 p.m.

Child - Acquired Disorders

T. HERSHEY, D.C. PERANTIE, S.L. WARREN, E.C. ZIMMERMAN, M. SADLER & N.H. WHITE. Hypoglycemia, Hyperglycemia and Age of Insult Effects on Spatial Memory in Children with Type 1 Diabetes Mellitus (T1DM).

Although severe hypoglycemia (SH) has been reported to reduce specific cognitive skills in children with T1DM, it has been difficult to determine if other clinical factors (age of SH or history of severe hyperglycemia) may also mediate these effects. We combined data from three studies on children with T1DM, all of which found that repeated SH reduced long-term spatial memory. We then examined the effects of age of first SH episode and exposure to severe hyperglycemia on memory. Each study recorded previous severe hypo- and hyperglycemic episodes (significant symptoms with extreme glucose levels requiring outside assistance) and tested short-term (5 sec) and long-term (60 sec) spatial memory with the Spatial Delayed Response (SDR) task. We analyzed data from 103 children with T1DM ages 6 to 18. Subjects were categorized as having 0, 1-2, or 3+ SH episodes, and as having 0 or at least 1 severe hyperglycemic episode. Children with a history of SH were further categorized as having their first SH episode before or after age 5. General linear model analyses were performed. Results confirmed that repeated SH reduces long-delay SDR performance. This effect was significantly enhanced if the first SH episode occurred before age 5. Severe acute hyperglycemia did not affect long-delay SDR but did reduce short-delay SDR. We suggest that there is a developmental trajectory to the negative effects of SH on memory and that severe hyperglycemia is unlikely to contribute to this relationship. How chronic or less severe glucose fluctuations modulate these effects remains to be determined.

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S.L. WARREN, D.C. PERANTIE, E.C. ZIMMERMAN, M. SADLER, N.H. WHITE & T. HERSHEY. Spatial Memory, Hippocampal Volumes, Severe Hypoglycemia (SH) and Hemoglobin A1c (A1c) Levels in Children with Type 1 Diabetes Mellitus (T1DM).

Delayed spatial memory is decreased in T1DM children with multiple prior severe hypoglycemic (SH) episodes, possibly due to hippocampal dysfunction. It is also possible that chronic hyperglycemia affects memory and hippocampal integrity. We tested whether overall glycemic control mediates spatial memory and hippocampal volumes. Thirty-six T1DM children (ages 7-16; 15 girls) performed the Spatial Delayed Response (SDR) task to test long delay (60 sec) spatial memory. Overall glycemic control (average of all A1c levels since diagnosis) was determined. Subjects were categorized by number of SH episodes experienced since diagnosis (0, 1-2, or 3+). Hippocampal volumes were

measured on an average image composed of ≥ 3 T1-weighted MRIs for each subject. Relationships between SH, average A1c, SDR and hippocampal volumes were analyzed with general linear models. We found that average A1c was higher in the 3+ SH group compared to the other SH groups (3+: 9.1 ± 0.8 ; 1-2: 8.4 ± 0.7 ; 0: 7.8 ± 1.1 , $p < 0.05$). SDR performance did not correlate significantly with average A1c. However, it did differ significantly across SH groups (3+ group had the greatest error), even when covarying for average A1c. Hippocampal volumes were not associated with SH or average A1c within the whole group, although greater power may be necessary to detect a difference. However, in girls only, increased hippocampal volume was associated with higher average A1c ($p < .05$). Our results suggest that SH, but not overall glycemic control, predicts long delay SDR performance. Finally, overall glycemic control may have a complex relationship with hippocampal volumes.

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B.J. DEERY, V.A. ANDERSON, R. JACOBS, J. NEALE & A. KORNBERG. Pediatric MS vs ADEM, More in Common than just the Letter M? Analysis and Comparison of Cognitive Features.

Due to cognitive deficits found in adult multiple sclerosis (MS) and other CNS demyelinating diseases, it is hypothesized children with MS and acute disseminated encephalomyelitis (ADEM) will also display cognitive impairment. It is predicted these deficits will be more severe and widespread in children due to interrupted myelin and cognitive development. MS children are also hypothesized to exhibit more widespread and severe cognitive impairment than ADEM children due to more serious CNS damage. Nine children with pediatric MS (aged 8-15), and nine with ADEM (aged 7-16), were assessed on cognitive tests measuring information processing, memory, attentional skills and executive functioning. Performance was compared to age-matched normative data. There was no significant mean differences between the pediatric MS and ADEM groups on age at disease onset ($p = .65$), age at testing ($p = .35$), or disease duration ($p = .44$). As a group the ADEM children performed within the average range on most cognitive domains with the exception of divided attention. The pediatric MS group performed outside the average range on cognitive domains of focussed, selective and shifting attention, and executive functioning. When the ADEM children were analysed separately, 33% had impairment on 2 domains, with 44% having impairment on at least 3 domains. Analysing the MS children separately, showed 17% had impairment on 2 domains, while 83% had impairment on 3 domains or more. As hypothesized, cognitive impairment is present in both pediatric MS and ADEM, which appears to be more widespread and severe than found in adult MS. Cognitive deficits in pediatric MS also appear to be more severe and widespread than in ADEM, as was predicted.

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A. PODRAZA, J. THOMAS, J. ERDOES & M. ADAMS. Neuropsychological Decline in Juvenile Batten Disease: A Longitudinal Case Study.

We present longitudinal neuropsychological evaluations from a now 12-year-old boy with Batten Disease, a rare, fatal, autosomal recessive lysosomal storage disease, that is marked by a progressive decline in intellectual ability, worsening seizures, and progressive loss of sight and motor function. The participant was a boy, evaluated neuropsychologically with a comprehensive battery of tests on three occasions over an 8-year interval. The neuropsychological evaluations revealed a progressive decline on intellectual measures from

the average range to the mild range of mental retardation first seen at age 9. The pattern of deficit on most measures of verbal memory and learning, attention/concentration, information processing speed, language function, visuospatial ability, and motor function was suggestive of severe diffuse cerebral dysfunction. Receptive vocabulary remained spared and in the average range. This patient showed no change on academic measures, which has not progressed past the first grade level. Clinical interview and behavior rating scale data remained consistent with mixed receptive and expressive language disorder, disruptive behavioral disorder, not otherwise specified with obsessive-compulsive personality traits, intermittent explosive disorder, and attention deficit hyperactivity disorder, predominately inattentive type since age 9. Batten Disease results in generalized neuropsychological dysfunction and academic deficits, although receptive vocabulary may be relatively spared. Initial symptoms may include attentional and behavioral symptoms that first come to psychiatric attention. When longitudinal neuropsychological testing finds a cognitive decline without a known cause, medical testing for lysosomal storage diseases, such as Batten Disease, may be indicated. Several treatment strategies are currently being investigated and early intervention will likely be critical in limiting disability.

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S.J. MISH, K.A. KERNS, J. ROBERTS & F. JAGDIS. Investigation of Children Treated for Congenital Toxoplasmosis: A Follow-up Study from a Toxoplasmosis Outbreak.

Outcome studies have shown that congenitally infected infants with brief or no treatment uniformly develop severe sequelae, such as mental retardation, seizures, motor deficits, and impaired vision from chorioretinitis. Though prompt initiation of intensive treatment regimes results in more favourable neurological and developmental outcomes in most children, little is known about the long-term prognosis of treated infants, and the impact on their academic achievement and cognitive abilities across development. In 1994-95, an outbreak of waterborne toxoplasmosis occurred in Victoria, British Columbia. A number of pregnant mothers were identified, and 12 infants were infected with *Toxoplasma gondii*. They received treatment protocols for one year and continued medical follow-ups through early development. This is the first of a series of studies tracking the cognitive outcomes of this cohort of congenitally infected infants. Academic achievement and thorough investigation of neuropsychological functioning (intelligence, perceptual and motor skills, attention, memory, executive functions) were evaluated in 10 of the 12 congenitally infected children (7-8 years of age). Assessments also included parental ratings of children's executive functions, adaptive functioning, and behaviour. Children generally exhibited average intelligence and academic achievement, but mild difficulties were consistently noted in the areas of attention and certain facets of executive functions. These results continue to support the finding that children treated appropriately for congenital toxoplasmosis have substantially better outcomes. Nonetheless, as brain areas subserving complex attention and executive functions come online during late childhood and adolescence, weaknesses may become more pronounced with age. Longitudinal follow-up of children with congenital toxoplasmosis is necessary.

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L.S. KRIVITZKY, M.J. NORTZ & D.L. GILBERT. Neuropsychological Functioning in a Case of Juvenile Parkinsonism.

Typical Parkinson's Disease, a common neurodegenerative disorder in the elderly, may include neurocognitive deficits consistent with dysfunction

in frontal-subcortical pathways. Little is known about the pattern of neurocognitive deficits in "Juvenile Parkinsonism" (JP), which occurs prior to age 21. The purpose of this case study was to explore the neuropsychological functioning in an adolescent female with JP. The subject was a right handed, 14 year-old female. Her initial presentation (onset at age 13) included declining grades, subjectively diminished concentration, bradykinesia, tremor, subnormal visual tracking, and psychomotor retardation. MRI showed mild general and cerebellar vermal atrophy; 18F-DOPA PET showed reduced striatal signal. Medications at the time of testing included carbidopa-levodopa. Methods for this case study included a comprehensive neuropsychological evaluation, medical record review, and neurology consultation. This evaluation demonstrated intact general intelligence (WISC-IV, FSIQ=102), with a relative strength in her verbal reasoning skills (Superior range). Average performance was noted across measures of nonverbal reasoning, basic academics, confrontation naming, working memory, sustained attention, and fine motor speed/dexterity. Mild weaknesses (16th to 21st percentile) were noted in psychomotor speed and reading comprehension. Impaired performance (≤ 5 th percentile) was identified in the domains of memory, executive functioning, reaction time, and visual scanning. This case study identified a pattern of neuropsychological functioning in an adolescent with JP that is generally consistent with the frontal-subcortical pattern of neuropsychological dysfunction that is often seen in individuals with typical geriatric Parkinson's disease.

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W.S. MACALLISTER, L.B. KRUPP, M. MILAZZO, B. BARNOSKY, A.L. BELMAN, C. CHRISTODOULOU, D. WEISBROT, S. RAO & W. SCHERL. Comparison of Memory Performance in Pediatric MS and Acute Disseminated Encephalomyelitis.

Cognitive dysfunction has recently been acknowledged in demyelinating illnesses of childhood, such as pediatric MS and Acute Disseminated Encephalomyelitis (ADEM). It has been suggested that children with ADEM experience less severe deficits than children with MS. Direct comparisons, however, have not been made. The current study directly compares both verbal and visual memory functioning of children with MS and ADEM. Forty-seven children aged 6 - 17 were enrolled in this study; 35 were diagnosed with MS, 12 experienced ADEM. Each was administered the Verbal Learning and Visual Learning subtests of the WRAML. One-way ANOVA's were calculated to compare both immediate and delayed recall for each group on each test. To control for the effect of age, age corrected z-scores were used as the dependent variables. The results indicate that the MS patients experienced greater verbal memory impairment at immediate recall ($p = .006$). A trend toward greater impairment was evident at delayed recall ($p = .084$). In contrast, no differences in visual memory were evident at either immediate ($p = .226$) or delayed recall ($p = .251$). Consistent with prior predictions, children with MS have greater verbal memory impairment than children with ADEM, but visual memory performance was comparable between the groups.

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B.C. LEJEUNE, P.S. FASTENAU, J.K. AUSTIN & D.W. DUNN. Language and Behavior in Children with a First Recognized Seizure.

Epilepsy is associated with language and behavior problems. At what point these problems manifest is unknown. We explored the relationship between language and behavior among children who had their first recognized seizure (FRS). Our hypothesis was that lower language scores would be associated with greater behavior problems. Participants were 170 children ages 6 to 15 years ($M=9.8$; $SD=2.5$). Mean time since FRS was 81.2 days ($SD=40.0$). Mean estimated IQ was 101.2 ($SD=15.9$);

91% were right-handed; 48% were female; 40% had prior unrecognized seizures (PURS); 90% were medicated. Diverse seizure types were included. Tests included Clinical Evaluation of Language Fundamentals-3rd edition, Kaufman Brief Intelligence Test, and Child Behavior Checklist. Hierarchical regression was used to test a model of relationships among PURS, age at seizure onset, sex, language and behavior. All language and behavior subscales were correlated ($r = -0.17$ to -0.32 , $p \leq 0.01$). PURS, age at onset, and sex were not related to language and behavior. Compared to norms, there were higher rates of language and behavior problems; 35% of children were in the at-risk range for behavior problems and 24% scored ≥ 1 SD below the mean on language. Higher than expected rates of language and behavior problems and the relationship between these variables suggest that children should be monitored for difficulties in these domains at the onset of FRS. [Supported by NIH/NINDS #22416 to JKA]

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K. NASH, R. GREENBAUM & J.F. ROVET. Emotion Processing in School-Age Children with Prenatal Cocaine Exposure.

While the effects of prenatal cocaine exposure (PCE) on emotion regulation and fear behavior have been well studied in infants and animals respectively, emotion processing has not been examined in school age children with PCE. Rather, these children have been studied for cognitive abilities, particularly attention, and behavior problems. Given that children with PCE are at risk for behavior problems, we sought to examine their understanding of emotions, especially fear, and determine whether they showed a distinct profile relative to children with ADHD. Studied were 16 children with PCE, 16 ADHD, and 16 normal controls aged 6 to 12 years. All were assessed for affect processing using the MN-TAP and for cognitive abilities, particularly language with the WASI and 3 language tasks. Parents completed the CBCL. All language and behavior items considered to deal with emotion processing were independently scored and a separate scale of fear processing was derived. On the MN-TAP, PCE and ADHD performed below controls in affect choice, whereas only PCE demonstrated a deficit ($p = .004$) in identifying fear in faces. Elevations on CBCL scales of Attention and Thought Problems, and Externalizing behaviors were seen in PCE and ADHD, whereas only ADHD had elevated scores on Internalizing Problems (Anxious Depressed, Depressed Withdrawn) and Social Problems. These results indicate more emotion processing deficits, particularly with respect to understanding fear, in PCE than ADHD or controls. In light of the role of the amygdala in fear processing, it may be a target structure prenatally to the effects of cocaine exposure.

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A.K. GUSTAFSON-DEBASTOS, S. RAZ, J. NEWMAN, A. SHOMAKER & D. BATTON. The Neuropsychological Outcome of Preterm-Birth Preschoolers Diagnosed with Mild Perinatal Intracranial Hemorrhage.

Our main objective was to study intellectual, language, memory, attention and motor skill development in preschool age children who were born prematurely (gestational age less than 33 weeks) and diagnosed with mild perinatal intracranial hemorrhage. We compared 30 preterm-birth preschoolers (ages 3 to 6 years) with mild intracranial bleeds to 21 preterm-birth controls with normal neonatal cranial ultrasounds. The comparison group was similar to the target group in a variety of socio-demographic characteristics as well as in degree of ante-, peri-, and neonatal risk. Twenty-four children in the target group had suffered a hemorrhage limited to the germinal matrix. In the remaining six children a small intraventricular hemorrhage was also evident. Analyses

with MANCOVA (using socioeconomic status, sex, gestational age and total number of complications as covariates) revealed no significant group differences in neuropsychological test scores reflecting performance on multiple outcome domains. However the total number of perinatal complications, a proxy variable representing overall perinatal medical status, was found to be consistently linked to neuropsychological outcome measures in the entire sample. These included indices of global intellectual functioning, expressive and receptive language skills, and long term verbal memory. Our findings suggest that the occurrence of a mild intracranial hemorrhage in the preterm infant carries minimal significance for developmental outcome. In contrast, the combined effect of multiple perinatal complications may adversely impact brain integrity, resulting in general cognitive, as well as specific language-related, neuropsychological deficits.

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D.G. WAKEMAN, K. LESAK, M. BARNES, A.F. KEY, N. CUNNINGHAM, S.D. KELLY, D. GOZAL, S. ROBINSON & D.L. MOLFESE. Sleep Apnea Changes the Brain's Processing of Syllables in Children.

To observe differences in processing that may occur as a result of children having sleep apnea/hypopnea. Auditory event-related potentials (ERPs) were recorded from 9 children referred for sleep apnea assessments. Six computer-synthesized syllables were presented to the children in random order. ERPs were recorded using a 128-channel Ag/AgCl electrode net. Peak amplitude and latency analyses of electrophysiological data compared between different scores of apnea/hypopnea indicated that although all children were able to discriminate between various consonants and vowels, the individual ERPs differed with the severity of the child's sleep disturbance. The overall results provide information concerning the impact of sleep and breathing on neurocognitive functioning and development in young children and may lead to identifying the risks for children who may be more cognitively vulnerable because of chronic sleep disturbances.

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J.M. TUREK, L. CATANIA, I. ROMERO, H. ADAMS, V. METZGER, S.E. SALLAN, L.B. SILVERMAN & D.P. WABER. Neurobehavioral Profile of Long-Term Survivors of Acute Lymphoblastic Leukemia (ALL): Increased Compliance and Decreased Metacognitive Skills. Investigations of late effects of CNS therapy for pediatric ALL have focused primarily on cognitive outcomes as measured by laboratory tests. Less attention has been directed to ecologically relevant neurobehavioral profiles. We evaluated 84 long-term ALL survivors, aged 6 to 16, enrolled on Dana-Farber Cancer Institute ALL Consortium Protocol 95-01. Parents (N = 84) and teachers completed the BASC (N = 59) and BRIEF (N = 39) at a median 5 years post diagnosis. By one-sample t-tests, parents rated all BASC internalizing behaviors as within normal limits, but externalizing behaviors were unusually low ($p < .01$), including hyperactivity, aggression, and conduct (all $p < .05$). Teachers corroborated the same profile, unusually low externalizing behaviors ($p < .01$), with normal levels of internalizing behaviors. Teachers documented low rates, however, for some specific scales (depression, atypicality, and withdrawal, all $p < .01$). They also reported better than average levels of adaptability, social skills, and study skills (all $p < .05$). Parents reported increased levels of problems for 5/8 BRIEF executive function indices, primarily metacognitive (all $p < .05$), whereas teachers endorsed only 2/8. There were no associations between outcomes and sex, age at diagnosis, or CNS therapy (18 Gy radiation or no radiation).

Children treated for ALL do not exhibit long-term adverse effects in terms of internalizing symptoms, and they appear to be unusually well behaved and compliant at home and school. They do, however, exhibit a somewhat higher than expected prevalence of everyday problems in executive functions, especially metacognitive skills.

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M. MAHONE, C. PRAHME, K. RUBLE, S.H. MOSTOFISKY & C.L. SCHWARTZ. Motor and Perceptual Timing Deficits Among Survivors of Childhood Leukemia.

There is growing evidence of cerebellar-frontal system change in children treated for leukemia, even in the absence of cranial irradiation therapy (Ciesielski et al., 1994). Lesnik et al. (1998) found that children treated with intrathecal chemotherapy, but not radiation therapy, showed morphometric changes in cerebellar lobules I-V and VI-VII and bilateral prefrontal cortices, relative to controls. Children with known cerebellar abnormalities have been reported to show deficits in judgment of time duration (Mostofsky et al., 2000). Compared to controls, individual with cerebellar lesions also show impaired judgment of time duration and increased variability on motor timing (repetitive tapping) tasks (Ivry & Keele, 1989). We compared 22 long-term survivors of acute lymphoblastic leukemia (ALL), ages 8-18, to 22 age- and gender-matched controls on tasks emphasizing cerebellar functioning including judgment of time duration and motor timing. Groups were also compared on a task assessing judgment of pitch, used as a control measure. Children in the ALL group were at least 5 years from diagnosis, treated with intrathecal chemotherapy (methotrexate in all, hydrocortisone and cytarabine in 20/22), but not radiation therapy, and free from recurrence of disease. Infusional methotrexate (1-2.5 g/m²/dose) was standard, with infusional 6-mercaptopurine given to 16/22. After controlling for IQ differences, the ALL group had significantly poorer performance than controls on judgment of duration and motor timing (both $p < .05$), but not judgment of pitch. Treatment with intrathecal and infusional chemotherapy for childhood ALL may be associated with skill deficits comparable to those seen in individuals with cerebellar abnormalities.

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J. BERNABEU, A. CANETE, C. FOURNIER, E. NOE, F. MENOR & V. CASTEL. Aphonic palilalia after transient mutism following cerebellar medulloblastoma resection in a child.

Transient mutism is a well documented phenomenon following medulloblastoma resection in children. Recovery often presents language disorders such as dysarthria but secondary palilalia has been not reported yet. Here we report a case of palilalia in a 7 year-old-boy who was diagnosed with a vermian medulloblastoma (5 x 5 x 4.5 cm). He underwent surgery, radio- and chemotherapy according to recently opened SIOP study. Neuropsychological and neurological assessments were performed. CT, PET and MR imaging was done. He became mute from 5 hours to 13 days after recovering from surgery. After the mutism episode he presented temporary dysprosody, and diminished verbal fluency which continues to date. Furthermore, we observed the well known Mutism and Subsequent Dysarthria (MSD) as well as Cognitive-Affective Cerebellar Syndrome. He was apathetic, indifferent and unable or unwilling to begin verbal and non-verbal interactions up to two months after surgery. Six months after diagnosis, aphonic palilalia appeared (he repeats the last spoken words with tongue and lip movements, but without sound) PET imaging revealed bilateral temporo-occipital, cerebellar and left temporal hypometabolism. Recent standard MRI shows no pathological signs. We present a previously non-described case of palilalia

following medulloblastoma resection in a child. Palilalia has been reported in certain pathologies, such as Tourette and Alzheimer's disease, associated with damage to the cortico-subcortical and corticocerebellar circuitry. Although the neural mechanisms underlying aphonetic palilalia remain uncertain, we suggest a corticocerebellar implication affecting posterior cortical areas in the appearance of this rare symptom.

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K.M. RENNIE & J. SCOTT. Inhibitory Control Following Stroke in Pediatric Patients with Sickle Cell Disease.

One of the most devastating complications of Sickle Cell Disease (SCD) is vascular occlusion in the brain or stroke. Overt stroke with obvious speech or motor deficits occurs in approximately 10% of children with SCD. In addition, sub-clinical cerebrovascular ischemia, documented by magnetic resonance imaging studies, is present in another 10-20% of pediatric patients with SCD. Following infarction, pediatric patients with SCD have been found to have neuropsychological impairments. While previous researchers have documented that these patients have impairments in attentional regulation following stroke, there is little research on the specific skills underlying their difficulties with attentional regulation. Thus, the purpose of this study was to examine specific deficits underlying problems in attentional regulation in pediatric patients with SCD following stroke. Thirteen pediatric patients between the ages of 6-18 with SCD and infarction were recruited from a large Sickle Cell Clinic for enrollment in this study. All participants underwent Magnetic Resonance Imaging (MRI) to document their stroke. A control group of 13 patients with SCD and no stroke were also enrolled in the study. The Conner's Continuous Performance Test-Second Edition (CPT-II) was administered to all participants to assess attentional regulation. Descriptive statistics were generated on all demographic variables. Analysis of variance was used to analyze CPT-II data. Results of the current study suggest that difficulties with inhibitory control may be underlying deficits in attentional regulation that children with SCD exhibit following stroke. Moreover, unlike many children with diagnoses of Attentional Deficit Hyperactivity Disorder (ADHD), these children tended not to demonstrate problems with hyperactivity.

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R. TARAZI, L.P. BARAKAT, M.L. GRANT & B. ELY. Neuropsychological Functioning in Preschool-age Children with Sickle Cell Disease: The Role of Illness-related and Psychosocial Factors.

To examine the association of illness-related and psychosocial factors with neuropsychological functioning in preschool-age children with SCD. Hypotheses: Sample would (1) perform less well than normative groups on neuropsychological measures and (2) perform relatively less well on the Memory/Attention domain compared to other domains; (3) psychosocial factors would predict variability in performance above that predicted by illness-related factors. Participants were 26 children with SCD, aged 3-5 years. Battery was administered assessing: general intellectual functioning, language, memory/attention, visuospatial/visuo-constructional, and motor/visuomotor skills. Parent completed questionnaires related to psychosocial functioning. Illness-related information was attained from medical charts and data collected for a study from which sample was recruited. Mean standard scores across domains ranged from 88.1 to 95.0. Results of t-tests suggested that participants performed significantly lower than normative samples across several domains. No meaningful differences were noted between domains. Correlation analyses indicated that disease severity was not significantly related to neuropsychological functioning. Maternal education/family income was correlated with most neuropsychological domains and, based on re-

gression analyses, accounted for much of the variance in functioning. Other psychosocial variables of interest included number of children living in the home, weekly hours in school/day care, and PIP difficulty score. SCD may not significantly affect neurological integrity in very young children without overt stroke. At this age, psychosocial risk factors may be appropriate targets for intervention, with the goal of promoting cognitive development. Despite several limitations, this study provides support for early identification of at-risk children in order to decrease neuropsychological morbidity in SCD.

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E.J. ANDERSON & P.J. DONOVICK. Fronto-Behavioral Deficits Associated with Childhood Undiagnosed Lyme Disease: A Case Study.

This presentation examines a 23-year-old man evaluated at a NY maximum-security prison. He was convicted of raping a mentally retarded woman and is an identified sexual perpetrator for previous offenses. For this individual, there is no family history of mental illness and he has a supportive, intact, middle class family. As a child he had three bouts of paralysis at ages 22 months, 4 years, and 10 years; each time resulted in a hospitalization. He was misdiagnosed with meningitis and multiple sclerosis until he was correctly diagnosed with Lyme Disease stage 3 by a positive spinal culture at age 11. According to his mother, he achieved normal developmental milestones until age 11 when there was a notable social and behavioral regression. Between the ages of 13-17, he was unsuccessfully placed in three residential homes each placement lasting less than 18 months. Results of the neuropsychological evaluation suggest normal intellect with behavioral and emotional disinhibition, akin to frontal lobe pathology as he lacks insight into his behavior and denies remorse for his offenses. He presents similarly to a verbal, hyperactive, child. The INS presentation will summarize his performances on the neuropsychological measures, his behavioral presentations, and medical records. This case further joins a growing body of literature of the importance of early diagnosis and treatment of Lyme Disease.

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M. BENJAMIN, S.C. HEATON & E.B. FENNELL. BASC Parent and Self-Report Ratings in Pediatric TBI: Pilot Data Examining Rater Differences.

Behavioral and emotional disturbance has been reported in children who have sustained a severe traumatic brain injury (TBI), but little is known about the differences between parent and self-report ratings in these domains. The adult TBI literature suggests that some patients exhibit poor insight into their own emotional and behavioral problems, which further highlights the importance of understanding potential rating differences. The Behavioral Assessment System for Children (BASC) is a behavior rating scale used to evaluate parent and self-ratings across several behavioral and emotional domains. However, we know of no studies examining parent and self-report ratings on the BASC within pediatric TBI. The current study presents pilot data examining parent and self-report ratings on comparable BASC scales (Depression, Anxiety, Somatization, and Atypicality) within a pediatric TBI sample. Participants consisted of 11 Severe TBI and 10 non-TBI Controls (4 normal controls, 6 orthopedic controls). T-tests were conducted comparing the groups on the BASC scales for both the self-report and parent-report versions. On the *self-report* scales, there were no significant group differences, with Severe TBI children not endorsing significant problems. In contrast, *parents* of children with Severe TBI endorsed significantly more problems than the parents of the non-TBI Controls. Results suggest that parent-report questionnaires may more accurately capture the presence of behavioral and emotional disturbance in children with Severe TBI.

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L.M. GARVEY, H.D. STOTT, R.M. BUSCH, J.S. HAUT, R.I. NAUGLE, I.S. ASHABO, E. WYLLIE & W. BINGAMAN. Behavior and Mood Change in Children Following Surgical Intervention for Treatment of Intractable Epilepsy.

Epilepsy in children has been associated with behavioral and mood problems. Studies have reported improved behavior following surgical treatment for epilepsy in patients with temporal lobe or mixed epileptic focus. It is unclear whether similar improvements can be expected in patients with other foci. Mood improvements have been found in adults following temporal lobectomy, but we are unaware of similar studies in children. This study investigated the relationship between surgery site and post-surgical behavior and mood changes in children with temporal (TLE) and frontal lobe (FLE) epilepsies. This was a retrospective study of 41 children with intractable epilepsy who were seen for pre- and post-surgical neuropsychological evaluations. Temporal lobe resections were conducted on 31 participants and frontal lobe resections were conducted on 10 participants. Results revealed a significant interaction between group and the Withdrawn/Depressed scale of the Child Behavior Checklist (CBCL); the TLE group demonstrated reduced post-surgical scores while the FLE group exhibited increased scores. Within groups, scores were reduced post-surgically on the Somatic Complaints, Social Problems, and Attention Problems scales of the CBCL for the TLE group; no differences were evident for the FLE group. Significant interactions were noted between group and the Ineffectiveness, Anhedonia, and Negative Self-Esteem scales of the Children's Depression Inventory (CDI) with reduced post-surgical scores for the FLE group. No within group differences were found on the CDI. The present results emphasize the differential effects of site of resection on behavior and mood. These findings support previous literature indicating that behavioral improvements are demonstrated post-surgically in children with temporal lobe resection, but suggest that children with frontal lobe resection may demonstrate increases in behavioral problems post-surgically.

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D. BLAINE, C. MORRISON, D.P. MISKIN, M. SAFIER & C.M. ZAROFF. Risk Factors for Mental Retardation in Children with Epilepsy and Patterns of Functional Skill.

Neurological factors associated with mental retardation, and functional skills in a sample of pediatric epilepsy subjects were examined. Eighty-three pediatric subjects from a tertiary care epilepsy center (mean age = 10, SD = 3.7), 32 with mental retardation (VABS SS < 70) and 51 without (IQ > 69), as determined by the Vineland Adaptive Behavior Scales and the appropriate Wechsler IQ scale, were studied. Groups were compared on the etiology of the epilepsy (symptomatic versus idiopathic), the age at seizure onset, and the number of antiepileptic medications being used. Within the sample with mental retardation, patterns of adaptive functioning were examined, including a consideration of gender. The mean age at seizure onset was significantly lower in subjects with mental retardation ($t[51] = -4.97, p < .01$), in whom significantly higher rates of symptomatic versus idiopathic epilepsy were found ($\chi^2[1] = 8.86, p < .01$). The average number of medications was similar between groups ($t[49] = 0.21, p > .05$). In subjects with developmental delay, communication and socialization skills were significantly stronger than self help skills ($F[1,3] = 27.9, p < .01$). No gender differences were noted.

Younger age at seizure onset and symptomatic epilepsy are risk factors for mental retardation in pediatric epilepsy. In those individuals with mental retardation, self-help skills were particularly compromised relative to communication and socialization abilities. Functional abilities did not vary according to gender.

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G.J. REY, E. SULLI, C. DUNOYER, P. JAYAKAR & M. DUCHOWNY. Behavioral Disorders in Children with Intractable Epilepsy.

The objectives are: a) Obtain estimates of the frequency and type of behavioral disorders in children with intractable epilepsy. b) Examine the contribution of seizure type, demographic and clinical factors to these disorders. Subjects consisted of 57 consecutive intractable epilepsy admissions for vEEG monitoring (Mean age=12.0, sd=3.5; 28 males, 29 females). All subjects underwent comprehensive neurological work-up and MRI. Behavioral disorders were examined utilizing the Child Behavior Checklist (CBCL). 36% of the sample presented clinically significant elevations in the Total CBCL score. Significant elevations for the individual subscales ranged between 15 to 52%, with the highest percentages in attention and social problems. Demographic factors, age of onset, IQ and illness duration were unrelated to the behavioral disturbances. Subjects with secondary generalization exhibited greater behavioral pathology, whereas subjects with extra-temporal foci exhibited greater somatic concerns. Subjects with left-hemisphere inter-ictal discharges had more social problems than those with right sided discharges. There were no differences related to ictal patterns. Lesional cases ($n=30$) had greater elevations in aggressiveness and delinquency scales. Children with intractable epilepsy have a higher incidence of behavioral disorders than the general epilepsy population. However, the pattern of behavioral disturbance is non-uniform and influenced by the seizure type and presence of structural lesions. Subjects with secondary generalization are at greater risk to develop behavioral disturbances and lesional cases demonstrate higher levels of aggressiveness and/or acting-out behaviors. In contrast, IQ, demographic factors, age of onset, and disease duration were not related to the disorders of behavior.

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C.M. ZAROFF & M. KESSOUS. Psychosocial Functioning and Seizure Variables in Pediatric Epilepsy.

To assess psychosocial functioning in pediatric epilepsy using both broadband and Syndrome scales of the Child Behavior Checklist and correlate results with seizure variables. The Child Behavior Checklist (CBCL) was administered to parents of 31 subjects at a tertiary care epilepsy center. Both broadband and Syndrome Scales were examined to increase sensitivity. Frequencies of scores in the Borderline clinical and Clinical ranges were derived. Point biserial correlation coefficients were derived between epilepsy etiology (symptomatic/idiopathic) and the CBCL scales. A t test was used to examine the Total Problems Scale score stratified by age at seizure onset (less than or equal to one year/greater than one year), epilepsy type (generalized versus partial), medication regimen (monotherapy/polytherapy), and gender. A Pearson correlation coefficient was derived between Intelligence Quotient (IQ) and the Total Problems score. Fourteen of thirty-one subjects (45%) had Total Problems T scores in the Borderline clinical/Clinical range. The highest percentage of children scoring in the Borderline clinical/Clinical range occurred on the Social Problems scale (16/31). Psychopathology did not differ based on seizure variables, including onset age, epilepsy type, and medication regimen. A non-significant trend for gender was observed, with males scoring higher than females. A

higher IQ was significantly associated with a lower score on the Total Problems scale ($r = -.46$, $p < .05$). In a select sample of pediatric epilepsy subjects, nearly 50% exhibited psychopathology. Social relationships in particular were compromised. Higher intellectual functioning was associated with lesser psychopathology. Findings indicate the clinical need for social skills training and peer mentorship, irrespective of individual seizure-related factors.

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B.P. HERMANN, J.E. JONES, M. SEIDENBERG, R. SHETH, M. KOEHN, R. HANSEN, K. WAGNER, R. WATSON, C. DOW, E. JOHNSON & R. CAPLAN. Neuropsychological Status of Children With New Onset Epilepsy.

To characterize the status of brain structure, neuropsychological function, and psychiatric co-morbidity in children with new onset epilepsy, 36 children with new onset epilepsy (within one year of diagnosis) and 14 healthy controls underwent high resolution MRI with quantitative volumetric processing, comprehensive neuropsychological assessment, and structured psychiatric interview (K-SADS). Subjects were 8-18 years of age and mean ages were 13.1 for controls and 12.5 for epilepsy. Psychiatric assessment focused on current and lifetime-to-date Axis I disorders. Cognitive assessment consisted of assessment of intelligence, academic achievement, language, verbal and visual memory, executive functions, and speeded cognitive and psychomotor processing. MRI volumetrics included assessment of total brain gray and white matter and total CSF. Psychiatric: 52% of the epilepsy vs. 18.8% of the controls had a current Axis I DSM-IV diagnosis ($p = .03$). Overrepresented in epilepsy versus controls were current major depression (16% vs. 0%) and lifetime-to-date ADHD (24% vs. 6.3%). 36% of the children with epilepsy exhibited an Axis I disorder prior to the onset of their first seizure. Cognition: There were no differences in IQ (approximately 107 for both groups), visual and verbal memory, and language function. Epilepsy patients exhibited significantly poorer attention (CPT), response inhibition (Stroop Interference), aspects of academic achievement (WRAT-3 arithmetic), and speeded cognitive abilities. Volumetrics: There were no significant differences total brain gray and white matter or total CSF. At the onset of epilepsy there are significant neurobehavioral abnormalities, most evident in psychiatric status, with subtle abnormalities in mentation but generally unremarkable brain structure. These findings will provide a baseline with which to track brain growth and cognitive development as well as potential indications of progressive adverse effects of chronic epilepsy.

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J. KATZENSTEIN, L.N. MATHIEU, P.S. FASTENAU, J.K. AUSTIN & D.W. DUNN. Reading Underachievement in Children with Epilepsy.

Children with epilepsy (CWE) underachieve in reading. Many components are necessary to achieve proficiency in reading, including speed of lexical access (LA) and psychomotor speed (PS). This study examined the extent to which LA (Stroop Color and Word trials) and PS (Trails A and B) predict reading achievement in CWE. It was hypothesized that poorer performance on the Stroop tasks and Trails A and B would predict poor reading achievement scores. Participants were 164 children with chronic epilepsy, ages 8-15 years ($M = 11.8$, $SD = 1.8$), 49.1% female, 91.3% Caucasian, and of mixed seizure types. CWE were administered the Kaufman Brief Intelligence Test, Woodcock Johnson-Revised Tests of Achievement (WJ-R), Stroop Color and Word trials, and Trails A and B. Mean IQ was 93.9 ($SD = 14.9$). Hierarchical regression analyses found that when controlling for IQ, the Stroop Word

trial significantly predicted reading achievement (as measured by the WJ-R), partial $r = 0.45$, $t(158) = 6.10$, $p < 0.0001$, in addition the Color trial did as well, partial $r = 0.19$, $t(157) = -2.04$, $p < 0.006$. Examination of the regression model indicated that the Stroop Word task accounted for 7.1% of the variance. The Stroop Color task accounted for an additional 1.4%. Trails A and B did not account for additional variance. Findings indicated that Stroop Color and Word trials significantly predict reading underachievement. Quickly accessing a lexicon might be problematic for CWE and therefore underlie the difficulty they have with reading in the classroom. This research was funded by a grant to Joan K. Austin from NIH/NINR R01 NR 04536-01

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P.S. FASTENAU, J. SHEN, D.W. DUNN & J.K. AUSTIN. Academic Achievement Among Children with Epilepsy: Rates of Learning Disability and Relationship to Seizure Variables.

Academic underachievement is common among children with epilepsy, but the proportion meeting criteria for learning disability (LD) is unknown. Children with epilepsy ($N = 173$, ages 8-15 years; 49% female, 91% White/Non-Hispanic; 79% one seizure type, 79% on one medication, 69% with active seizures) completed standardized individual academic achievement and IQ testing. Children with mental retardation were excluded. A total of 48% of children met psychometric criteria (one standard deviation discrepancy from IQ) in at least one academic area (13% reading, 20% math, 38% writing). Seizure variables (seizure control, seizure type, medication status, duration of disorder, or age of onset) yielded little information for reliably identifying children with LD. These findings demonstrate that all children with epilepsy are vulnerable to LD, regardless of seizure characteristics. A diagnosis of epilepsy (even with controlled seizures and "benign" seizure types) should provide sufficient cause to screen for learning disabilities.

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Epilepsy

J.I. BREIER, E.M. CASTILLO, P.G. SIMOS, E. PATARAIA, R.L. BILLINGSLEY-MARSHALL, J.W. WHELESS & A.C. PAPANICOLAOU. Atypical Language Representation in Patients With Chronic Seizure Disorder and Academic Achievement Deficits Using Magnetoencephalography.

To determine the relation between patterns of activation of cortical areas involved in reading and spelling and academic achievement in patients with chronic seizures. Patients (ages 9 to 52, $M = 25$, $SD = 12$) with left hemisphere seizure onset were identified as reading-spelling-arithmetic deficient (RSA: $n = 18$) or not impaired (NI: $n = 37$) based on standard tests (< 31 st %ile, mean < 26 th %ile on WRAT - III or WJ - III). All underwent functional mapping of language cortex using magnetoencephalography during a word recognition task as part of a pre-operative evaluation. The degree of language-specific activation (number of dipoles after the N1m resolution) in posterior superior temporal and inferior parietal areas and the onset latency of this activation were determined for each hemisphere. ANCOVA, with PIQ and age as covariates, was used to evaluate group differences on these measures. The RSA group exhibited a relative increase in degree, $F(1,51) = 7.63$, $p < .008$, and decrease in latency of onset, $F(1,48) = 5.63$, $p < .02$, of activation in these areas in the right hemisphere compared to the NI group. Results provide evidence for neurophysiological abnormality in left hemisphere areas involved in acquisition of literacy skills in RSA patients,

and are consistent with some degree of reorganization of language function to the right hemisphere in this group that is less efficient in supporting reading and spelling than homotopic areas of the left hemisphere. The proximity of areas involved in calculation and language may help account for the overlap of deficits.

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T. NEAL, P.S. FASTENAU, K.E. JOHNSON, D.W. DUNN & J.K. AUSTIN. Effects of Duration of Disorder and Seizure Control Status on Objective Neuropsychological Performance versus Subjective Self-Appraisal in Children with Epilepsy across Six Cognitive Domains.

Hufford et al. (2000) found more inaccurate self-appraisal of cognitive abilities in children with chronic vs. recent-onset epilepsy, but it was unclear if that reflected sampling bias. Examining duration within a single sample, this study tested the hypothesis that objective measures would be lower in children with longer duration, especially for children with persistent seizures, whereas subjective measures would be equal across groups. A 2x2x2 mixed Analysis of Variance (ANOVA) evaluated main effects and interactions among measures (subjective vs. objective), seizure duration (<6.3 vs. >6.4 years), and seizure control (active vs. controlled) for each of six cognitive domains. Participants (N=47) were ages 13-15 years (M=14.2;SD=0.7); 55.3% were female. Duration of disorder ranged 0.6 - 13.6 years (M=7.0;SD=4.5), and 66% had active seizures. Children completed the Subjective Awareness of Neuropsychological Deficits for Children (SAND-C; subjective measure) and a neuropsychological test (objective measure) for each cognitive domain. There was a main effect for Measure on executive/attention, $F(1,43)=24.39$, $p<0.01$, impulse control/carefulness, $F(1,43)=18.85$, $p<0.01$, and psychomotor ability domains, $F(1,43)=19.40$, $p<0.01$, with subjective appraisals being higher than objective scores. A Measure x Duration x Seizure Control interaction was observed on psychomotor ability only, $F(1,43)=5.04$, $p<0.05$. Children with epilepsy tended to overestimate their cognitive abilities. Those with longer duration and active seizures, in particular, showed a pronounced subjective-objective discrepancy for psychomotor skills. The higher self-appraisal might reflect lack of awareness or perhaps denial of cognitive deficits, and this might be greater with duration for some cognitive domains. [Funding: NIH/NINR #NR04536 (J.K.A.), UROP (T.J.M.)]

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T.L. BEST, C.P. LEE & D.W. LORING. Relationship Between Hemisphere of Seizure Surgery and Performance on the Wechsler Scales.

Although mild declines in confrontational naming and verbal memory have been reported following left anterior temporal lobectomy (ATL), general intellectual functions typically show no change or small improvements. However, there have been few studies in the modern surgical era comparing pre- to post-operative changes on the Wechsler Adult Intelligence Scale (WAIS). Thus, we revisit this issue by examining WAIS-R/WAIS-III performance in 182 patients who had either left or right ATLs for medically refractory epilepsy. 104 left ATL and 78 right ATL patients (98 females, 84 males; mean age 31.9) were administered the WAIS-R or WAIS-III before and after surgery (mean follow-up = 13 months) as part of a comprehensive neuropsychological examination. Although the magnitude of change was small, there were significant improvements in both groups after surgery on Digit Span, Picture Completion, Digit Symbol, Working Memory Index, PIQ, and FSIQ. Left ATLs showed significantly lower scores on Information after surgery. Neither group displayed significant postoperative changes on the remaining indexes or subtests. Furthermore, Left ATLs obtained lower

scores than Right ATLs both before and after surgery on Information, Similarities, VCI, VIQ, and FSIQ. These data suggest the small improvements obtained in IQ scores among ATL patients may be secondary to enhanced attention, concentration, and mental processing speed following surgery. These small general improvements may be related to factors such as reduced seizure frequency, cessation of subthreshold interictal discharges, changes in dose of antiepileptic drugs, or practice effects.

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M.A. CARSWELL & P.J. MOBERG. Meta-analysis of Olfactory Functions in Surgical and Non-surgical Epilepsy Patients.

Although studies have addressed the relationship between epilepsy and olfactory function, a number of controversies exist with regard to domains affected and patient characteristics involved. To probe these controversies quantitatively, we employed meta-analytic procedures to examine differences between surgical and non-surgical epilepsy patients on tests of odor identification, detection threshold, discrimination, memory, and recognition threshold. Moderator variables included gender, age, seizure focus, surgical status, and smoking history. Results indicated that across all olfactory domains, abilities in surgical and non-surgical epilepsy patients were significantly impaired ($d_s=-1.13$, $CI=-1.21<d<-1.05$), but that as expected this effect was inconsistent ($Q[73]=385.8$, $p<0.001$). Moderator variable analysis revealed that effect sizes were larger on tests of odor identification relative to discrimination, memory, or detection threshold tasks, and roughly comparable to that of recognition threshold. Post-hoc contrasts revealed more significant impairment in the right temporal lobe epilepsy (TLE) patients compared to left TLE, left temporal lobectomy, mixed temporal lobectomy, and frontal lobectomy patients. Unirhinal odor presentation was associated with more significant olfactory impairment compared to birhinal presentation within the epilepsy group and larger effects in right nostril odor presentation were identified. Greater olfactory deficits were also observed in studies with more males, younger patients, and positive smoking status among patients. These findings support a marked deficit in olfactory function in surgical and non-surgical epilepsy patients across all olfactory domains with the greatest impairment observed in right TLE patients and in right nostril presentation of stimuli. These data suggest greater dependence of olfactory function on right hemisphere brain structures.

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P. PRAMATARIS, L. NAKHUTINA, C. ZAROFF & W. BARR. Reliability and Validity of a Three-Category Semantic Fluency Task in Partial Epilepsy Patients.

The three-category semantic fluency task (composed of animals, fruits, and vegetables) is commonly-used in neuropsychological evaluations of patients with dementia. We investigated the reliability and validity of this task as used in evaluation of patients with partial epilepsy. The sample consisted of 192 individuals (88 males; 173 right handed and 18 left handed) undergoing inpatient evaluations with VEEG. Internal reliability of the three category task was found to be acceptable (mean Cronbachs alpha = .812). The validity for identifying lateralized dysfunction was examined by drawing a smaller sample of patients whose pathology was localized to one hemisphere (27 right hemisphere, 29 left hemisphere). Within this sample, there were significant differences in overall performance between the two groups (left vs. right hemisphere) in the animal category ($t=2.359$, $p=.022$) and near significant differences with the sum all 3 categories ($t=1.935$, $p=.058$). There was no difference of performance between the two diagnostic groups within the fruit ($t=.990$, $p=.327$) and vegetable ($t=.904$, $p=.370$) categories. Sub-

sequent stepwise discriminant functional analysis revealed that, of the three individual categories and the sum of the categories, only animals predicted laterality of pathology ($\Lambda=.907$; r canonical=.306). The data suggests that the animals category alone produces more accurate information for lateralization of cerebral dysfunction than the three categories taken together. The findings raise questions about the utility of using the three category semantic fluency task in evaluations of patients with partial epilepsy.

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J.E. JONES, B. HERMANN, J.L. WOODARD, J.J. BARRY, F.G. GILLIAM, A.M. KANNER & K.J. MEADOR. Screening for Major Depression in Epilepsy Using Common Self-Report Depression Inventories.

Major depression is a common interictal psychiatric disorder in chronic epilepsy, frequently under-recognized, with lifetime-to-date rates approximating 30%. The purpose of this investigation was to determine the ability of commonly used depression inventories to screen for major depression in epilepsy. Individuals with epilepsy, regardless of seizure type, were recruited from epilepsy centers at five universities. Inclusion criteria included: 18+ years of age, treated only with medications (excluding surgery and VNS patients), and on stable medications for 30 days. 174 individuals met all selection criteria. Trained investigators at each site interviewed subjects with the Mini International Neuropsychiatric Interview (MINI) to identify current DSM-IV Axis I disorders, and the Mood Disorders module of the Structured Clinical Interview for DSM-IV Axis I Disorders-Research Version (SCID-I) to identify lifetime-to-date and current DSM-IV Axis I mood disorders. Patients completed the Beck Depression Inventory-2 (BDI-2) and the Center for Epidemiological Studies-Depression scale (CES-D). ROC analyses were all statistically significant with areas under the curve ranging from .88 to .94 (all $p < .001$). Sensitivities consistently ranged between .84 and .96, and sensitivities consistently exceeded .78. Inspection of positive and negative predictive powers showed that negative predictive value was consistently quite high (exceeded .97 across analyses). There is little probability of major depression when screening scores are below identified cut off points. Positive predictive value was modest for both the BDI-2 and the CES-D, not exceeding .55 for the MINI or SCID. Common self-report measures can be used to screen for major depression in epilepsy. Major depression can be effectively ruled out, but given the modest positive predictive power, subjects scoring above the cut-off point should undergo further screening to confirm the diagnosis of major depression. Correspondence: *Bruce Hermann, PhD, Department of Neurology, University of Wisconsin, 600 N. Highland, Madison, WI 53792. E-mail: jejones@neurology.wisc.edu*

C. PRICE, S. EISENSCHENK, R. GILMORE & D. BOWERS. Circadian Cortisol Rhythms after Right or Left Temporal Lobectomy.

Little is known about circadian cortisol rhythms in post-temporal lobectomy patients relative to non-surgical controls. Based on the hippocampal-glucocorticoid negative feedback theory, we hypothesized that removal of the medial temporal lobe would increase the intrinsic reactivity of the hypothalamo-pituitary-adrenal (HPA) axis as measured by morning and evening cortisol levels. Unilateral anterior temporal lobectomy (ATL) patients ($N=16$) and matched controls ($N=8$) provided saliva at home immediately upon awakening and then one, four, nine, and 11 hours thereafter. These diurnal samples were collected for 3 consecutive days. The right and left ATL groups were matched for seizure onset and time since surgery. All were left language dominant and had nonlesional temporal lobe epilepsy prior to surgery. Analyses were conducted on trapezoid Area Under the Curve (AUC) values and logarithmically transformed mean raw cortisol levels. The three groups were equivalent on total AUC [$F(2,23)=.14$, ns]. However, the R ATL pa-

tients exhibited greater cortisol levels at the final collection time relative to the other groups (Group x Time [$F(8, 80) = 2.53$, $p < .05$]). This finding was confirmed with a group comparison of the evening AUC and a Chi-square analysis reporting more abnormal evening elevations in the R ATL patients relative to the other two groups [R ATL=5/8; L ATL=0/8, Control=2/8, $X^2(2)=7.66$, $p < .05$]. Groups did not differ on measures of depression or anxiety. These data provide preliminary evidence that the normal daily attenuation of the HPA axis, particularly during the evening hours, is altered in the Right ATL patients. There is no evidence of abnormal morning reactivity in the Left for Right ATL patients suggesting that despite removal of HPA axis neuroanatomical structures, the HPA axis retains its normal wake response. The relationship to other markers of emotional reactivity (i.e., startle) will be discussed. Supported by UF Opportunity Fund (DB)

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M.E. WITGERT, J.W. WHELESS & J.I. BREIER. Panic Symptoms in Nonpileptic Seizures.

In the current study we investigate the prevalence of panic symptoms in adults and adolescents with pseudoseizures. If a difference in prevalence exists, it may suggest important implications regarding the diagnosis and treatment of nonepileptic seizures in the different age groups. We identified 21 adolescents and 18 adults referred for video-EEG monitoring on the Epilepsy Monitoring Unit (EMU) of the Texas Comprehensive Epilepsy Program at Memorial Hermann Hospital as a part of a Phase I epilepsy evaluation. All subjects received the diagnosis of nonepileptic seizures based on observations of typical events, scalp electroencephalographic patterns, and event duration; when no EEG correlate was found during the event, a diagnosis of nonepileptic seizure was made. Participants completed a neuropsychological battery and mood and personality screening measures. Results suggest that adults and adolescents with nonepileptic seizures may exhibit differing rates of symptoms associated with anxiety disorder. Adolescents, many of whom were overextended in daily activities, reported significantly more symptoms of panic disorder than adults ($t = 5.98$, $p < .001$). Three adolescents met the full criteria for panic attack, while no adults met these criteria ($\chi^2 = 3.79$, $p < .05$). Approximately one half of the adolescent group reported at least three symptoms of panic disorder, while only one adult reported that many ($\chi^2 = 11.001$, $p < .0009$). In addition, while numerous adults endorsed no panic symptoms associated with their nonepileptic seizure episodes, all adolescents endorsed at least one symptom. These results suggest that the conversion symptoms experienced by adolescents may be more likely to be exhibited in the form of panic attacks. Treating the symptoms of panic disorder could provide alleviation of episodes as well as reduce distress and improve quality of life while sparing the adolescent patient lengthy and costly evaluations as well as unnecessary medications.

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S. TESTA, B.K. SCHEFFT & J.P. SZAFIARSKI. Correlates of Health-related Quality of Life in Epileptic and Psychogenic Nonepileptic Seizures: Mood Symptoms, Personality Factors, and Neurocognitive Functioning.

Individuals with psychogenic nonepileptic seizures (PNES) consistently rate their health-related quality of life (HRQOL) more poorly than those with epileptic seizures (ES). The current study investigated the impact of mood, personality factors, and neurocognitive functioning on the relationship between seizure diagnosis and HRQOL. A parallel goal of the current study was to inform treatment designed to improve HRQOL among individuals with intractable seizures. A total of 114 individuals

(69 ES and 45 PNES) undergoing a comprehensive epilepsy evaluation completed the Quality of Life in Epilepsy-89 questionnaire, measures of current mood state, the Minnesota Multiphasic Personality Inventory-2, and a battery of neuropsychological tests. A series of hierarchical multiple regression analyses were conducted to determine the contribution of current mood state, personality, and neurocognitive functioning to HRQOL above and beyond seizure diagnosis in order to explain the reported between-group differences. Similar to previous studies, individuals with PNES reported poorer HRQOL than those with ES. Additionally, current mood state was strongly related to HRQOL and appeared to moderate the relationship between seizure diagnosis and HRQOL. However, when somatization and more chronic aspects of psychological distress were added to the model, the moderating role of current mood state no longer remained significant. Moreover, somatization and psychological distress were significantly related to HRQOL. Relationships between neurocognitive functioning and HRQOL were not detected. While current mood state accounted for a significant portion of HRQOL, treatments designed to improve HRQOL among individuals with intractable seizures should also address chronic psychological distress and mechanisms of coping.

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M.F. DULAY, M.K. YORK, E.M. SOETY, W.J. HAMILTON, I.L. GOLDSMITH, E.M. MIZRAHI, A. VERMA, R.G. GROSSMAN, D. YOSHOR & H.S. LEVIN. Relationship Between Memory and Depression After Anterior Temporal Lobectomy.

Severity of depression is inversely correlated with neuropsychological test performance in medically intractable epilepsy patients, and depression is the most common psychiatric disorder in patients with temporal lobe epilepsy (TLE) before and after seizure surgery. In patients who undergo an anterior temporal lobectomy (ATL) for their seizure disorder, decreases in memory scores have been reported following surgery, especially following left-sided procedures. To test whether the relationship between depression and memory continues to exist after ATL, we characterized the nature and extent of pre- and post-surgical mood changes (MMPI-2 Depression subscale), as well as changes in verbal and visual memory (e.g., Verbal and Nonverbal Selective Reminding Tests), in 57 right-handed patients who underwent ATL (22 left- and 35 right-sided procedures) for medically intractable complex partial seizures. Patients were tested before surgery and an average of six months after surgery. Results indicated that (a) 23% of the patients had clinically significant levels of depressive symptoms after surgery compared with 37% preoperatively, (b) 69% of the patients with significant postoperative depression also had measurable depression before ATL, (c) both pre- and post-operative depression were inversely correlated with scores on memory tests, even after controlling for seizure outcome, (d) depressive symptoms interacted with side of surgery (e.g., depressed right-ATL patients performed poorest on visual memory tests compared with non-depressed left- or right-ATL or depressed left-ATL patients, omnibus $F(3,49)=4.60$, $p<0.05$), and (e) depressive symptoms were related to type of underlying pathology pre-surgery but not post-surgery. Our findings highlight the clinical impact of depression on the cognitive performance of TLE patients, both before and after surgery.

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M.F. DULAY, J.D. FARGO & B.K. SCHEFFT. Contribution of Frontal Lobe Functions to Episodic Memory in Medically Intractable Epilepsy.

Research suggests that impaired frontal lobe functioning may disrupt memory encoding, storage and/or retrieval processes. The relative explanatory power of different frontal lobe functions in accounting for

memory test performance was evaluated in 291 individuals with medically intractable unilateral left or right temporal lobe epilepsy (LTLE, $n = 126$; RTLE, $n = 106$) and unilateral left or right frontal lobe epilepsy (LFLE, $n = 37$; RFLE, $n = 22$). Patients with video-EEG defined seizures completed measures of attention (WMS-III Letter-Number Sequencing and Spatial Span; WAIS-R ACDQ), executive functioning (WCST; Stroop Color and Word Test; Trails B), and verbal (Denman Story) and visual (Benton Visual Retention Test; Warrington's Recognition Memory Test) memory. ANOVA showed that LTLE patients performed significantly poorer on verbal memory tests compared with RTLE patients (Tukey post hoc p value $< .05$). No other group differences were found on the memory tests with mean performances in Below Average ranges compared to normative data. Hierarchical regression analysis, controlling for overall IQ, indicated that the predictive power of different frontal lobe functions was moderated by site of seizure onset and type of memory test (visual or auditory). For example, poorer visual working memory ($p = .003$), response inhibition difficulties ($p < .001$), and a perseverative response style ($p = .037$) collectively accounted for 38% of the variance in poorer visual recall test performance in individuals with LTLE. Results are consonant with the hypothesis that memory processes can be disrupted by impaired frontal lobe functioning.

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I.S. ASHABO, R.M. BUSCH, H.D. STOTT, R.I. NAUGLE, L.M. GARVEY, I. NAJM & W. BINGAMAN. The Impact of Depression and Anxiety on Pre- and Post-Surgical Memory Functioning in Adults with Temporal Lobe Epilepsy.

Patients with temporal lobe epilepsy (TLE) have been found to have higher rates of depression and anxiety than patients with other forms of epilepsy. Depression and anxiety are known to impact memory performance. The purpose of this study was to investigate the impact of depression and anxiety on memory functioning in pre- and postsurgical patients with TLE. This study employed a retrospective analysis of 100 adults with intractable TLE who were seen for presurgical neuropsychological evaluations. Patients were also seen approximately six months after surgery. Data from patients with invalid PAI profiles either pre- or postsurgically were excluded, resulting in a sample of 72 presurgical patients and 66 postsurgical patients. Depression and anxiety were assessed using the Personality Assessment Inventory. The Wechsler Memory Scale, Third Edition was used to assess immediate and delayed verbal and visual memory. Six MANOVAs evaluated the relationships between pre- and postsurgical depression and anxiety scores and pre- and postsurgical memory scores. The results of this study suggest that depression and anxiety scores are indeed related to memory performance in patients with TLE. Anxiety appears to have a greater impact on memory performance than depression. Patients with high presurgical anxiety subscale scores had significantly lower memory performance on all presurgical memory indices than non-anxious patients, whereas patients with high presurgical depression scores only demonstrated greater difficulty than non-depressed patients on auditory immediate memory presurgically. Presurgical anxiety was also related to postsurgical visual memory scores, whereas presurgical depression scores were unrelated to postsurgical memory. This suggests that preoperative assessment of anxiety may provide prognostic information about memory changes postsurgically. Unexpectedly, postsurgical depression and anxiety scores were unrelated to postsurgical memory.

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J. PARRISH, M. SEIDENBERG, S. SWANSON, D. SABSEVITZ, B. HERMANN, B. BELL & A. HALTINER. **Recognition and Identification of Famous Faces Following Anterior Temporal Lobectomy.** Face identification is generally acknowledged to be composed of distinct component processes. Investigation of patients with lateralized brain damage, such as unilateral temporal lobe epilepsy (TLE) provides an opportunity to study the relative contribution of right and left hemisphere systems to these component processes. We previously reported dissociable patterns of impairment in famous face recognition, semantic identification (i.e., reasons for fame), and naming among patients with chronic left and right unilateral TLE. Left TLE patients showed intact face recognition and semantic identification ability but pronounced impairment in naming famous faces. In contrast, the right TLE patients were impaired on all three component processes (i.e., recognition, semantic identification, and naming). We examined these same TLE patients (10 rights, 9 lefts) following anterior temporal lobectomy (ATL), to determine the added impact of resection of lateralized temporal neocortex and mesial temporal lobe structures on the component process of famous face identification. Right ATL patients showed a greater pre-post surgery decline in famous face recognition, while the left ATL patients showed a greater decline in naming of famous faces. Furthermore, of those famous faces named pre-surgery but no longer named following surgery, the left ATL group was able to provide more semantic details than the right ATL group. In summary, while patient with chronic left and right TLE exhibit dissociable abnormalities in component processes of famous face identification, subsequent resection of left or right anterior temporal neocortex and mesial structures results in further lateralization-specific alteration in famous face identification.

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L. NAKHUTINA, P. PRAMATARIS, C. ZAROFF & W. BARR. **Three-Year Test-Retest Reliability and RCI Values for Memory Indices for Temporal Lobe Epilepsy.**

The Rey-Osterrieth Complex Figure (ROCF) and California Verbal Learning Test (CVLT) are two commonly used neuropsychological measures in evaluating post-surgical memory outcome in epilepsy patients. Previous studies reported test-retest norms from non-surgical epilepsy samples retested in less than 1 year. Practice shows that many patients undergo reevaluation after a more extended time, however no norms are available to evaluate their outcome. We assessed test-retest performance on the ROCF and the CVLT in a sample of epilepsy patients undergoing testing on two occasions (mean interval = 34.4 months) in order to derive reliable change indices (RCI) and regression-based norms. Diagnoses were made according to clinical symptomatology and EEG findings. None of the patients had undergone surgery. All were maintained on stable doses of antiepileptic drugs. None had a progressive neurological or psychiatric disorder. Due to restricted range on the ROCF Copy score, the reliability coefficient was reduced and would not yield accurate norms. The derived adjusted RC (90%) cutoff values for ROCF Delayed Recall were (≤ 11 , ≥ 12). Based on 24 patients with CVLT data, RCIs for CVLT Total were ≤ 10 , ≥ 13 , and for Long Delay Free Recall ≤ 3 , ≥ 5 . Additional findings were obtained from regression-based analyses including age, education, seizure duration, age of onset, and a baseline score in a step-wise procedure. The results will provide a means to evaluate outcome in patients undergoing studies of long term memory outcome. N/A

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F. WINSTANLEY, P.C. LEBBY, M. CANFIELD, D.I. TEMPLER & J.A. WALKER. **Post-Operative Verbal Memory and Language Impairment in Left Anterior Temporal Lobectomy patients with a Reversed and Expected Wada Memory Asymmetry Score: Examining Reliable Change Indices.**

To compare group means between Reversed and Expected Wada Memory Asymmetry patients across a variety of Neuropsychological measures to determine if there is an increased risk for cognitive decline for the expected group. It is hypothesized that there will be significant differences between groups on all measures, and that the reversed group will perform significantly worse relative to the expected group and as determined by Reliable Change Indices (RCIs) 72 consecutive patients undergoing anterior temporal lobectomy at UCSF medical center b/w 1986 and 2003. Inclusion criteria: Left language dom./ L-ATL; complete neuropsychological data at pre/3mo. post-operative periods; complete/valid Wada test; FSIQ >69 . A one-way MANCOVA with WMA as the independent variable (Reversed and Expected). Dep.Var.= subtests of the RAVLT(Sum of trials 1-5; Trial 6; and Recognition)and the BNT, all at the 3 month post-operative period as the dependent variables, and the pre-operative scores as the covariate. There were significant differences between Reversed and Expected WMA patients on all neuropsych. tests (all at $p < .01$ level) However, Reliable Change Indices for all verbal memory measures indicated that neither group had a significant decline post-operatively on any verbal memory test. Post-operative decline on the Boston Naming Test was the only significant decline as determined by RCI scores, and both groups experienced this decline. The results of the study show that although statistically Reversed WMA patients are at an increased risk for verbal memory and language impairment, the overall decline itself is not significant when using RCIs. Further, the correlation between impairment on the BNT and post-operative verbal memory decline illustrates a possible language confound which can impair verbal memory abilities. This is useful information for epilepsy clinics when consulting a patient as to have surgery or not based on the results of Wada Memory Testing.

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K. BAYLESS, R. HANSEN, B.P. HERMANN & M. SEIDENBERG. **A Quantitative MRI Study of Cerebellar Atrophy in Temporal Lobe Epilepsy.**

Cerebellar atrophy (CA) is a recognized neuroradiological abnormality associated with chronic epilepsy. Only a small number of studies of have used quantitative MRI techniques to address this issue. This study used quantitative MRI volumetrics to characterize the degree of CA in chronic temporal lobe epilepsy (TLE), determine the role of several potential etiological factors, and identify the neuropsychological correlates of CA. 78 patients with TLE and 63 age- and gender-matched controls underwent high-resolution MRI with manual tracing of the cerebellum. Cerebellar volumes were examined in relation to clinical seizure variables and selected cognitive domains (IQ, memory, motor dexterity). Corrected cerebellar volumes (ICV) were significantly smaller (3.9%) in the TLE group ($p=.016$). A significantly greater proportion of TLE patients exhibited CA (3.4% of controls vs. 22% of TLE patients, $p=.031$). CA in TLE was associated with an increased number of lifetime generalized tonic-clonic (GTC) seizures ($p=.021$) and history of an initial precipitating injury ($p=.036$). Not significantly associated with CA were frequency of complex partial seizures, polytherapy, and percent of duration of epilepsy taking PHT. There was a trend of greater age-associated loss of cerebellar volume in TLE ($r = -.45$, $p<.001$) compared to controls ($r = -.22$, $p=.09$). CA was associated with significantly lower Performance IQ ($p=.04$) and speeded fine motor dexterity ($p<.003$) in TLE participants. CA is evident in a sizeable minority of patients with chronic TLE and appears to be related to factors

associated with both the cause and course of the disorder (i.e., presence of an initial precipitating injury and number of lifetime GTC seizures). These findings appear consistent with a "two-hit" model, involving both neurodevelopmental and course factors. Future research into the specific cerebellar regions affected by atrophy may help us to better understand the etiology and consequences of this disorder.

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T.E. SITZER, B.W. JASPER, S. EISENSCHENK, S.N. ROPER & A.B. MOORE. Herpes Zoster and Epilepsy: A Neuropsychological Case Report.

Herpes zoster is typically regarded as a relatively benign disease in healthy adults. However, this virus can lead to more serious outcomes including encephalopathy. A single case study is used to explore the neurocognitive profile of a patient with epilepsy possibly subsequent to a diagnosis of herpes zoster. We present data from an outpatient evaluation of a 65-year-old right-handed man with a history of herpes zoster in the left facial distribution with subsequent seizures, who was followed by a multidisciplinary team for intractable epilepsy. The patient underwent a comprehensive neuropsychological evaluation, which included general mental status examinations using the MMSE, RBANS, and Dementia Rating Scale-II, examination of linguistic abilities using Controlled Oral Word Association, verbal fluency, and the Boston Naming Test, assessment of visual memory and learning as measured by the BVMT-R, and appraisal of mood. Both functional (PET) and structural (MRI) neuroimaging studies failed to reveal abnormalities. However, EEG monitoring indicated seizure activity in the left temporal lobe. Results of the neuropsychological evaluation revealed impaired verbal and visual recall and recognition, as well as impaired verbal fluency. Attention, visuospatial skills, and confrontation naming were intact. Neuropsychological findings were consistent with EEG results implicating temporal lobe involvement but also indicated frontal involvement. This is a case example of a traditionally minor illness that likely resulted in significant neurological complications (e.g., intractable epilepsy). Often the etiology of epilepsy is unknown, yet these data are consistent with a small but growing body of literature that is beginning to implicate viral infections.

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Medical Illness

M.P. KELLY. Time Course of Neuropsychological Recovery with CPAP Treatment.

Previous research has suggested that Obstructive Sleep Apnea (OSA) results in impaired neuropsychological functioning, and that treatment with Continuous Positive Airway Pressure (CPAP) leads to improved neuropsychological performance. Studies to date have generally followed patients for a maximum of six months of treatment, and most indicate some degree of neuropsychological impairment after six months of CPAP. Information regarding the potential for recovery beyond six months of treatment would be useful for clinical decision-making and design of clinical trials. The objective of the present clinical case study is to describe the time course of neuropsychological recovery over one year of CPAP treatment. The subject/patient is a 40 year-old right-handed male who was referred for neuropsychological evaluation after performing below expected levels in graduate level course work. Concurrent with initial neuropsychological evaluation the patient underwent a sleep study

that was consistent with OSA. This paper is based on a single case study methodology reporting results of comprehensive neuropsychological assessment shortly before CPAP, with follow-up assessment at approximately four months and twelve months post-treatment. Baseline assessment revealed impaired performance in multiple domains including general intellectual functioning, attention, learning, memory, executive functioning, and dexterity. Assessment at four months post-CPAP revealed modestly improved performance in the attention and memory domains, but with continued impairment in all domains found impaired at baseline assessment. Assessment at 12 months post-CPAP revealed normal neuropsychological functioning. Data from the present case study adds to the literature by suggesting that recovery of neuropsychological functioning may occur for up to one year following CPAP treatment.

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R.O. HOPKINS, J.C. JACKSON & C. WALLACE. Neurocognitive Impairments in ICU Patients with Prolonged Mechanical Ventilation.

Approximately 55,000 patients are treated in ICUs each day. Between 4%-10% of patients require long-term mechanical ventilation (MV; > 5 days), while also consuming 30%-50% of ICU resources. Patients with long term MV days frequently have functional disabilities and require continued family and professional support. Limited information is available regarding neurocognitive outcome in ICU patients requiring MV >5 days, although between 25% and 46% of general ICU survivors (ventilated and non-ventilated) have cognitive deficits. This study will assess neurocognitive outcome following treatment with MV >5 days at hospital discharge and six months post-discharge. We prospectively assessed neurocognitive function in 32 MV patients to determine the prevalence of cognitive sequelae (defined as 2 neuropsychological test scores >1.5 SD or 1 test score >2 SD below the normative population mean). There were 18 females and 14 males, with a mean age of 53 ± 20 years (range 18 to 81 years) and a mean education level of 13 ± 2 years (range 9 to 17 years). The mean ICU length of stay was 16 ± 19 days, with a mean duration of MV of 10 ± 19 days. Ninety-one percent of survivors of long-term MV (29/32) had cognitive sequelae at hospital discharge and 41% (13/32) had cognitive sequelae at 6-months. 7 patients (22%) had mild to moderate symptoms of depression at hospital discharge, compared with 4 patients (14%) at 6-months. Patients on prolonged mechanical ventilation have high rates of cognitive sequelae that persists at least 6 months post-hospital discharge.

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M.E. ZIMMERMAN, J. ARNETT, M. STANCHINA, R.P. MILLMAN & M.S. ALOIA. Intermittent Hypoxemia and Learning and Memory in Sleep Apnea.

Obstructive sleep apnea (OSA) is a sleep disorder characterized by chronically fragmented sleep and intermittent desaturations in arterial oxygen, or hypoxemia. Cognitive impairments reported in individuals with OSA have been linked to both sleep fragmentation and hypoxemia. However, little is known about the independent contribution of hypoxemia to learning and memory in OSA. Forty-two participants (24 men, 18 women) diagnosed with OSA were individually pair-matched on RDI, BMI, age, gender, estimated verbal IQ (AMNART), and education into two groups that differed only on the severity of hypoxemia. All participants were administered tasks of verbal (HVLT-R) and nonverbal (BVMT-R) learning and memory. Independent t-test analyses revealed significant group differences on HVLT-R learning trials 1-3, immediate recall, and delayed recall ($t = -2.00$ to -2.13 , $p < 0.05$ to 0.00). No significant group differences were demonstrated in performance on the BVMT-R. Calculation of T-scores for HVLT-R based on published nor-

mative data revealed that the high hypoxemia group performed in the average range while the low hypoxemia group was in the below average range. The findings of the current study suggest that OSA hypoxemic individuals appear to demonstrate relatively improved performance on a test of verbal learning and memory despite stringent matching on extraneous variables. These findings are contrary to expectations. The mechanism by which a lack the hypoxemic group performs better remains unclear. It is speculated that individuals with more severe hypoxemia may develop compensatory strategies at the cellular level, similar to that seen in some individuals with cardiac disease (pre-conditioning).

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M.E. ZIMMERMAN, J. ARNETT, M. STANCHINA, R.P. MILLMAN & M.S. ALOIA. Neuropsychological Functioning in Sleep Apnea.

Reports in the existing literature of neuropsychological dysfunction in obstructive sleep apnea (OSA) have been mixed. Inconsistencies in findings may be due to utilization of experimental neuropsychological assessments and inadequate control groups. The present investigation sought to examine the impairment profile of a large, well-characterized, never-treated group of individuals with OSA using standardized tests and published normative data. One-hundred and eighty-six (122 males and 64 females) participants diagnosed with OSA on polysomnography were consecutively recruited for a study examining the efficacy of Continuous Positive Airway Pressure (CPAP) treatment. Participants were administered a comprehensive neuropsychological battery (ANART, TMT, COWA, Letter-Number Sequencing, PASAT, Grooved Pegboard, HVLT-R, and BVM-T-R) prior to receiving treatment for OSA. Test results of each participant were converted to standardized T-scores based on published normative data. Descriptive group statistics revealed well-developed cognitive abilities in the average range across multiple domains with the exception of impaired performance on tests of psychomotor speed and verbal memory recognition. Since a large portion of the group scored in the high average or better range on the ANART, we examined the impairment profile of those within the average range separately. Those 98 individuals showed a more severe impairment profile, with deficits in the above domains, as well as in verbal learning and recall, and nonverbal memory recognition. These findings provide support for the presence of neuropsychological impairments in never-treated individuals with OSA that may differ as a function of premorbid verbal IQ. Specifically, deficits were demonstrated in the cognitive domains of psychomotor functioning and verbal and nonverbal memory. The biological mechanisms of these impairments, as well as the neuropsychological sequelae of treatment adherence, are discussed.

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D. CRAGAR, J.F. MALEC & P.D. BROWN. Comprehensive Neuropsychological Evaluation in Patients with Primary Brain Tumors and Subjective Cognitive Complaints.

To investigate via retrospective review, neuropsychometric test performances in a sample of primary brain tumor patients with subjective cognitive complaints. It is hypothesized that patients will differ based on tumor lateralization (right vs. left), localization (frontal vs. temporal), grade (low vs. high), and treatment timing (pre vs. post). Participants included 98 consecutive patients referred for comprehensive neuropsychometric evaluation based on subjective cognitive complaints thought to be associated with their brain tumor or its treatment. Patients with frontal tumors performed significantly worse than those with temporal tumors on the perceptual-organization index of the WAIS-III (POI = 92 vs. 104; $t = 3.39$, $p = .001$) and the WCST (Categories com-

pleted = 4.4 vs. 5.4; $t = 2.01$, $p = .05$). Patients with left hemisphere or midline tumors performed worse than patients with right hemisphere tumors on total learning on the AVLT (Total = 37 vs. 38 vs. 47, $F = 4.853$, $p = .01$). Patients with left hemisphere tumors performed worse on the BNT than patients with right hemisphere or midline tumors (Total = 44 vs. 51 vs. 51; $F = 4.156$, $p = .02$). There were no significant differences between patients with low vs. high grade tumors or between patients who were pre treatment vs. post treatment. Brain tumor patients who report subjective changes in cognitive functioning show specific profiles of cognitive impairment on an objective battery of neurocognitive testing consistent with tumor localization and lateralization, but not based on tumor grade or treatment timing.

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R.L. COLLINS, S. LIPPMAN & C.A. MEYERS. The Effects of Interferon-alpha and 13-cis Retinoic Acid on the Cognitive Function of Adults with Aggressive Squamous Cell Carcinoma.

Interferon alpha (IFN) and 13-cis retinoic acid (CRA) are currently used in combination for the treatment of advanced squamous cell carcinoma (SCC). While CRA is not usually associated with significant dose-limiting side effects, IFN has been consistently associated with the induction of depression. Moreover, treatment with IFN may be related to cognitive impairment, with some investigators demonstrating impairments in memory, executive functioning, and verbal fluency. The purpose of the present study was to more fully characterize the effects of IFN on mood and cognitive functioning in a sample of 54 patients with advanced SCC. Following baseline neuropsychological assessment, patients were randomized to IFN + CRA or observation and underwent follow-up assessment after 3 months treatment. It was predicted that patients undergoing treatment would evidence declines in verbal memory, executive functioning, and verbal fluency, and demonstrate increased depression symptoms and decreased quality of life relative to patients randomized to observation. Small differences were demonstrated following 3-months of treatment across domains of verbal fluency and executive functioning. Increases in depressive symptoms and a greater endorsement of general cancer concerns were also noted following IFN treatment. No differences were found on additional measures of cognitive functioning. Effect sizes were small, though nearly all cognitive measures were in a pattern consistent with IFN + CRA either impairing performance, or suppressing practice effects, relative to patients in the observation condition. The sum of the effects suggest diffuse but meaningful alterations in functioning (cognitive and mood) and are generally consistent with frontal-subcortical dysfunction.

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T.E. SITZER, L. RENTERIA & D.E. DEDE. Neuropsychological Presentation of a Third Ventricle Tumor.

Third ventricle tumors are extremely rare and very little literature exists that characterizes cognitive test performance in afflicted individuals. This case study is intended to inform about the neuropsychological presentation of such a patient. The patient is a 20-year-old Caucasian male with 12 years of education who was assessed prior to surgical intervention. He presented with complaints of short-term memory loss as well as personality change. Neuroimaging confirmed that there was a mass fully obstructing the anterior third ventricle and part of the right lateral ventricle. The mass was found to arise from the wall of the third ventricle and suspected to be astrocytoma in etiology. The test battery consisted of the Mini Mental Status Examination, Repeatable Battery for the Assessment of Neuropsychological Status, Peabody Picture Vocabulary Test 3rd Edition, Trail Making Test, and Luria motor/written

sequencing tasks. The patient's performance on measures of receptive language and working memory were intact. Confrontational naming was in the Low Average range. On tests of memory, the patient was unable to benefit from repeated learning trials or recognition cues. He was also unable to retain information after immediate and delayed recall trials and was confabulatory in his responses. His constructional and perceptual abilities were severely impaired as was his ability to shift and sustain attention. On the sequencing tasks, he displayed extremely perseverative behavior and was stimulus bound. Patients with third ventricle tumors appear to be at risk for developing impairments in long-term memory and executive function, which are domains associated with frontal subcortical functions.

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A.F. STEWART, C.H. BIELAJEW, M. PARKINSON, B. COLLINS & E. TOMIAK. Cognitive Difficulties among Breast Cancer Survivors following Adjuvant Chemotherapy: A Meta-Analysis.

Given the improvement in mortality rates associated with breast cancer, the importance of understanding the long-term neuropsychological consequences of chemotherapy is becoming increasingly vital. This study applies meta-analytic techniques to the scant literature on the relationship between contemporary adjuvant chemotherapy treatment for breast cancer and cognitive dysfunction as examined through neuropsychological indices. Five studies were found from 212 potential articles, based on three inclusion criteria - breast cancer, chemotherapy, and neuropsychological tests. Treatment-control comparisons were used to generate 41 Hedge's d effect sizes across eight cognitive domains: simple attention, working memory, short-term memory, long-term memory, speed of processing, language, spatial abilities, and motor abilities. Statistically significant effect sizes, showing diminished cognitive function for chemotherapy treatment groups compared to control groups were obtained for all cognitive domains with the exception of simple attention, and are as follows: working memory ($d=-.27$), short-term memory ($d=-.27$), long-term memory ($d=-.33$), speed of processing ($d=-.30$), language ($d=-.44$), spatial abilities ($d=-.38$), and motor abilities ($d=-.40$). Overall, these results suggest that women who undergo adjuvant chemotherapy as treatment for breast cancer are at mild to moderate risk for cognitive decline. These findings are exploratory given that all studies in this meta-analysis were retrospective. A prospective investigation examining the cognitive effects following chemotherapy among women with early stage breast cancer is underway.

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R. RIGGS, C. ANDERSON-HANLEY, P. O'BRIEN, H. MUSS & B. COMPAS. Neuropsychological Functioning, Fatigue, and Sleep in Breast Cancer Patients.

Many early stage breast cancer patients report changes in cognitive functioning over the course of their treatment. However, not all women demonstrate objective neuropsychological deficits. This study examined the relationships among objective neuropsychological performance, self-reported cognitive functioning, sleep, and fatigue. Four groups of women ($n=53$) were recruited for this study. The groups included: 1) newly diagnosed early stage breast cancer patients receiving radiation only, 2) newly diagnosed early stage breast cancer patients receiving radiation and hormonal therapy only, 3) newly diagnosed early stage breast cancer patients receiving radiation, chemotherapy, and hormonal therapy, and 4) healthy women with no history of cancer. All participants underwent comprehensive neuropsychological assessments at five time points (baseline, mid-treatment, post-treatment, and 3 and 6 months post initial treatment). While no significant differences were found among

the groups at any time point and no significant changes in cognitive functioning were seen in any group over the course of the study, the breast cancer patients did self-report significantly more problems with their cognitive functioning. Furthermore, while these self-reported cognitive complaints were not related to treatment type, depressive symptoms, or anxiety symptoms, the complaints were correlated with severity of self-reported fatigue and sleep disturbance. Self-reported level of fatigue was significantly correlated with self-reported problems with language ($r=.32$), perception ($r=.40$), attention ($r=.44$), practical problems ($r=.31$), and memory ($r=.52$). Furthermore, women who reported changes in their neuropsychological functioning over the course of their cancer treatment were twice as likely to also report sleep disturbances. These data may indicate that disturbed sleep and fatigue play a role in the report of cognitive impairments following treatment for breast cancer.

Correspondence: *Raine Riggs, PhD, Psychiatry, Dartmouth Medical School, DHMC-One Medical Center Drive, NCCC, Rubin Bldg, HB 7927, Lebanon, NH 03756. E-mail: Raine.L.Riggs@Dartmouth.edu*

A. MADAN, C.M. SOURATHATHONE, A.L. MEIDINGER, J.M. MASON, V. ALLEN, K.L. NETSON, B.M. MCGUIRE, A.H. THURSTIN & B.A. BUSH. Verbal Memory Functioning and End Stage Liver Disease: the Consequence of Excessive Alcohol Consumption beyond Hepatic Insufficiency Alone.

Although memory problems are commonly self-reported in end stage liver disease (ESLD), studies implicating verbal memory functioning have been inconsistent. We hypothesized that impairments in verbal memory functioning would be evident across measures, and alcohol-induced (ETOH) and hepatitis C-induced (HCV) ESLD would result in greater impairment relative to other ESLD etiologies, because of the formers' direct effects on CNS functioning. 125 individuals with ESLD, who were primarily middle-aged (51.9 ± 9.6 years), married (74%), European-American (86%) males (52%) with some college education (13.2 ± 2.6 years) and moderately severe ESLD (15.3 ± 6.0 MELD score), comprised three etiologic groups: ETOH, HCV, and OTHER (non-ETOH and non-HCV; e.g., cryptogenic cirrhosis). Performance across measures of verbal memory functioning was compared to normative values and among ESLD etiologies. Based on multiple single sample t -tests with a Bonferroni correction, individuals across ESLD etiologies performed 0.5-1.0 standard deviations below normative values on the California Verbal Learning Test, Second Edition (CVLT-II) and Wechsler Memory Scale, Third Edition (WMS-III). Multivariate analyses of covariance revealed that the ETOH group performed significantly worse than the OTHER group on the CVLT-II Trials 1-5 total score. Findings from this study suggest that: 1) chronic hepatic dysfunction results in subtle verbal memory impairments, regardless of ESLD etiology; and 2) sustained periods of excessive alcohol consumption result in greater impairments in learning and memory than hepatic insufficiency alone. Service providers should be cognizant of these deficits, especially when explaining medical recommendations. Future research should examine possible consequences of the observed impairments (e.g., noncompliance) and whether transplantation improves functioning.

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K.L. NETSON, A. MADAN, J.M. MASON, A.L. MEIDINGER, C.M. SOURATHATHONE, V. ALLEN, B.M. MCGUIRE, A.H. THURSTIN & B.A. BUSH. Memory and Executive Function in Elderly Patients with End-Stage Liver Disease.

Hepatic insufficiency related to end-stage liver disease (ESLD) adversely affects cognitive functioning, and age-related changes in cognitive functioning are well-documented in the general population. We examined whether elderly patients with ESLD exhibited poorer neuropsychological performance than younger patients, hypothesiz-

ing that elderly patients would perform more poorly on measures of executive function, verbal recall, and motor speed. 84 participants completed neuropsychological testing as a standard part of evaluation for liver transplantation. Participants were 42 elderly (age 60-75) and 42 younger (age 35-50) ESLD patients in three etiological categories: alcoholic cirrhosis (ETOH; $n=24$), hepatitis C virus (HCV; $n=30$), and other etiologies (OTHER; $n=30$). Age groups were matched for etiology, gender, education, and alcohol consumption. Disease severity was moderate for all age and etiological groups. Data were analyzed for between-groups differences using MANCOVA. Elderly patients generally demonstrated poorer performance on cognitive set-switching as measured by the Trail Making Test B/A ratio, and an age-by-etiology interaction revealed some variability in this finding across etiological groups, $F(2,77)=5.07$, $p<.01$. Statistically, but not clinically significant age-related differences on measures of verbal fluency ($F(1, 77)=9.99$, $p<.01$) and verbal recognition ($F(1, 77)=4.122$, $p<.05$) emerged. No other significant age-related differences were observed. Elderly ESLD patients at pre-transplant exhibit greater difficulty switching cognitive set than younger patients, however some etiological differences exist. Overall, elderly patients may require greater education and supervision with transplant-related medical regimens. However, age-related neuropsychological factors do not alone prohibit transplantation of elderly patients. Follow-up studies should examine the cognitive outcome of elderly patients post-transplant.

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R.C. HILSABECK, S.R. MOONEY, D.T. STROUD, P. MALEK-AHMADI & E. VARIYAM. Frontal-Subcortical Functioning in Patients with Chronic Hepatitis C and the Effect of Antiviral Therapy.

Chronic hepatitis C (CHC) affects approximately 3 million Americans and is associated with neuropsychiatric symptomatology. On neuropsychological testing, about one-third of persons with CHC demonstrate cognitive difficulties, mainly in frontal-subcortical functions. Preliminary data suggest antiviral therapy with interferon also affects cognitive functioning. The purpose of this study was to explore further the effect of antiviral therapy on cognitive functioning in CHC patients using a more comprehensive battery of tests than prior studies. Participants were nine patients with CHC and three healthy volunteers. Four of the patients had mild fibrosis and three had severe fibrosis. Fibrosis stage was unknown in two patients. Patient and healthy volunteers did not differ in age, education, gender, or ethnicity. All participants underwent neuropsychological testing focused on frontal-subcortical functions at baseline and approximately 3 months later. Two participants began antiviral therapy within one month of baseline testing. CHC participants exhibited greater cognitive dysfunction than healthy volunteers on all measures at baseline. Greater liver fibrosis was associated significantly with poorer test performance. The two CHC patients on antiviral therapy showed a noteworthy decrease in performance on Part B of the Trail Making Test at follow-up, while untreated CHC patients and healthy volunteers displayed improvements. In summary, CHC participants demonstrated greater cognitive dysfunction than healthy volunteers on measures of frontal-subcortical functioning, and greater liver fibrosis was associated with poorer neuropsychological performance. A noteworthy decline in performance on a measure of conceptual set shifting was associated with antiviral therapy.

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J.H. WEN, K.B. BOONE, D. SHERMAN & A. LONG. Neuropsychological Sequelae of Mitochondrial Neurogastrointestinal Enteropalmopathy (MNGIE): Case Report .

MNGIE is a unique and rare autosomal recessive disorder that affects multiple organs in the human body, including the peripheral and central nervous system. Prominent clinical features include gastrointestinal manifestations, cachexia, ophthalmoplegia, and leukoencephalopathy. MNGIE has a poor prognosis and life expectancy typically does not exceed beyond the fifth decade. We offer the first neuropsychological profile of a male patient with MNGIE. The patient is a 35 year-old left-handed dominant, Italian-American male with 13 years of education born to consanguineous parents (blood kinship). The patient's overall intellectual functioning fell in the low average to borderline range. His neuropsychological test scores suggest that his most profound difficulty involved executive functioning, including rapid response inhibition, problem solving in ambiguous situations, cognitive set shifting, and word and design generation. However, mental speed, memory and motor functioning were also impaired while visual perceptual/spatial skills, attention, expressive vocabulary, and academic achievement scores fell in the borderline to impaired ranges. The patient passed most effort measures despite the fact that he met criteria for a dementia. Prior to testing, the extent of the patient's deficits had not been readily apparent to medical providers and other professionals managing his care. Rehabilitation medicine interventions were highly effective in managing this complex medical illness. We also propose that neuropsychological testing should be a component of the diagnostic and treatment protocol given that major cognitive decline and significant psychiatric disorder (as was exhibited in this case) may be a significant unidentified feature of the disease. The results of neuropsychological assessment identified numerous cognitive and motor deficits and led to structured cognitive interventions which improved the quality of the patient's remaining life span.

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J. SCHATZ & R. BUZAN. Cerebral infarct volume, brain morphology, and cognitive functioning in sickle cell disease .

To assess the effects of lesion volume and white matter loss on cognitive functioning in children with sickle cell disease (SCD) and cerebral vascular injury. Twenty-eight children with SCD completed neuropsychological testing. Visible tissue injury and regional midsagittal corpus callosum (CC) areas were assessed via magnetic resonance imaging (MRI) exams. A thin-slice (1.25mm) volumetric sequence was obtained in the sagittal plane for CC measurements. A standard T2-weighted sequence was used to assess the presence, location, and volume of infarcts (Schatz et al., 2002). Intra- and inter-rater reliabilities were $>.90$ for CC and head size measures and $>.80$ for lesion volume. ANOVA indicated CC size was smaller for children with silent infarcts ($n=8$) or overt stroke ($n=8$) than for those without visible infarcts ($n=12$). Total CC size did not predict IQ or other cognitive scores after controlling for total lesion volume using multiple regression. The size of the rostral body of the CC independently predicted measures of distractibility, speeded production, and working memory. Posterior CC size was reduced in children with silent cerebral infarcts, even in the absence of posterior infarcts on MRI. White matter tissue loss may be more extensive in children with silent infarcts than suggested from visible lesions. Frontal tissue loss in SCD is related to deficits in attention and executive skills. Brain morphology provides additional explanatory power for cognitive functioning in SCD beyond visible infarcts.

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L. KEARNEY, A. DEMATATIS, M. GRAHAM & S. HOLLIDAY. Cognitive Impairment in Systemic Lupus Erythematosus: Hispanics and Caucasians Compared to Normal Controls.

Past research indicates patients with Systemic Lupus Erythematosus (SLE) frequently have neuropsychological deficits. Greater SLE disease severity, as measured by renal manifestations and SLE activity/damage, has been found in Hispanics and African Americans when compared to Caucasians. However, few studies have examined ethnic differences in SLE-related cognitive impairment. This study investigates cognitive impairment for Hispanic and Caucasian SLE patients in comparison to normal controls. Normals ($n=77$) and SLE patients ($n=122$) enrolled in a community-based study were administered the Automated Neuropsychological Assessment Metrics (ANAM), a computer-administered neuropsychological battery comprised of nine subtests. A MANCOVA was run with ethnicity (Hispanic vs. Caucasian) and disease (SLE patient vs. control) as independent variables, 8 subtests of the ANAM throughput T-scores as dependent variables, and age/years of education as covariates. The sample was primarily Hispanic (60.3%) and female (84.1%). Main effects were found for ethnicity (trend at $p<.10$) and SLE disease activity ($p<.01$), but no significant disease by ethnicity interactions were found. Post-hoc ANOVAs indicated significant overall differences by ethnicity on coding delayed/immediate memory, code substitution, continuous performance, simple reaction time, spatial processing ($p<.05$), and by SLE status (SLE vs. Controls) on all ANAM variables ($p<.01$). Hispanic SLE patients had greater SLE activity ($p<.01$), but not greater depression. Hispanic SLE patients did not show greater cognitive impairment than their Caucasian counterparts; however, SLE patients did have greater cognitive impairment than normal controls. Further research is necessary to identify whether cognitive impairment varies by ethnicity in SLE patients over time.

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S. HOLLIDAY, M. NAQIBUDDIN, R. BREY & M. PETRI. Change in Cognitive Function Over Time in Newly Diagnosed SLE: Brain CONNECTIONS.

The Brain CONNECTIONS Study follows cognitive function over time in recently diagnosed SLE patients. We have previously reported that a significant proportion of SLE patients in the cohort showed cognitive impairment at the baseline visit. We now report the follow-up data for 21 patients seen for follow-up assessment. SLE patients diagnosed within nine months are enrolled in CONNECTIONS. All patients take the Automated Neuropsychological Assessment Metrics (ANAM) initially and every three months thereafter. The primary cognitive dependent variable for each ANAM subtest is throughput or cognitive efficiency (number of correct responses per minute). Paired t tests were used to compare ANAM performance on the first two study visits on 21 SLE patients and 79 normal controls. Reliable Change Index (RCI) scores were also computed based on 79 normal controls that took ANAM two times in the same session. The 21 SLE patients significantly improved on seven of nine ANAM subtests ($p<.001$). Normals demonstrated a robust practice effect on all ANAM tests ($p<.001$). Inspection of RCIs revealed that only one SLE patient significantly declined on five of the ANAM tests. One other declined on four and two declined on three tests. Of the 21 SLE patients, only five did not decline on any ANAM tests, while 12 significantly improved on one or more tests. ANAM has a significant practice effect over the first two administrations in both SLE patients and controls. SLE patients were twice as likely to decline rather than improve over the 3-month interval. Excessive within and between session variability may be characteristic of SLE-related cognitive impairment.

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C.J. BOYS & R.S. ZIEGLER. CNS Effects of Myotonic Dystrophies Types 1 and 2.

Muscular dystrophies are defined as genetically determined disorders that result in muscle necrosis and fibrosis. Although muscle dysfunction is often the most obvious feature of these disorders, most muscular dystrophies significantly affect other organ systems. Myotonic Dystrophy types 1 and 2 (DM1 and DM2) are multisystemic, with multiple organ involvement including the brain. The purpose of this pilot study was to determine whether there is a difference between the central nervous system effects of adult onset DM1 and DM2, and to determine whether the abnormalities in congenital onset DM1 involve the same CNS features as due to the adult onset patients with DM1. 6 subjects (5 females,) that included 3 each of DM1 and DM2, who were >21 years were evaluated as part of a pilot study to gather data for a larger study involving neuroimaging. Neuropsychological domains assessed included cognition, attention, verbal memory, visual spatial, language, executive functions. Significant weaknesses were found on measures of executive function and fine motor speed. The DM2 group demonstrated significant impairment on measures involving spatial working memory and delayed matching to sample tasks, forward planning, and delayed working memory. In conclusion, both groups of subjects performed within the average range on measures of overall cognitive functioning, attention, visual, and verbal memory skills. However, subjects with DM2 demonstrated clear areas of weakness on measures of executive functions involving spatial working memory, planning, and initiation. These studies will help clarify the precise abnormalities in both conditions and will have implications regarding the causes of the developmental and degenerative features.

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J.R. FESTA, T.M. DEVINCENT, E. CONNOLLY, R.S. MARSHALL & R.M. LAZAR. Reversal of Hemodynamic Failure Improves Neuropsychological Function in Moyamoya Disease.

To characterize the clinical profile of Moyamoya disease (MMD) and to demonstrate the relationship between cerebral hemodynamics and neuropsychological functioning in a MMD patient undergoing treatment with encephaloduroarteriosynangiosis (EDAS) neurosurgery. Moyamoya disease is a rare chronic cerebrovascular occlusive condition involving the internal carotid arteries that causes hemodynamic failure. Researched mainly in Asia, MMD has yet to be characterized in the US. Here we sought to determine whether neurocognitive functioning would reflect the cerebral hemodynamic state both before and after EDAS. The patient was a 43 year-old, R-handed, Caucasian female with bilateral MMD disease R>L who came to clinical attention because of TIA. She underwent longitudinal evaluation that included neuropsychological and hemodynamic assessment as well as CO₂ reactivity, CT, MRI, fMRI, MRA, and angiographic neuroimaging. She was seen 20 days prior to EDAS in the right hemisphere and 7 days after EDAS on the left. At baseline, the patient showed LUE motor dysfunction and significant differences between her verbal and visual-spatial abilities consistent with angiographically-demonstrated occlusion of the R ICA. Following EDAS surgery and verified cerebral reperfusion, she demonstrated improvements in LUE motor function, visual functions, processing speed, attention and concentration. Our case demonstrates that cognitive dysfunction secondary to hemodynamic failure may be reversible. Longitudinal research of Moyamoya disease is needed to determine the diagnostic profile of MMD in the US and the effects of EDAS on patient prognosis, and would shed light on other cerebrovascular conditions.

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A. WICKLUND, A. AMMAR, J.C. WEITLAUF, R.L. HEILBRONNER, J. FINK, R.C. LEE, K. KELLEY & N.H. PLISKIN. MMPI-2 Patterns in Electrical Injury: A Controlled Investigation.

The present study utilized the MMPI-2 as a tool for the identification of a distinctive distress profile following electrical injury (EI). Profiles were examined on the basis of injury parameters (i.e., time since injury, LOC, voltage), and litigation status. Additionally, EI profiles were compared to traumatic brain injury (TBI) patients and chronic pain sufferers (CP) to ascertain whether the emotional sequelae of EI represent a unique pattern of psychological distress. MMPI-2 profiles were examined from 85 EI, 20 mild TBI, and 21 CP patients. In EI, significant elevations ($T > 65$) were found on Hs, D, and Hy scales. Scores on the Pt and Sc scales also approached significance. The influence of injury parameters and litigation status in EI, and profiles across the three subject groups were examined using separate repeated measures ANOVA. Neither injury parameters nor litigation status were predictive of distinctive profiles. For the group comparison, scores on the Hs, Hy, and PD scales were significantly higher within the EI cohort as compared to CP. No differences emerged between EI and TBI groups. However, TBI patients showed significant elevations on Hy compared to CP, and EI patients endorsed more somatic symptoms than CP patients. The heightened focus on somatic concerns is not surprising given the unusual nature of the somatic sequelae following EI. The results suggest that while the MMPI-2 may reveal global psychological distress, its utility in differentiating unique patterns of distress by population is speculative. Implications for future research will be discussed.

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C.C. BALDERSTON, J. LOUCHEAD, D. BROOKS & P.J. MOBERG. Neuropsychological, Clinical, and MRI findings of an Adult with Joubert Syndrome.

Joubert syndrome is a rare autosomal recessive disorder caused by a set of cerebellar and brainstem abnormalities. Most research on this disorder has focused on children and adolescents and little is known about its presentation in adulthood. We present the case of the second oldest known case of Joubert syndrome. Patient J.S. was a 30 year-old Caucasian female first diagnosed with Joubert syndrome at age 24. Previous neuropsychological studies of this disorder in younger patients describe developmental delay across many domains including motor, language, adaptive behaviors and general development. J.S. underwent clinical, neuropsychological, and neuroimaging studies to determine her current level of functioning as one of the few adults with Joubert syndrome in comparison to the previous research reported in children. MRI showed the classic "molar tooth sign" characteristic of Joubert syndrome. Her clinical assessment was notable for a significant level of depression and anxiety. J.S. also endorsed current and previous symptoms of psychosis (mainly auditory hallucinations). Against the background of Low Average intellectual functioning, achievement testing ranged from low average to high average. Neuropsychological testing revealed mild impairments in verbal and graphomotor fluency, mental flexibility, and simple attention with a relative strength in verbal memory. J.S.'s pattern of impairments was generally consistent with that seen in younger Joubert syndrome patients (although less severe) in line with the developmental nature of this disorder. Future research examining the developmental trajectory of cognitive, clinical, and psychiatric symptoms is warranted.

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D. TIEN, M. LACY, S. HUNTER, D. MOTTLOW, K. KASZA & D. FRIM. Long Term Neurocognitive Impact Of Nonsiphoning Shunt Placement.

The objective of the current study is to investigate the long-term impact of a nonsiphoning shunting device on cognitive and academic per-

formance. Fifteen children ages 6-15 (mean 10.0 years of age), with a history of absorptive hydrocephalus, shunted within the first year of life with nonsiphoning valves underwent neuropsychological testing. Children shunted with nonsiphoning valves exhibited deficits in the domains of visuospatial processing, divided attention and fine motor speed, with relative resistance to altered CSF pressure in intellectual (WISC), academic (WJR), and cognitive processing speed. However, on measures of behavioral and adaptive functioning, parents rated their children as having significantly more problems than peers with attention, working memory, general self-monitoring, and community living. Our findings were consistent with past findings of impairment in visuospatial and fine motor functioning. In contrast to past findings of lower intelligence and impaired memory functioning, children in this study exhibited relative resistance to altered CSF pressure in intellectual, academic, and cognitive processing speed. While group differences were minimal, individual performance varied significantly and will be discussed. The present study provides a greater understanding of the long-term impact that a nonsiphoning shunting system placed during the first year of life has on neurocognitive functioning. Implications for treatment in this school age population will also be presented.

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A. INSCORE & D.J. SCHRETLEN. Serum Uric Acid and Cognitive Functioning in a Community Sample.

Persons with partial hypoxanthine-guanine phosphoribosyltransferase (HPRT) deficiency suffer from hyperuricemia and cognitive impairment, but not the self-injury and motor abnormalities that characterize those with complete HPRT deficiency. The purpose of this study was to determine whether serum uric acid levels correlate with cognitive functioning in a broadly representative community sample of reasonably healthy adults. We hypothesized that greater serum uric acid level would be associated with poorer cognitive functioning. Participants included 194 adults enrolled in the Johns Hopkins Aging, Brain Imaging and Cognition study (mean = 56 ± 19 years old; 56% female; 81% white). Neuropsychological and laboratory blood test data were collected on the same day. Partial correlation, correcting for age, was used to examine the relationship between serum uric acid and cognitive functioning. After correcting for age, serum uric acid levels were found to correlate significantly with many neuropsychological tests, particularly those measuring psychomotor and processing speed, attention, working memory, and word list learning/memory. Although the correlations were modest in size (most r s ranged from 0.18 to 0.27), higher levels of uric acid were associated with poorer performance on nearly every neuropsychological measure. Contrary to early claims that gout and/or hyperuricemia might be associated with above average IQ, these findings are more consistent with just the opposite. We found a detrimental effect of increased serum uric acid on cognitive functioning. This suggests that even sub-clinical increases in uric acid might be associated with mild and selective cognitive deficits.

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T.B. FLYNN, P. KIRSHBOM, R. CLANCY, R. ITTENBACH, D. HARTMAN, S. PARIDON, G. WERNOVSKY, T. SPRAY & J. GAYNOR. Outcome Following Repair of Total Anomalous Pulmonary Venous Connection (TAPVC): Exploration of Resilient and Vulnerable Neuropsychological Functions.

Children with congenital heart defects requiring neonatal surgical repair are at risk for neuropsychological dysfunction. Risks include congenital, preoperative, intraoperative and post-surgical factors. The health

and cognitive outcome for many is good. Yet, deficits in motor and visuospatial skills have been described along with impairments of attention, working memory and executive function. This study explored which cognitive skills are resilient and those vulnerable among survivors of TAPVC repair. Participants were 30 children who underwent repair of TAPVC at The Children's Hospital of Philadelphia between November 1983 and November 1996. Mean age at surgery was 35 ± 43 days. Neuropsychological testing was completed as part of research-related follow-up, not because of clinical concerns. Median was 11.1 years. Direct testing included: WASI; WIAT-II Subtests; CMS; Grooved Pegboard; VMI; NEPSY Visuomotor Precision; TEA-Ch Subtests; ROCF; and COWA. Principal component analysis with varimax rotation was used for data reduction; four factors emerged accounting for more than 67% of total variance. The factors and test results loading most heavily on each were: (I) Visual—ROCF Immediate and Delay Reproduction & PIQ; (II) Verbal—VIQ, WIAT-II Word Reading & CMS Verbal Delay Index; (III) Attention/Executive—TEA-Ch Score!, WIAT-II Numerical Operations & COWA and (IV) Motor—Grooved Pegboard. These loadings were $\pm .700$ or greater. Test results loading $\pm .700$ or higher on the Visual, Attention/Executive and Motor factors were all significantly lower among the TAPVC repair survivors than population norms ($p < .01$). In comparison, test results with similar loadings on the Verbal factor were not significantly different from population norms. Children with a history of TAPVC repair in infancy are at risk for late neuropsychological dysfunction. Verbal functions appear to be resilient, while visual, attention/executive and motor functions may be more vulnerable.

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B.D. BELL, H. STANKO & R. LEVINE. Normal IQ in a 55-Year-Old with Newly Diagnosed Rhombencephalosynapsis.

Rhombencephalosynapsis (RS) is a rare congenital disorder characterized principally by agenesis/hypogenesis of the cerebellar vermis and fusion of the dentate nuclei and cerebellar hemispheres. Only about 40 cases with RS have been described and the majority of these have been children. It is only within the past 15 years that the diagnosis was made during life, and it never before was made beyond the fourth decade. While the literature suggests that RS is often associated with behavioral and/or intellectual impairment, no previous report has described overall neuropsychological functioning. This report describes an employed male who was diagnosed with RS by MRI at age 55. After head CT was performed to investigate sinus complaints, MRI demonstrated multiple intracranial abnormalities. These included complete aplasia of the cerebellar vermis with midline fusion of the cerebellar hemispheres. The hippocampi were described as abnormal and globular. The neurological examination revealed only subtle sensory-motor abnormalities. The neuropsychological results were generally within normal limits. For example, a 7-subtest WAIS-III FSIQ fell within the average range (FSIQ = 90) and auditory memory scores also were within normal limits. However, poor immediate visual memory (WMS-III Faces) and motor dexterity (Pegboard) were identified. In summary, this is the first reported RS patient diagnosed beyond age forty and with documented normal intelligence. Consistent with previous findings of grossly intact cognition by neurological examination in a minority of individuals with RS, the generally intact performance by this patient on cognitive tests provides further evidence that the disorder is not invariably associated with widespread cognitive impairment. The relatively intact cognitive status in this case appears to be attributable to the fairly limited extent of his brain abnormalities compared to many previously reported RS cases.

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Symposium 6/3:30–5:30 p.m.

Cultural Considerations in Neuropsychological Research and Practice

Chair: Jennifer Manly
Discussant: Ruben Echemendia

J. MANLY. Cultural Considerations in Neuropsychological Research and Practice.

Despite widespread use and validity of neuropsychological measures in many settings, lack of proper validation among ethnic minorities and non-English speakers may lead to decreased specificity of tests when used in ethnically diverse settings. This symposium will address poor specificity and other challenges to neuropsychological assessment among racial, ethnic, and linguistic minorities in the United States when tests are used to: 1) accurately detect HIV-related neurocognitive impairment; 2) assess and manage TBI/MTBI; 3) determine the role of acculturation, language preference, and linguistic competencies on standardization samples from the WAIS-III/WMS-III and WISC-IV Spanish; 4) conduct early detection of cognitive impairment and dementia; and 5) diagnose stroke and access medical, psychological, and educational services among children with sickle cell disease. Presentations from leaders in the field of cultural neuropsychology will explore the unique challenges to neuropsychological assessment of ethnically diverse children and adults in clinical and research settings, and share data detailing cutting-edge solutions to those challenges. Presenters will examine the contributions of race and racism, acculturation, immigration, language use, educational experience, and socioeconomic status to cognitive test performance, and treatment and management of neurobehavioral dysfunction.

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M. CHERNER. Issues of Cultural and Linguistic Diversity in the Neuropsychology of HIV Infection.

Neurobehavioral dysfunction is a common consequence of HIV infection. While modern antiviral regimens offer great promise in terms of survival and physical health, HIV associated neuropsychological (NP) impairment has not been eradicated. HIV/AIDS has affected African Americans and Hispanic Americans in a manner disproportionate to their representation in the general U.S. population. Worldwide, the majority of people infected with HIV do not conform demographically to those for which validated NP measures exist. Thus, challenges regarding the cultural and linguistic appropriateness of assessment instruments and norms are salient in correctly diagnosing HIV related NP impairment, particularly in its milder manifestations. Individuals infected with HIV often come from disadvantaged backgrounds, with poor quality of education and comorbid factors, such as substance dependence, that add complexity to the interpretation of test results. An additional complicating feature of HIV/AIDS, not shared with most other causes of brain injury, is that it continues to carry significant stigma, particularly in culturally traditional communities. This, combined with an historic distrust of medical environments and limited access to information and health resources, can lead to delays in seeking medical care, with negative implications for cognitive functioning. Application of population-specific test norms as well as careful examination of sociodemographic influences and premorbid functioning are among the approaches that have been used to mitigate diagnostic errors. Assessment of culturally relevant everyday functioning abilities may represent an ecologically valid method for documenting brain dysfunction in ethnically diverse groups.

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R.J. ECHEMENDIA. Cultural Factors in the Assessment of Patients with TBI/MTBI.

The assessment and management of Traumatic Brain Injuries is a key component in clinical neuropsychology. Neuropsychological tests have increasingly been used in forensic settings for patients having or claiming to have brain injuries. Neuropsychological tests have also become the foundation for the detection of Mild Traumatic Brain Injuries in sport and used to make decisions about return to play. The war in Iraq is causing scores of soldiers to be sent home with brain injuries. Although the population of the U.S. is becoming increasingly ethnoculturally diverse, there have been few attempts to examine whether our current approaches to the diagnosis and management of these injuries remains valid. For example, symptom validity tests have increased in popularity in the forensic arena. They are routinely used to assess appropriate motivation and effort among litigants with TBI/MTBI, yet few have questioned whether these tests are equally valid when used with ethnically and linguistically different populations. This paper will present epidemiological data regarding rates of occurrence of TBI/MTBI in ethnic populations. Questions will be raised as to whether there are specific cultural factors that may affect the neuropsychological assessment of TBI/MTBI in relation to other forms of CNS pathology. Also of interest is whether there are specific cultural factors that affect the sports and forensic arenas. The availability or absence of ethnic specific tests, normative data and assessment approaches will be reviewed. Finally, the implications of these findings on clinical practice will be discussed.

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J.G. HARRIS. Cognitive Assessment with Ethnoculturally Diverse Examinees.

There is a growing need to conduct assessments of individuals from diverse linguistic and cultural backgrounds. Yet, this poses a challenge given few tools, limited expertise, and a dearth of empirical data to guide practitioners and those who must make decisions based upon test outcome. Questions raised about the ethics of providing services to culturally and linguistically diverse individuals compound the dilemma. Furthermore, discussion of the educational and social consequences of developing measures to address these assessment demands remains controversial. These difficult topics will be discussed and new methodologies for assessment practices will be considered in this presentation by using the WAIS III and forthcoming WISC IV Spanish as illustrative examples. One of the more challenging questions to be addressed concerns the determination of when it is advisable or justifiable to assess a non-native speaker in English, and how to take acculturation into consideration. In this presentation, we will address the impact of language and acculturation on performance on two established tests, by reporting data obtained from the WAIS III/WMS III standardization. Language preference, living experiences and educational experiences within the U.S. are used to predict intellectual and cognitive performance on these well-established measures. Additional data concerning the performance on WISC IV of children from diverse backgrounds will be presented for comparison. Finally, the development of a measure to specifically address the needs of Spanish speakers in the U.S. will be presented, using the forthcoming WISC IV Spanish as an example. WISC IV Spanish data concerning the relationship of acculturation, language preference, and linguistic competencies will be presented.

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J.J. MANLY. Challenges in Assessing Cognitive Status and Accurate Detection of Dementia among Ethnically Diverse Elders.

Changes in the ethnic and racial landscape among the elderly in the US suggest that ethnic minority populations will bear an increased share of the economic and social burden associated with diseases that predominantly affect the elderly such as Alzheimer's Disease (AD) and other progressive dementias. Neuropsychologists are fundamentally unprepared for this growth in cultural, racial, and linguistic diversity because neuropsychological tests have poor specificity among minority populations and cannot reliably differentiate subtle impairment associated with the early stages of dementia from the effects of normal aging. Misdiagnosis of dementia is thus more likely among cognitively normal African Americans and Hispanics as compared to non-Hispanic Whites. The most prevalent attempt to address these issues has been to develop separate norms by race/ethnicity. Although this is a reasonable first step towards reducing misdiagnosis among culturally and linguistically different groups, separate norms have many disadvantages. In response, we have taken another approach to improving the specificity and utility of cognitive tests among ethnic minority elders. Data will be presented to suggest that aspects of cultural and educational experience can be explicitly measured and related to test performance both cross-sectionally and longitudinally. Data showing the relationship of acculturation, quality of education (i.e., reading level and historical school financial data) to cognitive test performance will be presented. Regardless of race, literacy level was the strongest predictor of performance on measures of verbal and nonverbal ability and the best predictor of future memory decline.

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D.A. WHITE, V. SHEDD, A. KING & M. DEBAUN. Pediatric Sickle Cell Disease: Stroke, Cognitive Outcome, and Race.

Sickle cell disease affects approximately 1 in 400 African Americans. Stroke is the most profound neurological sequela of the disease and is estimated to occur in 30% of children before the age of 12 years. In the present investigation we examined the relationship between stroke and cognitive outcomes in three groups of children (6 to 18 years of age) with sickle cell disease: No stroke ($n = 55$), silent stroke ($n = 17$), and overt stroke ($n = 11$). Our findings revealed that 22% of children with no stroke and 27% of children with overt stroke were retained at least one grade in school. In comparison, there was a substantial increase in the percentage of children retained in the silent stroke group (47%). The discrepancy between no stroke and silent stroke groups is not unexpected, as one would predict poorer school performance in children with major neurological complications. The discrepancy between the silent and overt stroke groups is less intuitive. Upon reflection, however, this discrepancy is not surprising. Overt strokes are readily identified on neurological examination, and state laws require that children receive individual education plans and special services following diagnosis. In contrast, silent strokes are identified using neuropsychological testing and magnetic resonance imaging, examinations that are costly and infrequently performed as standard of care for children with sickle cell disease. These results will be discussed within the context of race-related obstacles and challenges in accessing medical, psychological, and educational services.

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Symposium 7/3:30–5:30 p.m.

Personality Change Following Traumatic Brain Injury: Nature, Prevalence, and Measurement

Chair: James Malec

Discussant: Muriel Lezak

J.F. MALEC. Personality Change following Traumatic Brain Injury: Nature, Prevalence, and Measurement.

Personality change is often considered universal after moderate-severe traumatic brain injury (TBI) but few studies document change with standardized personality assessment. This symposium presents studies from two U.S. and one Australian center. B. Rush will describe NEO Personality Inventory Revised (NEO-PI-R) profiles for three patient groups: mild TBI, moderate-severe TBI, and orthopedic injury controls. Self and informant NEO-PI-R ratings, obtained at 2-3 months and 1-2 years post-injury, were essentially normal across groups. NEO-PI-R factors were minimally predictive of independent living and vocational outcomes at 1 year post-injury. J. Malec will show, for these same cohorts, that self and informant ratings of depression more consistently predicted self- and informant-rated outcomes than personality ratings. R. Tate will describe relationships between post-injury behavior change (Current Behavior Scale; CBS) and the Eysenck Personality Questionnaire (EPQ). Most TBI patients showed significant changes on the CBS. Although EPQ ratings correlated with behavior change, EPQ change did not reliably predict individual behavior change, challenging the value of standardized personality assessment in individual cases. A. Buffington and D. Schretlen will elaborate on correlations between NEO-PI factors and outcome, and demonstrate how discrepancies between self and informant personality ratings also predict outcome. Results suggest that self-awareness moderates the relationship between personality self-report and outcome. Symposium results raise significant questions about the prevalence and severity of personality change following TBI, and question the value of routine standardized personality assessment in TBI populations. M. Lezak will discuss the clinical implications of these issues and methodological limitations.

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B. RUSH, J.F. MALEC, A.W. BROWN & A.M. MOESSNER. Early and Late Standardized Personality Profiles after Mild and Moderate-Severe Traumatic Brain Injury compared to Orthopedic Controls.

Objective: To determine whether standardized personality ratings completed by patients and their significant others (SO) change over time and whether personality ratings predict independent living and vocational outcome after mild and moderate-severe traumatic brain injury (TBI). Design: Prospective analysis of the association between ratings of personality, depression, and outcome using multiple regression analyses. Participants: Inception cohort of three clinical trauma groups (Mild TBI, Moderate TBI, Orthopedic controls) and their SO. Outcome Measures: Living and Vocational Independence Scale (LVIS) rating, 1-2 years post-injury. Predictor Variables: Patient and SO ratings from the NEO-Personality Inventory-Revised (NEO-PI-R) completed within the first few months post-injury (Early assessment) and at 1 to 2 years post-injury (Late assessment). Results: All groups revealed normal personality functioning at Early and Late assessments. Minimal changes in personality were detected over time for all groups. Neuroticism, and more specifically, Depression, as described by patients and their SO, accounted for a small (4-8%) proportion of variance in LVIS outcome beyond that accounted for by post-traumatic amnesia (PTA), age, and

education. Conclusions: The majority of individuals with TBI demonstrate normal personality function and little change in core personality structure over time. Personality function contributes modestly to outcome. Depression also contributes modestly to outcome. As such, depression may be more important to assess than personality in predicting long-term outcomes and individual differences in adjustment to injury.

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J.F. MALEC, B.K. RUSH, A.W. BROWN & A.M. MOESSNER. Prediction of Self-rated and Significant Other-rated Outcome after TBI by Standardized Personality Assessment.

Objective: Determine whether standardized personality measures completed by patients and significant others (SO) predict long term outcome after traumatic brain injury (TBI) also described by both by patients and SO. Subjects: Inception cohort of three clinical trauma groups (Mild TBI, Moderate TBI, orthopedic controls) and their SO. Measures: Patient and SO NEO-PI-R personality ratings obtained Early in the first few months after injury and Late, 1-2 years post-injury; Mayo-Portland Adaptability Inventory completed by patients and SO at Late evaluation. Results: Among NEO-PI-R personality variables examined (Neuroticism, Extraversion, Openness, Agreeableness, Conscientiousness, Depression), the Depression facet most consistently explained variance of long term MPAI outcome as reported by patients or SO beyond that accounted for by injury severity (post-traumatic amnesia) and education. The strongest association was between self-report Late Depression and self-report Adjustment/Participation subscale (23% independent variance explained) with other rater/measure pairings sharing 9-16% variance. Depending on rating source, 11-26% of orthopedic controls were significantly depressed (Depression facet T>60) at one or both assessments compared to 36-42% of TBI patients. Conclusions: Depression is a common psychological disturbance after TBI and is associated with reduced adjustment and community re-integration. Depression occurs more frequently than other disturbances of personality that may evolve from TBI and affects both the perception and reality of outcome. Depression may have a reciprocating relationship to outcome, that is, poorer outcomes lead to increased depression which, in turn, results in reduced motivation, isolation, and further reduction in outcome.

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R.L. TATE. Assessing Characterological Changes after Traumatic Brain Injury: Comparison Between a Standardised Personality Questionnaire and an Injury-Specific Rating Scale.

Objective: Questions have been raised about the appropriateness of applying tests of psychopathology developed for and standardised on psychiatric populations to the group with traumatic brain injury (TBI). This issue also applies to tests of personality for the assessment of characterological changes after TBI that are a direct consequence of the injury related to frontal systems dysfunction. One aim of the present study was to compare a standardised test of personality (Eysenck Personality Questionnaire-Revised, EPQ-R) with a rating scale developed specifically to measure characterological changes after TBI (Current Behaviour Scale, CBS). Method: A close relative of 28 people undergoing rehabilitation after TBI completed the EPQ-R and CBS regarding the injured person's personality and character. Data were collected soon after admission regarding the person's premorbid functioning. Prospective assessments were made at 6 and 12 months post-trauma. Results: Fifteen (54%) participants showed significant characterological changes on the CBS between the pre- and post-trauma assessments. Changes on four of the five EPQ-R scales (N, P, A and

C) were significantly correlated with changes in CBS. When participants were stratified into those showing reliable changes on the EPQ-R, however, there were discrepancies at an individual level, particularly on the E and P scales, with 0% and 27% agreement respectively with the CBS classification. Conclusions: These findings suggest that standardised tests of personality have limitations in their use to document those characterological changes that are direct consequences of the brain injury.

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A.L. BUFFINGTON & D.J. SCHRETLEN. Discrepancies in Self- vs. Informant-Rated Neuroticism and Openness Correlate with Psychosocial Outcome Following TBI.

Objective: To examine the relationship of personality trait ratings and psychosocial outcome following traumatic brain injury (TBI). Participants: Thirty-four adults who sustained a TBI 8 years earlier and 34 adults who served as their informants. Measures: Outcome predictors included self and informant ratings of five basic personality traits derived from the NEO Personality Inventory (NEO-PI). The patient sample was divided into Good (n=14) and Poor (n=20) outcome groups based on self and informant responses to an interview assessment of social role engagement and informant ratings on the Katz Adjustment Scale. Results: The Good outcome patients rated themselves as higher in Extraversion and lower in Openness than Poor outcome patients. Informants rated Good outcome patients as higher in Extraversion and Agreeableness and lower in Neuroticism. Finally, discrepancies in self- vs. informant-rated Neuroticism and Openness differentiated the two groups as follows: Informants rated Poor outcome patients as higher in Neuroticism and lower in Openness than these patients rated themselves. Conversely, informants rated Good outcome patients as lower in Neuroticism and higher in Openness than these patients rated themselves. Conclusions: Patients and informants agreed that being gregarious, assertive, and energetic correlate with favorable outcome following TBI. Beyond this, patients and informants showed no agreement about which personality traits predict outcome. In fact, discrepancies between self and informant ratings of emotional stability, impulsivity, preference for familiarity, and creativity correlated significantly with outcome. We speculate that these discrepancies reflect differences in insight, and that greater insight predicts more favorable long-term outcome following TBI. Correspondence: *James F. Malec, PhD, Psychiatry and Psychology, Mayo Clinic College of Medicine, Genesee ME TBI, Rochester, MN 55905. E-mail: malec.james@mayo.edu*

Paper Session 5/3:30–5:30 p.m.

Learning Disabilities/ADHD

J. WISE, H. PAE, R.A. SEVCIK, M.W. LOVETT, M. WOLF & R.D. MORRIS. Receptive Vocabulary Skills and the Development of Phonological Awareness in Children with Reading Disabilities.

Phonological awareness (PA) is the ability to recognize that orthographic patterns represent specific phonemic elements of speech (Nitrouer, 1999). A large body of research has indicated that the primary problem for children who do not learn to read is a deficit in PA (e.g., Catts, Fey, Zhang, & Tomblin, 2001; Morris et al., 1998; Stanovich, 1988). Less research, however, has examined what drives the development of PA (Metsala & Walley, 1998). Recent research (e.g., Dickinson, McCabe, Anastasopoulos, Peisner-Feinberg, & Poe, 2003; Olofsson & Nierssoe 1999) suggests that receptive language skills influence the acquisition of PA. The purpose of this study was to examine the development of PA skills

in children classified with RD who evidenced either typical receptive vocabulary skills (TRV) or below-average receptive vocabulary skills (B-ARV). Two hundred three elementary school aged children received 70 hours of small group reading intervention. Children were tested at three time points throughout the intervention. Repeated measures ANOVAs were conducted with measures assessing letter sound knowledge and PA skills as dependent variables. Results indicated that the B-ARV group evidenced significantly ($p < .05$) lower scores on both measures throughout the intervention. The B-ARV group did not, however, acquire PA skills at a significantly ($p > .05$) slower rate than the TRV group. Results supported previous research that has suggested receptive language skills are related to the development of PA skills. The lack of a significant interaction between language group and time point, however, do not support the idea that elevated receptive vocabulary skills will foster more rapid acquisition of PA skills.

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R. TUNICK & B.F. PENNINGTON. Cognitive Overlap between Reading Disability and Speech Sound Disorder: A Test of the Severity Hypothesis.

Dyslexia or reading disability (RD) and speech sound disorder (SSD) overlap at symptomatic, cognitive and etiological levels. However, this comorbidity is incomplete and not entirely understood. The severity hypothesis, which views RD and SSD as manifestations of the same disorder at different developmental stages, is one proposed framework for conceptualizing the relationship between the disorders. The overall goal of this research was to test the cognitive overlap between the disorders at the same age, early in reading development, to clarify the utility of the severity hypothesis in explaining the demonstrated comorbidity. A comparison of cognitive profiles was undertaken in two samples, one including probands and controls at age 5 (n=137), and one including siblings and controls aged 7-8 (n=74). In both samples, the SSD and RD groups were matched on background characteristics and severity of the primary disorder. Group performance across three cognitive domains, phonological awareness (PA), phonological memory (PM) and rapid serial naming (RN), was examined in a series of repeated measures ANOVAs and t-tests. Children with RD and SSD exhibited both shared and specific cognitive deficits. The two groups were found to share a deficit of similar magnitude in the domain of PA, while a deficit in RN was limited to those with RD. Both groups demonstrated a PM deficit, which was greater in magnitude in those with SSD. These results do not support the severity hypothesis, and instead lend support to a multiple deficit model regarding the relationship between the disorders. This model suggests a multifactorial and interactive relationship between the two disorders.

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A.M. BOLLICH, A.S. EVANS & A. PALAV. Executive Linguistic Functioning Differences in Children with Dyslexia and ADHD.

Conflicting data have been reported regarding the presence of executive deficits specific to linguistic functioning in children with Attention Deficit/Hyperactivity Disorder (ADHD). However, phonemic, but not semantic, fluency deficits are consistently reported for children with reading disorders. The current study expands on previous findings by exploring differences on executive language measures in children with ADHD, with and without Dyslexia. Children (N=73; 6-14yrs) diagnosed with ADHD, inattentive (ADHD-I; n=26) and combined (ADHD-C; n=47) types, with (n=12) and without (n=61), Developmental Dyslexia (DD) were clinically evaluated. Both groups had average receptive vocabulary and did not differ on sex or

age. Interest measures included letter and semantic fluency and the Expressive Vocabulary Test (EVT), an expressive vocabulary measure requiring cognitive flexibility and inhibition to retrieve alternate words in response to test stimuli. Analyses of variance (ANOVA) were used to assess for group differences across measures. Comparing subjects with ADHD with and without DD yielded a main effect for DD on letter fluency ($F=4.58$; $p=.04$) and the EVT ($F=4.54$; $p=.04$), with no interactions. An identical pattern was found when analyses were conducted on ADHD-I and ADHD-C groups separately. The executive language measures were found to be insensitive to executive dysfunction characteristics of ADHD in children. In contrast, linguistic and phonological demands of the EVT and letter fluency tasks were reflected in the poor performance of children with DD. The average performance of children with DD on semantic fluency may reflect organizational support this task provides to tap category exemplars using common vocabulary.

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B.R. WILLIAMS, E.H. STRAUSS, D.F. HULTSCH, M.A. HUNTER & R. TANNOK. Reaction Time Performance in Adolescents with Attention Deficit Hyperactivity Disorder (ADHD): Evidence of Inconsistency in the Fast and Slow Portions of the RT Distribution.

Research attributes heightened levels of reaction time (RT) inconsistency (moment-to-moment variation in performance) in ADHD to periodic extremely slow responses. We sought to extend such findings to adolescent ADHD using methodology allowing control of confounds related to repeated measurement. Visual 2-choice RT data were collected from 72 adolescents (12-17 years of age) across 4 groups differentiated based on the presence or absence of ADHD and reading difficulties (RD). Measures of inconsistency (i.e. within-subject SD) were taken separately across 32 trials, and in the fastest and slowest 25% of trials. Data were purified from the effects of practice and fatigue, and from group differences in mean RT. Separate ANOVAs for overall inconsistency and inconsistency in the slow trials demonstrated that the relationship between ADHD and inconsistency was dependent on RD such that the ADHD group was more inconsistent than controls, but only when RD was present. There was a main effect of ADHD in inconsistency in fast responses. The effects observed in fast and slow responses were not attenuated when controlling statistically for the effects of the other. Inconsistency in the slow portion of the RT distribution depended on reading ability highlighting the importance of the measurement of reading skill in ADHD adolescents. This is also the first study demonstrating that an ADHD group differed from controls with respect to inconsistency in the fast portion of the RT distribution. There appear to be independent sources of variation in inconsistency affecting the fast and slow portions of the RT distribution in ADHD.

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G. SELKE, D. BOWERS, M. BREWSTER, L. WILLIAMS, S. QUDROT, A. BECKWITH, L. HURLEY & E. FENNELL. Affective Modulation of the Startle Reflex in Children with Attention-Deficit/Hyperactivity Disorder.

Accumulating evidence suggests emotional dysregulation in Attention-Deficit/Hyperactivity Disorder (ADHD). Affective modulation of the startle reflex is a valuable tool for measuring emotional reactivity. Normal adults show smaller startle reflex responses to pleasant

stimuli and larger startle responses to unpleasant stimuli. Enhanced startle to unpleasant stimuli is also influenced by content type (i.e., threat > sad pictures). The study aimed to compare ADHD to healthy control children, predicting ADHD children would show decreased startle modulation to unpleasant pictures. Thirty-seven ADHD and 25 healthy control children ages 7-14 years were presented with a 100dB acoustic startle probe while viewing pleasant, unpleasant, and neutral pictures (12/category). Unpleasant pictures consisted of 4 direct threat, 4 victimization, and 4 injury/disgust pictures. The primary dependent measure was startle eyeblink magnitude. Results revealed a reliable linear trend over Picture Category ($F[1,60]=32.94$, $p<0.0001$), but no reliable interaction of Diagnostic Group with linear trend over Picture Category ($p=.93$), indicating that both groups showed an overall adult-like pattern of startle modulation (unpleasant>pleasant). Results also revealed a reliable linear trend over Unpleasant Picture Subcategory ($F[1,60]=24.21$, $p<0.0001$), and a reliable interaction of Diagnostic Group with linear trend over Unpleasant Picture Subcategory ($F[1,60]=4.72$, $p<0.034$). Controls showed aversion enhanced startle for all subcategories, with threat ($t=53.0$) > injury/disgust ($t=51.4$) > victimization ($t=50.6$), whereas ADHD children showed enhanced startle for threat ($t=53.3$) and injury/disgust ($t=52.9$), but inhibited startle for victimization ($t=47.1$). Both healthy control and ADHD children demonstrate aversion enhanced startle modulation. However, ADHD children do not reliably show enhanced startle when viewing pictures depicting victimization, providing support for emotional dysregulation in ADHD.

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R. VAURIO, D.M. TUCKER, J.L. RITCH & C. CARLSON. Organization of Semantic Memory in Children with Attention-Deficit/Hyperactivity Disorder.

Semantic memory is an organized knowledge network comprised of discrete bits of information and the relationships among them. Associations between concepts within the network may be organized based on their temporal co-occurrence in the environment (e.g. functional relationship; cereal and spoon) or hierarchically by their similarity to an abstract concept (e.g. semantic relationship; dog and cat). Attention to salient features of the concepts is necessary for creation of associations between concepts in the network. Developmental disturbances in attention may then interfere with organization of the semantic memory network. The present study examined the organization of the semantic memory network in 46 children with ADHD; 18 Combined type (C) and 28 Inattentive type (IA) and 24 normative controls. Semantic memory organization was examined using a computer-based, lexical decision, priming task adapted from the paradigm used by Nation and Snowling (1999). Target words in this task were preceded by a prime that was either functionally or semantically related to the target. Word pairs were also classified as having either high or low association strength. Analysis of covariance, with age as the covariate, resulted in a significant Group (C/IA/ Control) X Relationship (functional/semantic) X Priming status interaction ($p=.024$). While all 3 groups demonstrated a significant priming effect for functionally related pairs, only the normative controls showed priming in the semantic condition. These data suggest that developmental difficulties with attention have an adverse effect on the development of the semantic memory system. Implications for development of executive functions, memory retrieval and reading are discussed.

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Paper Session 6/3:30–5:30 p.m.**Mild Cognitive Impairment and Preclinical Dementia**

R. AU, A. BEISER, H. CABRAL, S. AUERBACH, M.J. TOCCO & P.A. WOLF. Defining amnesic MCI in the Framingham Offspring Study.

The amnesic subtype of MCI is widely considered to represent the prodromal phase of Alzheimer's disease. Although memory deficits in this nondemented group are most prominent, "some" nonmemory deficits are tolerated. The imprecision in definition, including lack of consensus on appropriate tests, has led to variable findings, as has subject selection bias inherent in many studies. The Framingham Offspring Study offers an opportunity to examine the prevalence of amnesic MCI within a community-based sample followed prospectively since 1971. 1935 men and women were given a neuropsychological test battery that included 3 different measures of memory from the WMS: Logical Memory, paragraph A (LM), Visual Reproductions (VR), and Paired Associates (PA). Deficit performance was defined as scores falling 1.5 SD below age and education adjusted means. Prevalence rates for MCI were comparable for any individual memory test (LM - 3.0%; VR - 2.9%; PA - 3.4%); but were higher if deficits on any two (range 5.5-6.0%) or all three tests were considered (8.2%). We also found prevalence of MCI varied greatly when absence of nonmemory deficits were limited to age and education adjusted means below 1.0 SD ($n=58$; 3.0%) vs. below 0.5 SD ($n=237$, 12.2%). When MCI with concomitant memory and nonmemory deficits (MCI-Multiple domain) were examined, age and education-adjusted deficits in memory of 1.5 SD and in nonmemory of 1.0 SD ($n=75$; 3.9%) resulted in somewhat higher prevalence rates compared to deficit performance of 1.5 SD in memory and 0.5 SD on nonmemory tests ($n=43$; 2.2%). Whereas our findings suggest that there is an identifiable deficit in memory, it is also true that 1) each different measure of memory will yield a unique sample of potential cases of amnesic MCI, and 2) using multiple measures of memory will lead to higher rates of amnesic MCI. The implication is that the clinical utility of an MCI diagnosis will remain uncertain until we achieve better precision in case identification.

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K.M. HAYDEN, L.H. WARREN, C.F. PIEPER, J.T. TSCHANZ, M. NORTON, J. BREITNER, K.A. WELSH-BOHMER & THE CCMS INVESTIGATORS. Detection of Pre-clinical Vascular Dementia and Alzheimer's Disease in Population Samples: The Cache County Memory Study.

It is unclear whether vascular dementia (VaD) has a cognitive prodrome, akin to mild cognitive impairment (MCI) and its relationship to the later development of Alzheimer's disease (AD). To evaluate this question, we examined neuropsychological test performance in a large sample of cognitively normal, community residents aged 65+ to see if we could differentiate preclinically between those individuals who would later be diagnosed with either VaD or AD. Participants ($n=485$) were identified from Cache County Memory Study, a population based study of aging and dementia. All were clinically normal on baseline examination and had follow-up evaluations three years later, revealing 62 incident dementia cases (14 VaD cases; 48 AD cases). We identified a number of neuropsychological tests, a priori, that would best discriminate between diagnosed VaD and AD cases (executive and memory measures, respectively). Further ad hoc analyses sought to determine if we could differentiate between these groups three years prior to their clinical diagnosis. Our findings indicated that all the tests significantly differentiated

dementia cases from non-cases at the time of diagnosis. Further, the CERAD Word List Recognition Test, Logical Memory I and II (WMS-R), and Trail Making Part A tests were able to differentiate VaD from AD cases after adjustment for age, sex, education, and dementia severity. Recognition (correct recognition of foils) and Trails A were able to discriminate pre-clinical VaD cases from AD cases three years prior to diagnosis ($p = 0.0009$ and $p < 0.0001$, respectively). These results in a large community sample suggest that VaD has a preclinical syndrome, distinguishable from the prodrome of AD.

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L.H. WARREN, J.T. TSCHANZ, K.D. GARRETT, M. NORTON, L. SANDERS, T. OSTBYE, C.F. PIEPER, K.A. WELSH-BOHMER & THE CCMS INVESTIGATORS. Relationship of Mild Cognitive Impairment to Other Preclinical Dementia Constructs: The Cache County Memory Study.

Multiple constructs, such as mild cognitive impairment (MCI) or cognitive impairment no dementia (CIND), are used in dementia research to denote the transitional cognitive state between normal aging and dementia. Previously, we assessed the comparability of these common categorization schemas in a sample of individuals enrolled in the Cache County Memory Study (CCMS), and demonstrated that these various constructs were not interchangeable. We examine now, the relationship between the various constructs to one another in order to better understand the subsamples captured with each method and the relative placement of these constructs along the continuum between normal aging and dementia. Non-demented community residing older (age 65+) individuals ($n=661$) were clinically examined and categorized into subgroups (e.g. CIND, MCI) using operationalized criteria. Agreement between constructs in classifying individuals as mildly impaired or normal was examined using unweighted kappa statistics. The results from comparing the various categorization approaches indicated fair to excellent agreement (range 0.33-0.90) between age-associated memory impairment (AAMI), aging associated cognitive decline (AACD), and CIND. Additionally, these same three constructs also appeared to distinguish a similar subset of individuals in the population who were considered minimally impaired ($\text{Kappas} > 0.40$). Most other typology comparisons showed poor agreement ($\text{Kappas} < 0.40$). These results suggest that the constructs AAMI, AACD, and CIND are more closely related to each other, whereas the other examined typologies, such as MCI or mild ambiguous (CCMS term for prodromal dementia), may tap into a different portion of the cognitive continuum, perhaps in a range more enriched for preclinical Alzheimer's disease or other mild neurocognitive conditions.

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K.J. MURPHY & A.K. TROYER. Lower Semantic than Phonemic Fluency Characterizes Mild Cognitive Impairment and Alzheimer's Disease.

A pattern of greater impairment in semantic than phonemic verbal fluency characterizes Alzheimer's Disease (AD). Mild cognitive impairment (MCI) may represent a pre-clinical stage of AD. Although MCI is not associated with impairment on non-memory tests such as verbal fluency, the same pattern of lower semantic than phonemic fluency may be present. We investigated whether relative performance on phonemic versus semantic fluency would distinguish MCI from normal aging and AD. Participants were 58 healthy older adults, 29 patients with MCI, and 33 patients with AD. The groups were matched for age, sex, and education. One-minute trials of phonemic (i.e., "f") and semantic (i.e., "animals") fluency were administered during a neuropsychological assessment. For controls, MCI, and AD, respectively, phonemic fluency

scores were 14.7, 13.8, and 10.6; semantic scores were 17.8, 14.9, and 9.0. MANOVA showed a significant group difference, $p < .001$, and a significant group by fluency-task interaction, $p < .001$. Difference scores (phonemic minus semantic) were -3.1, -1.1, and +1.6, respectively. Planned comparisons showed that difference scores distinguished each group from the other two (e.g., normal aging < MCI < AD; all p 's < .04). A comparison of normal aging, MCI, and AD showed a progressive difficulty with semantic relative to phonemic fluency. Semantic fluency is vulnerable to the neuropathological changes of AD because it requires rapid access to semantic memory stores. Our findings demonstrate degradation of semantic memory pre-clinically, before the clinical manifestation of AD. Patterns in verbal fluency could be an important predictor in identifying MCI individuals at greatest risk for developing AD.

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Y. STERN, N. SCARMEAS, C. HABECK, K.E. ANDERSON, G. PELTON, M. TABERT & D. DEVANAND. PET Measure Of Functional Connectivity Predicts Progression In Individuals With Minimal To Mild Cognitive Impairment (MMCI).

PET scans document metabolic or blood flow changes associated with AD pathology, but PET changes in individuals with MMCI cannot be reliably detected. We hypothesized that an analytic approach that could identify a pattern of functional connectivity that is affected by AD pathology might be more sensitive than more traditional analytic approaches. This would enable prediction of subsequent cognitive and functional progression in MMCI. Using Scaled Subprofile Modeling, we identified a covariance pattern that was present in resting $H_2^{15}O$ PET scans of 16 cognitively healthy elders (HE) and 17 mild AD patients. The AD patients expressed this pattern to a significantly greater degree than the HE. We prospectively applied this covariance pattern to 23 non-demented individuals with MMCI. The MMCI subjects then were followed for 3.7 (1.98-7.07) years. MMCI group expression of the pattern was intermediate between the HE and AD patients. Further, degree of pattern expression in the MMCI subjects was related to CDR (0 vs .5) and correlated with their mental status and memory test scores. 26% (6/23) progressed to AD and CDRs worsened in 48% (11/23). Logistic regression showed that subjects with higher initial expression of the covariance pattern were more likely to have worsening CDR scores during the followup period (OR=5.33; 95% CR 0.89 - 31.92; $p < .06$). GEE models used initial expression of the covariance pattern in the MMCI subjects to predict subsequent rates of decline, controlling for age, gender, education, and baseline performance. Higher pattern expression was associated with more rapid decline in mental status ($\beta = -0.36$, $p = 0.08$) and more rapid increase in CDR sum of box scores ($\beta = 2.50$, $p = 0.02$) over time. Covariance analysis can discriminate between MMCI subjects with higher and lower cognitive and functional performance. Expression of covariance patterns can also predict the degree of MMCI subjects' subsequent change in cognition and function.

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R. KRIKORIAN, M. SHIDLER & J.A. WELGE. Phytoestrogen Supplementation and Cognitive Function in Menopausal Women with Mild Cognitive Impairment.

Phytoestrogens can have estrogenic effects in brain. We sought to investigate effects of isoflavone supplementation on cognition in postmenopausal women with Mild Cognitive Impairment (MCI), an age-related condition marked by working memory and secondary memory deficits and increased risk for dementia. Women who met criteria for MCI were recruited from the community and enrolled in a randomized, double-blind, placebo-controlled trial. The active supplement group re-

ceived tablets containing soy-derived isoflavones, yielding 30 mg of isoflavone aglycone. One tablet was taken three times a day for 16 weeks. Pre- and post-intervention assessments of working memory using a modification of the Stop-Signal task were performed. In this interim analysis of data for 30 participants from the ongoing study, we found no significant difference between the groups with respect to age (62.6 v 62.2), educational level (14.7 v 14.2), and time since last menstrual cycle (12.6 v 17.6). There was a small difference in IQ estimate (105.8 vs 98.1), although both groups were within the average range. There was no group difference with respect to depression at time of enrollment and no treatment effect on this factor. At baseline, performances on the Stop-Signal task were not different. However, a repeated measures ANOVA indicated improvement in response accuracy ($p < .05$) in the active supplement group. This preliminary finding suggests that supplementation with isoflavones may improve sustained attention, an aspect of working memory function, in postmenopausal women with acquired cognitive decline. This is consistent with recent research indicating cognitive enhancement in young and older adult nonclinical samples treated with soy food and isoflavones. If upheld, this result would support the use of isoflavone supplementation as an alternative to treatment with steroid hormones, which impart increased risk for cardiac disease, cancer, and possibly dementia.

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Poster Session 5 /4:00-5:30 p.m.

Assessment/Psychometrics

M.P. KELLY, L. CARLSON, G. SOUTHWELL & D. UMETSU. Expanding Training Opportunities in Clinical Neuropsychology through the Use of the Videoteleconference .

Developing efficient and effective didactic training for Postdoctoral Fellowship programs in Clinical Neuropsychology can be hampered by the relatively small number of faculty and fellows at individual training sites, as well as limited types of clinical cases for case conference. Travel to other locations to expand training opportunities can be logistically difficult if not impossible. The objective of this presentation will be to describe the development and evaluation of a videoteleconference (VTC) based fellowship didactic program based at Walter Reed Army Medical Center in Washington DC and Tripler Army Medical Center in Honolulu HI that has been ongoing for six years. Since inception, the VTC has expanded to include postdoctoral fellows from as many as five different sites, and involvement from training neuropsychologists from as many as nine different sites ranging from Hawaii to Europe. Program evaluation is conducted annually using a specifically developed questionnaire that is distributed electronically. Results include presentation of 1) initial development of the joint VTC didactics program 2) evolution of the program as the result of participant feedback 3) technical problems encountered and their solutions 4) strategies to maximize coordination among sites 5) barriers to interaction among participants at the various sites and tactics to overcome them 6) curriculum 7) program evaluation techniques and results, including the specific unique benefits of the use of the VTC 8) suggestions for future applications of VTC for training and continuing education in neuropsychology. Program evaluation results indicate that the VTC is a viable method for expanding and enhancing didactic training for postdoctoral fellows, and also is viewed as beneficial for professional development by experienced participating neuropsychologists.

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L. RIEMENSCHNEIDER, S. BARBER, M. VERSCHELL, R. FOLEN, G. SOUTHWELL, B. POPPEN & B. ROPER. The Next Best Thing To Being There: A Pilot Study of Neuropsychological Testing Via Low-bandwidth Telemedicine Technology.

Neuropsychological services are unavailable to many in remote locations, a salient problem in rural areas and settings such as Tripler Army Medical Center in Honolulu, Hawaii, where patients are commonly transported many miles for care. Low-bandwidth telemedicine technology has potential to extend professional services and expand practice opportunities for neuropsychologists allowing them to work inexpensively with patients at a distance. A pilot study was undertaken to investigate the comparability of a set of neuropsychological instruments administered via telemedicine as compared to the standard face-to-face format. A group of 19 normal volunteers was administered a battery (MMSE, CVLT-II, RBANS, WAIS-III Information and Letter-Number Sequencing) in both conditions (face-to-face and remotely, with a small camera, tv, laptop with 56k modem, and two phone lines) in a counterbalanced design, utilizing alternate forms when available. Pearson correlations indicated moderate to strong consistency of scores between administration conditions, with most values comparable to published reliability data for these tests (e.g., RBANS Total Index standard vs. video $r=.818$, $p<.00$). Evaluation of mean differences revealed that only WAIS-III Letter-Number Sequencing was significantly different between conditions ($p=.008$), consistent with observations noting that sound quality issues appeared to interfere with the video administration. Interestingly, a number of volunteers spontaneously indicated increased comfort with the telemedicine administration as compared to face-to-face. Results are promising for the use of inexpensive low-bandwidth technology to extend neuropsychological services to those geographically isolated, thereby improving access to care and expanding opportunities for neuropsychologists. Improved sound quality must be addressed for tasks with high auditory attention demands. Further evaluation with a larger participant pool and in a clinical population is needed. The views expressed in this abstract are those of the author and do not reflect the official policy or position of the Dept of the Army, Dept of Defense, or the U.S. Government.

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G. QUINTIN, J. LEE, I. CLARKSON, R. MRAZ, S.J. GRAHAM & K.K. ZAKZANIS. Measuring Attention in an Ecologically Valid Virtual Environment.

The overarching goal was to develop a series of ecologically-valid tasks testing selective, sustained, divided, and alternating attention, for application towards cognitive rehabilitation. The objective of this preliminary study was to demonstrate that use of a virtual environment (VE) could offer varying levels of difficulty that could be effectively measured by parameters built within the VE. Each domain of attention was tested at various levels of difficulty, which were defined by tasks that successively increased attention load. Furthermore, within each level, the speed at which objects were presented, as well as the frequency of target items, were also varied. The tasks themselves were implemented in a virtual environment that resembled a factory with conveyor belts on either side of the participant. Each of the 11 young healthy participants (6 women, 5 men) was randomly assigned to 4 of 11 possible subtests. Correct responses, errors of omission and commission, as well as reaction times were measured. All tasks demonstrated a clear effect of the level of difficulty on performance. Increased attentional load led to a rise in number of errors. The speed and target frequency within each level also influenced accuracy and reaction time. The tasks did not demonstrate any floor or ceiling effects, which seems to point to the versatility of this tool. These tasks have shown to be effective in presenting attentional challenges of varying difficulty, which can be validly assessed. Overall, this suggests that these tasks may be a promising means for cognitive rehabilitation.

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N. DONINGER, D.M. EHDE, R.K. BODE, K. KNIGHT, C.H. BOMBARDIER & A.W. HEINEMANN. Measurement Properties of the Neurobehavioral Cognitive Status Examination in Acute and Post-Acute Traumatic Brain Injury.

Investigate the ability of the Neurobehavioral Cognitive Status Examination (NCSE) to distinguish levels or types of cognitive impairment among individuals with acute traumatic brain injury (TBI) relative to an outpatient sample of individuals with TBI. Calibration of item responses from a sample of 120 individuals admitted to an inpatient rehabilitation medicine service for TBI and a separate sample of 296 community dwelling adults with TBI. Samples were comparable with respect to age, gender, ethnic distribution, employment status, and education. The NCSE was administered, on average, 29 days after injury in the acute inpatient sample and 2,496 days after injury in the community dwelling sample. Several calibrations employing various strategies revealed inconsistencies in measurement properties between samples. For the inpatient sample, person and item separation indices suggested that the full instrument characterizes three strata of performance. Elimination of the easiest items created a better-targeted instrument (i.e., generated more spread among individuals) with no significant increase in error. Calibrations conducted with data on the full instrument from the community dwelling sample distinguished three strata of performance despite a skewed distribution towards high levels of performance. Additional calibrations for each sample identified memory and verbal reasoning as the most difficult domains; however, both analyses indicated significant measurement error. Three strata of performance were identified in both samples despite the presence of skewed distributions. Caution is warranted in using this measure as a screening device in both acute and post-acute TBI settings, as it may not detect cognitive impairments influencing rehabilitation.

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C.L. YANTZ, B.E. GAVETT, J.K. LYNCH, J.M. FISHER & R.J. MCCAFFREY. Comparison of the Heaton, et al. Demographically Adjusted Deficit Scale and the Reitan and Wolfson Neuropsychological Deficit Scale Scores in a Sample of Litigating Adults.

We examined the comparability of the Deficit Scale (DS) of Heaton, Miller, Taylor, and Grant (2004) and the Neuropsychological Deficit Scale (NDS) of Reitan and Wolfson (1993) across eight variables from the Halstead-Reitan Neuropsychological Battery (HRNB). The DS and NDS were used to examine the performance of 131 litigating adults on eight HRNB variables (Category Test, Trails A and B, Seashore Rhythm Test, Speech-Sounds Perception Test, and Total Time, Memory, and Location scores for the Tactual Performance Test). In order to compare DS and NDS scores, we created three composite severity scores: none to mild (0 and 1 for Reitan and Heaton), mild to moderate (2 for Reitan and 2 and 3 for Heaton), and moderate to severe (3 for Reitan and 4 and 5 for Heaton). Wilcoxon signed rank tests revealed that all eight comparisons were significantly different ($p<.01$). NDS scores indicated greater levels of impaired functioning compared to DS scores across all of the variables, except for TPT Total Time. The DS compared to the NDS on TPT Total Time, however, may be an artifact of differences in the time limit for test trial administration (10 min. vs. 15 min., respectively). In seven out of eight instances, DS scores revealed a significantly lesser degree of neuropsychological impairment relative to NDS scores in this sample of litigating adults. The implications of these findings will be discussed along with several cases illustrative of these findings.

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A.H. PARK. Six Year Case Study of Serial Neuropsychological Assessments and Repeated Quantitative Electroencephalogram (QEEG) Readings after Accidental Electric Shock.

The present case study examines the neuropsychological sequelae of accidental electric shock as indicated by serial neuropsychological testing and repeated QEEGs over 6-years. Predictions derived from patient verbal memory deficits, disorientation, and negative affect were expected to manifest as a hemispheric lateralization in cerebral activation. The a-priori hypothesis was a deactivation at the left, relative to the right, cerebral hemisphere and a depression of QEEG values at parieto-temporal regions. The patient was a 38-year-old, right-handed Caucasian female who suffered a 120V accidental electric shock from faulty electrical wiring 6 months before testing. Neuropsychological tests included functional screenings for sensorimotor, spatial awareness and integration, affect, and aphasia as well as the WAIS-R, Halstead-Reitan Test Battery, Grooved Pegboard Test, Denman Neuropsychology Memory Scale, WMS-R, MMPI-2, and BDI. Both QEEG records were satisfactory, and the patient was instructed on eyes closed and relax procedures. At both QEEG sessions, increased right temporal-parietal Beta activation coincided with floating sensation and dizziness as evidenced on sensorimotor and spatial awareness and integration screenings. Relatively less Beta activation at the left temporal region was associated with anterograde verbal memory deficits on the WAIS-R, WMS-R, and Denman tests. Greater activation across all bandwidths at the right, relative to left, frontal region coincided with reduced right-hand movement, receptive dysprosodia with hyperfluency in affectively valenced speech on aphasia screening, and clinical anxiety and depression on affect screening, MMPI-2, and the BDI. The results of this research with longitudinal neuropsychological and QEEG assessments reveal a signature pathophysiology that specifies the neurobehavioral treatment needs after electrical shock.

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R.L. STEGMAN & E.C. DROWN. Incremental Validity of Additional Tests when Administering the Repeatable Battery for the Assessment of Neuropsychological Status.

The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) is an efficient instrument, but it has limitations. The current study was an investigation to determine the incremental validity of the Benton Judgment of Line Orientation (BJOL), Boston Naming Test (BNT), and Trail Making Test (TMT) relative to the RBANS. The BJOL was compared to the RBANS Line Orientation (RBANS LO) and the BNT was compared to the RBANS Picture Naming (RBANS PN). There is no direct comparison between the TMT and the RBANS. Medical records were reviewed to identify 25 consecutive patients who had been administered the RBANS, BJOL, BNT, and TMT. The raw data were analyzed using a standard computer statistic program. All patients happened to be male and almost all were of Western European American heritage. Ages ranged from 46 to 84 with an average of 70.28. Pearson 2 tailed correlation between the RBANS LO and BJOL was $r = .816$, $p < .001$. Pearson 2 tailed correlation between the RBANS PN and BNT was $r = .768$, $p < .001$. There were literally no paraphasic errors with the RBANS PN while on the BNT the average number of paraphasic errors was 8.56. There were no significant correlations between paraphasic errors and any of the measures on the RBANS. There were numerous correlations between TMT Part A and RBANS subtests. There were two modest, conceptually consistent correlations between TMT Part B and the RBANS subtests of Coding and Semantic Fluency, but they were questionable due to the incredibly high failure rate of patients with Part B (17 of

25). There was no incremental validity with the BJOL. Incremental validity with the BNT was mixed. Paraphasic errors, which appeared only with the BNT, appeared to measure unique functions not measured with the RBANS and, therefore, added value. Incremental validity with the TMT was mixed. Part A added no value. Part B added considerable value.

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M. KEIL & J. SUHR. Brief Neuropsychological Assessment in the Prediction of Everyday Functional Abilities of Older Adults.

Neuropsychological assessment is frequently requested for answering questions about real-world functioning. The ecological validity of neuropsychological assessment, however, remains largely unknown. Only a handful of studies have examined the relation of neuropsychological tests to measures of everyday functioning, with moderate relations between functional measures and cognitive measures, whether global or specific in nature. The pattern of relationships among cognitive measures (RBANS, TMT, COWA, orientation) and functional measures (Direct Assessment of Functional Status - DAFS plus prospective memory as measured by RBMT subtests) was examined in 59 older adults (mean age 80.3, 15 male), all residents of assisted living facilities who volunteered to participate in the study. RBANS total score accounted for only slightly less variance (50%) than specific cognitive tests (56%) in prediction of DAFS/RBMT performance. Superior prediction was made when combining global and test-level cognitive scores in regression on DAFS/RBMT (61%). Specific cognitive tests that accounted for the most variance in functional performance (after accounting for global impairment using RBANS total score) were temporal orientation and delayed verbal recall. Results suggest that cognitive measures are strongly related to direct measures of functional performance, even after controlling for global cognitive impairment. Findings support the use of cognitive testing as predictors of functional status in an assisted living population.

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A.G. VOLPE, C.A. NOGGLE, R.S. DEAN & A.S. DAVIS. Predicting Neurological Impairment with the Dean-Woodcock Sensory Motor Battery.

Neuropsychological assessments contribute unique information regarding the functional strengths and weaknesses of patients necessary for the diagnosis of disorders and useful for accurate prognoses and rehabilitation planning that brain imaging cannot provide. A major component of these neuropsychological batteries, which has been at the core of early explorations of brain functioning and is, to this day, an important part of neurological and neuropsychological examinations, is the assessment of sensory-motor functioning. Sensory-motor assessments provide information about the patients neurological functioning and may reveal pathognomic signs. The present study assessed the predictive ability of Dean-Woodcock Sensory Motor Battery (D-WSMB), part of a new neuropsychological measure, the Dean-Woodcock Neuropsychological Battery (D-WNB). Participants ($n = 500$) included 250 individuals who had been referred for neuropsychological evaluations (mean age = 53.58), and 250 normal volunteers that denied being diagnosed or treated for neurologic, psychiatric, or orthopedic disorders (mean age = 48.75). Statistical analyses indicated the D-WSMB was able to correctly identify 92.8% of the cases, identifying 94.4% of the normal population and 91.2% of the neurologically impaired subjects. An additional discriminant analysis was conducted to establish the accuracy of the D-WSMB to identify individual diagnoses within neurologically impaired and normal subjects whereby the following cases were

correctly identified: 44.9% cardio-vascular accidents, 66.7% multiple sclerosis, 40% seizures, 42% traumatic brain injuries, 62.7% dementia, and 54.5% Parkinsons Disease. Findings indicate the D-WSMB is useful in identifying neurological damage and specific diagnoses in a relatively quick assessment.

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A.S. DAVIS, J.M. TRINKLE, W. FINCH & R.S. DEAN. Classification and Regression Tree Analysis of the Dean-Woodcock Sensory-Motor Battery with Neurologically Impaired and Normal Individuals.

The Dean-Woodcock Sensory Motor Battery (DWSMB) is part of a new comprehensive neuropsychological assessment battery which includes 18 subtests that assess a variety of cortical and subcortical sensory-motor skills. An important component of establishing the construct validity of a new neuropsychological measure is assessing which subtests best distinguish between normal and neurologically impaired individuals. A total of 1651 participants (700 neurologically impaired and 951 normal individuals) were administered the DWSMB. Classification and Regression Tree (CART) analysis was used to determine which subtests best distinguished between the two groups. CART is a method of predicting group membership with a nonparametric statistical approach. CART works by finding the optimal partition of subjects based on the predictor variables, where success is determined by accuracy of group classification. Initially, the best split for the group occurred with Gait and Station. Subjects with a Gait and Station Derived W-score < 468 included 363 subjects, with 81% of this group in the clinical group. The next split occurred with Auditory Acuity. Subjects with an Auditory Acuity Derived W-score < 446 included 139 subjects with 94% in the clinical group. Further splits indicated many of the subtests were successful in distinguishing between normal and neurologically impaired individuals. Subtests from the DWSMB that have a subcortical focus seem to best distinguish between normal and neurologically impaired individuals. The majority of the subtests seemed to distinguish between the groups. The results from this study provide strong evidence of the good construct validity of the DWSMB.

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K. MCBURNEY-REBOL, A. LAUTZENHISER, D. WALLACE, L.K. PAUL & W.S. BROWN. Assessment of Social Information Processing: Behavioral and Autonomic Responses to the Thematic Apperception Test.

We have found the Thematic Apperception Test (TAT) to be useful in eliciting socio-emotional deficits in individuals with callosal agenesis. However, it is unclear whether these deficits reflect problems in social perception versus narrative construction. The current study sought to understand the normal emotional impact of social information in TAT cards by assessing psychophysiological responses independent of verbal narratives. Verbal ratings of emotion and psychophysiological reactions (e.g. facial electromyography, EMG; and skin conductance response, SCR) to 6 TAT cards were assessed in 30 graduate students (20 women and 10 men) between the ages of 22 and 31 ($M = 25.4$; $SD = 3.06$). Each TAT card was first presented with the people graphically removed, and then in original form. Participants' verbal ratings reflected significantly more affect ($p < .001$) and arousal ($p < .001$) to people versus non-people cards. The interaction between TAT card and social information was significant for the left side of the face, both corrugator ($p < .003$) and zygomatic muscle ($p < .001$), indicating larger responses to the people versions of some cards. SCRs did not differ significantly for presence of social information. Ratings of emotion (mostly negative) increased when

people were present in the TAT cards. For some cards, significant differences in EMG were found depending on the presence of social information for the left hemi-face only, supporting right hemispheric involvement in negative emotions. The results provide support for use of psychophysiological responses to TAT cards in the study of socio-emotional processing in neuropsychological disorders.

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R.J. SPENCER, P.P. GIGGEY & O.A. SELNES. A new screening test of psychomotor speed: The timed alphabet-writing task.

Brief mental status screening tests generally do not include measures of psychomotor speed. This investigation evaluated the validity of a timed alphabet writing task (AWT) of psychomotor speed. We measured the time required to write the letters of the English alphabet in a sample of 133 outpatients (46% male; education = 15 years), and compared these scores with performance on other tests of psychomotor and non-psychomotor speed. Tests of psychomotor speed included the Trail Making test parts A (TRAT) and B (TRBT), Grooved Pegboard Test (GP), and Symbol-Digit Modalities Test (SDMT). Non-psychomotor speed measures included Rey Complex Figure Test-copy (RCFT-C) and recall (RCFT-R), Boston Naming Test (BNT), and Rey Auditory Verbal Learning Test (short and delayed recall). After partialling out age and MMSE performance, AWT ($Mean = 26$ sec; $SD = 14$ sec) was more strongly correlated with tasks of psychomotor speed (median $r = .52$) than with the control tasks (median $r = .14$). Principal components analysis was then conducted, using TRAT, TRBT, GP, and SDMT, with results indicating that AWT uniquely explained 28% of the variance in these factor scores after accounting for age, education and MMSE scores ($p < .01$). These results suggest that the timed AWT has robust construct validity as a test of psychomotor speed and because administration requires less than one minute, it is a useful supplement to brief mental status screening tests.

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T. GIOVANNETTI, M.F. SCHWARTZ & D. HOLZ. A Comparison of Two Scoring Methods for Naturalistic Action Assessment.

Patients with cognitive deficits often experience problems in naturalistic action (e.g., grooming, meal preparation, etc.); however, neuropsychologists rarely assess naturalistic action in the clinic. This may be because traditional methods require videotaping and extensive training of coders. The present study explored the sensitivity of an on-line, user-friendly coding method for detecting naturalistic action impairment. Fifty-four patients with degenerative dementia, 46 patients undergoing rehabilitation for stroke or traumatic brain injury, and 28 control participants were administered the Naturalistic Action Test (NAT; Schwartz et al., 2003), a standardized performance-based measure. Performance was assessed using 2 coding systems: 1) Comprehensive Error Score (CES)- analysis and classification of all errors (i.e., omission, substitutions, etc) and 2) NAT Score (NS) - a simplified system that combines the percent of steps accomplished and analysis of a subset of key errors. Results showed that NS captured less than 50% of the errors coded with the traditional error analysis; however, both scoring systems were highly correlated ($r = .83 - .78$) and demonstrated a high rate of agreement (83 - 90%) in classifying patients as impaired compared to control performance. Furthermore, both scoring methods significantly correlated with an external measure of functional disability (Functional Independence Measure; $r = .42, .39, p < .01$ for both). In sum, the NS is as sensitive as the CES in detecting naturalistic action impairment and is recommended as a more efficient method for the clinical assessment of naturalistic action.

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D. ORME & B. THOMPSON. A Case for Aviator-Specific Norms.

Aviators who sustain head trauma must undergo neuropsychological evaluation to determine medical qualification to return to flying. This presentation argues the need for aviator-specific norms and demonstrates their usefulness using IQ test norms developed using a large sample of USAF pilot training candidates. Participants were 5617 USAF pilot training candidates. Mean age was 22.98 (mean = 2.44). Most were male (91.8%) and caucasian (91.7%). Subjects were administered psychological tests including the Multidimensional Aptitude Battery (MAB), a group-administered intelligence test. SAS GLM MANOVA procedure was used to analyze main effect for ethnic groups for FSIQ, VIQ, PIQ, and subscales. Contrast estimates were performed to determine significant differences for each test relative to ethnic group where a significant main effect for ethnic group was determined. Mean FSIQ was greater than 1 SD above test norms (mean = 120.6; SD = 8.2), indicating need for aviator-specific norms. SAS GLM MANOVA revealed significant differences between ethnic groups for summary scores. Consequently, ethnic group-specific mean FSIQ, VIQ, PIQ, and subscale scaled scores were developed. Tables were also developed showing statistically significant differences between VIQ/PIQ and subscale scores for the total group and by ethnic group and gender; base rates for VIQ/PIQ difference scores were also calculated for these groups. Aircrew represent a unique population. Consequently, it is important that aviator-specific psychological test norms be used whenever possible when making critical return-to-flying decisions. Additionally, ethnic background also needs to be considered. Tables developed for this study may be used with aviators. Correspondence: *Daniel Orme, Ph.D., Department of Health Psychology, University of Missouri - Columbia, One Hospital Drive DC 046.46, Columbia, MO 65212. E-mail: ormed@health.missouri.edu*

R.J. SPENCER, P.P. GIGGEY & O.A. SELNES. The Symbol-Digit Modalities Test: incidental learning performance.

Incidental learning of the Symbol-Digit Modalities Test (SDMT-IL) remains largely unexplored. This investigation examined SDMT-IL in predicting performance on other measures of memory above and beyond the effects of demographics and general cognitive functioning. Specifically, performance on SDMT-IL was used to predict performance on WAIS-III Digits Backward (DB), Rey Complex Figure recall (RCF-R), Rey Auditory Verbal Learning Test immediate (RAVLT-IR), short (RAVLT-SR) and long delayed recall (RAVLT-DR) in a sample of 97 (43% male; 15 years education) outpatients, ages 22-85 years (mean = 63) referred for neurocognitive evaluation. Five separate stepwise regression analyses were conducted, each using one memory measure as DV. Age, education, MMSE, and either RAVLT-SR or RCF-R were entered as a group in step 1, and SDMT-IL was entered in step 2. Results indicated significant entry of SDMT-IR at step 2 in models predicting RAVLT-SR, RAVLT-DR and RCF-R. In these models, variables in step one explained 59, 62, and 56 percent of the variance in RAVLT-SR, RAVLT-DR and RCF-R, respectively ($p < .01$), and SDMT-IL in step 2 accounted for an additional 2.9, 2.3 and 5.6 percent of variance ($p < .05$). These results suggest that SDMT-IL predicts short and long-delayed (but not immediate or working) memory above and beyond age and general cognitive function. Therefore, SDMT-IL may be an important marker for storage and retrieval processes, and an effective screening measure to identify patients for more comprehensive memory evaluation.

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J. TAN, E. STRAUSS, D.F. HULTSCH, M. HUNTER & R. DIXON. Influence of Impending Death on the Mini-Mental State Examination.

A cross-sectional, retrospective study was conducted to investigate the impact of impending death on test performance on the Mini-Mental State Examination (MMSE), a measure of general cognitive functioning. Using data from the Victoria Longitudinal Study, test scores on the MMSE of 39 healthy individuals collected five years before death were compared to those of 39 age- and education-matched healthy individuals who were still alive. Results revealed a significant difference between the MMSE total score of individuals who died within three years post-measurement, and survivors and those who died between three to five years after measurement. When the individual items were analyzed, only the "WORLD" and "copy pentagon" items obtained results similar to the total score, providing support for the specificity of impending death effect on fluid abilities. The cause of death (cardio/cerebro-vascular disease and non-cardio/cerebro-vascular disease) however, did not differentiate the groups, suggesting that the mechanism of impending death may not be disease-related. Our results confirm that the influence of impending death on cognitive functioning can be observed on the MMSE about three years before death; however, the source of the influence is unknown. Of note, the differences in overall MMSE scores were small, less than one point, revealing statistical but not clinically meaningful differences and do not justify the need to collect new normative data to remove impending death effects.

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K. SCHMIDT, J.M. LIETO, E. KIRYANKOVA & A. SALVUCCI. Validity of the Dementia Rating Scale-2: Alternate Form.

The Dementia Rating Scale-2: Alternate Form (DRS-2: AF) was developed by Schmidt (2004) to reduce the practice effects that can occur in serial assessments with the original DRS-2 (Jurica, Leitten, & Mattis, 2001). Our main goal was to provide evidence for construct validity, concurrent validity, and predictive validity. Two separate validation studies were conducted. In Study 1, the DRS-2: AF was administered to 52 community-dwelling adults over age sixty without dementia to assess the construct validity of the subscales. In Study 2, the DRS-2: AF and Mini-Mental State Examination (MMSE) were administered to a sample of 65 participants living in a continuing care retirement community (35 healthy residents and 30 residents with dementia) to demonstrate both concurrent and predictive validity. In Study 1, convergent and discriminant correlational analyses between the DRS-2: AF subscales and traditional neuropsychological measures revealed solid evidence of construct validity. In Study 2, Total Scores on the DRS-2: AF were highly correlated with MMSE scores ($r = .81, p < .001$). When raw scores were converted into MOANS scaled scores based on age, a cutoff score of 7 on the Total Score resulted in a sensitivity of 90.0% and specificity of 94.3%. The results of these validity studies are robust, and suggest that the DRS-2: AF may be a useful assessment tool in both clinical and research settings.

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J.L. SALVATIERRA, M. ROSSELLI, R. TAPPEN, C. WILLIAMS, B. NAAR & M.C. RAMIREZ. The Influence of Education on the Mini-Mental State Examination in a Hispanic Elderly Population.

The Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) is one of the most commonly used screening measures for dementia. The MMSE has been criticized for its bias against individuals with lower levels of education. Further criticism comes from the fact that the serial sevens item, which measures attention and cal-

culation, is frequently replaced by a less difficult backwards spelling task. The performance of Hispanic elderly individuals at different levels of education on both the serial seven and the spelling backwards tasks was examined. Educational level was expected to influence scores on the MMSE. This study examined the performance of 117 elderly Hispanic individuals on the Spanish MMSE (mean age 74.46; SD=7.94; Female: 70.9%), who were divided into three groups based on educational level: less than 7 years of education (n=41), between 7 and 11 years of education (n=29), and over 11 years of education (n=47). No age difference across groups was found. Two MMSE total scores were obtained for each participant using either serial sevens or backwards-spelling tasks. Data were analyzed using a repeated measures analysis of variance mixed design. Total scores on the MMSE were significantly influenced by years of education. Individuals with less than 7 years of education obtained a significantly lower score than individuals with 7 years of education or more. A significant difference in scores was also observed between the total scores using serial sevens and the backwards-spelling tasks. The interaction was non-significant. Although years of education influenced total scores on the MMSE, all groups, regardless of educational level, obtained lower scores on the serial sevens task than on the backwards spelling task.

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L.J. HAMILTON & Y. SUCHY. Behavioral Dysregulation as a Function of Age and Task Complexity.

The Push-Turn-Tap-Tap (PTT) is a computer-administered task paralleling the Motor Programming Factor (MP) of the Behavioral Dyscontrol Scale (BDS). The PTT measures a variety of motor learning and motor programming abilities, such as the ability to learn progressively harder hand sequences, the ability to engage in smooth tapping, and the ability to perform tasks effortlessly, smoothly, and rapidly without mistakes. The present study examined whether age was related to declines in performance on the PTT as a function of task complexity. The PTT was administered to three groups of healthy community dwellers: college-aged (18-28), middle-aged (42-50), and older (58-68) who were required to learn four progressively more difficult sequences of three hand movements. Four different indexes of motor control (speed of tapping, motor perseveration, time of single correct sequences, and number of errors), as well as preparation time for subsequent sequence, were assessed. We found that motor control of older participants was virtually equal to that of younger participants during performance of simple sequences, but deteriorated disproportionately as task complexity increased, all $F(3,51)$ values > 2.8 , all $ps < .049$. In contrast, preparation time for subsequent sequence was longer for older participants across all levels of complexity, $F(3,50) = 33.78$, $p < .001$. These results suggest that the PTT may prove to have both theoretical and clinical utility in assessment of motor control.

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J. REDFIELD. Demographically Corrected WMS-III Scores For Ethnic Minorities: Use With Caution, If At All.

The suitability of demographically corrected WMS-III scores for different ethnic groups was evaluated. Hypothetical data sets were created to represent performance at the 50th percentile for each primary WMS-III subtest at 3 different ages: 25, 50, and 75. Data were analyzed using the WAIS-III—WMS-III—WIAT-II Scoring Assistant Program, with systematic variation of ethnic group, gender, and years of education between 6 and 16 years. Anomalies in demographically corrected WMS-III scores for African American and Hispanic individuals were identified. For example, using the same raw scores, African Americans with 6 years of education obtain demographically corrected WMS-III scores that are up to 10 T-score points lower

than those of African Americans with 11 years of education. For African Americans with less than 11 years of education, demographically corrected scores derived from the same raw scores decrease with decreasing years of education, opposite the pattern for white individuals over the same educational range. For African Americans with more than 11 years of education, demographically corrected scores decrease with increasing years of education, as they do for whites. This paraboloidal trend occurs with the Immediate, General, and all Auditory Memory Indexes, but not with the Visual or Working Memory Indexes; it is also present for selected subtest scores contributing to those indexes. Among Hispanic individuals, only the General Memory Index has a paraboloidal trend over the educational range. Results were not affected by age or gender. The substantial differences in trend lines between ethnic groups over the educational range suggest that demographically corrected WMS-III scores for African American or Hispanic individuals be used with great caution, and sometimes, perhaps not at all.

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S.E. O'BRYAN, C.W. SCHRIMMER & J.R. O'JILE. Discrepancies Between Self-Reported Level of Education and Estimated Reading Level: Potential Implications for Neuropsychological Test Interpretation.

Current standard neuropsychology practice is to examine normative sample performance for systematic influences of demographic variables and then to correct for these influences. The most commonly examined demographic variables are age, gender, and education, and current normative databases frequently take these into consideration. However, there is a literature to suggest that self-reported level of educational attainment may not be an accurate reflection of some patient's level of performance and may actually over predict grade estimates based on reading level. Many of these studies have focused on older samples of individuals who were free of neurological and/or psychiatric symptoms. The current study sought to evaluate this discrepancy in a younger, clinically diverse sample. In the current study a younger sample (average age = 44.5) of African American (N = 62) and Caucasian (N = 133) patients referred to an outpatient psychiatry unit was examined. Results suggest that the prior findings of a significant discrepancy between self-reported educational level and Wide Range Achievement Test-3rd edition Reading Recognition performance hold for a younger sample with a broad range of clinical diagnoses. The potential implications for these findings are discussed in terms of selecting appropriate norms and interpreting neuropsychological test results.

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L. FRAKEY, A. SHRIKISSOON, K.G. THOMAS, W.J. JACOBS & R.M. BAUER. Identifying Deficits in Spatial Abilities Following Right Medial Temporal Lesions.

Lesions to the language-nondominant right hemisphere have been shown to produce deficits on clinical neuropsychological tests of spatial ability. We investigated the diagnostic efficiency (positive predictive power (PPP), sensitivity, negative predictive power (NPP), and specificity) of commonly used clinical measures of spatial ability and of an experimental task of spatial learning and navigation in the evaluation of patients who had undergone resective surgery for intractable epilepsy (ATL). Participants who had undergone either a left- or right-ATL and matched controls were assessed on a battery of clinical measures of spatial ability and on a computer analog of the Morris Water Maze called the C-G Arena. Clinical measures were administered and scored using the standardized instructions and norms available in the published manuals. Performance on Arena was represented as standard score deviations using the matched control group as the comparison. Using a liberal cutoff value for determining impairment (-1 SD), none of the

measures showed adequate diagnostic efficiency in identifying participants with right hemisphere lesions. However, using a more stringent cutoff for impairment (-1.5 SD) only the experimental measure, the C-G Arena, showed adequate diagnostic efficiency. Specifically, PPP, NPP and specificity were greater than 0.70. Sensitivity failed to reach a diagnostically efficient level (0.44). Results suggest that traditional clinical measures of spatial ability are inadequate for identifying spatial impairment in patients with medial temporal lobe lesions. The C-G Arena, an experimental measure of spatial learning and navigation, showed the best diagnostic efficiency in correctly identifying this group and may have significant clinical utility.

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C. PARADEE, L.J. RAPPORT & R.A. HANKS. Short Form of the Morningness/Eveningness Questionnaire Among Rehabilitation Inpatients.

Circadian preference is the most powerful individual difference in the realm of circadian rhythms. The most commonly used measure of morning or evening preference is Horne & Ostberg's (1976) Morningness/Eveningness Questionnaire. However, its length (19 items) has been criticized as too long for screening and research purposes. A shorter measure has been developed (r-MEQ; 5 items) and has been shown to have comparable ability to identify morning- and evening-oriented individuals in student and worker populations. The present study examines the equivalence of these two measures in a population of rehabilitation inpatients, among whom circadian preference has been established as an important clinical consideration. The MEQ was administered to 99 individuals during their inpatient stay in a midwestern rehabilitation hospital. The criterion measure was Horne and Ostberg's 19-item MEQ, which identified 65 morning- and 14 evening-oriented persons. Nineteen individuals fell in the "neither" category. The 5 items of the r-MEQ were then extracted to compare categorization results. Forty-seven persons were categorized as morning oriented, 11 as evening, and 41 as neither. In this investigation, the r-MEQ was consistently more specific than sensitive in identifying morning- and evening-oriented persons (94% specific vs. 69% sensitive for AM; 99% specific vs. 71% sensitive for PM), arguably favorable for research examining differences in these populations. Reliability of both versions was also assessed. The use of the shorter form for research purposes in this population appears to be warranted. However, further examination in which the two measures are administered separately to participants is recommended.

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F.C. GOLDSTEIN, V.J. ROBERTS, J.L. WOODARD, J.J. MUIR, M.B. MITCHELL & A.V. ASHLEY. Direct Assessment of Functional Status: A Cultural Bias?

The direct assessment of basic and instrumental activities of daily living (ADL), as opposed to self or collateral informant ratings, provides an objective measure of patients' capabilities that is unaffected by factors such as level of awareness. The current study examined whether cultural differences may affect the assessment of these activities. Patients with probable Alzheimer's disease (19 African American, 12 Caucasian) and cognitively intact controls (7 African American, 8 Caucasian) were administered the Direct Assessment of Functional Status (DAFS) scale for older adults. Analyses indicated that the DAFS was significantly impaired in the AD patients, relative to controls, in the areas of Time Orientation (telling time, orientation to date), Communication Abilities (telephone skills, preparing a letter for mailing), Transportation (Identification of Commonly Encountered Road Signs), Financial Skills (identifying and counting currency, writing a check, balancing a checkbook, making change), and Shopping Skills (shopping from memory and with a written list). The groups did not differ significantly in

basic ADL subscales measuring Dressing/Grooming or Eating skills. However, there was also an effect of race on performance of selected subscales ($p < .05$). Forty six percent of the African Americans did not previously drive compared to 15% of the Caucasians, and 23% of the African Americans did not previously manage a checkbook compared to none of the Caucasians. Analyses restricted to those who had performed these activities revealed that African American patients and controls as a group performed more poorly than Caucasian patients and controls on the Transportation and Financial Skills subscales. The results suggest that the assessment of functional abilities contains a cultural bias reflecting experience and exposure to certain activities. These factors need to be considered when evaluating these skills.

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D.P. LOWERY. Subtle attention impairments in the absence of dementia provide sensitive predictors (7- fold increased risk) and markers of post operative Delirium.

Incidence of delirium in elderly elective orthopaedic admissions is between 20%-40%. An acute and disturbing fluctuating of consciousness, delirium is associated with poor prognostic outcomes including longer hospital stay, increased costs, risk of falls, institutionalisation, reduced activities of daily living, cognitive impairment, dementia and death. Consciousness manifests through attention; we therefore hypothesise a validated measure of attention will provide a sensitive marker of delirium, and subtle attention deficits will be a significant risk factor for delirium. A prospective study monitored 100 consecutive elective orthopaedic volunteers, >70 years old, and free of dementia. Mini-Mental State Examination, Confusion Assessment Method and CDR Lids computerised battery of attention performance tasks, were administered pre and post operatively up to a year after surgery. Independent t test analysis and odds ratio statistical tests were used. Patients who developed delirium had significantly slower mean reaction times (RT) ($p = 0.01$) (OR, 7.1; CI 95%, 1.9-25.6 for optimal cut-off) and greater variability of RT ($p < 0.0001$) pre-operatively. Additionally, patients with delirium had significantly slower RT (day 3-7 $p < .015$); and significantly greater fluctuations of RT (day 3-7 $p < .010$) post operatively. Subtle attention impairments provide sensitive predictors and markers of delirium. Early detection and prevention of delirium is a key clinical management issue. Implementing such a tool prior to surgery can identify high risk patients, providing opportunities to optimize preventative management strategies. Additionally, the link between delirium and subtle deficits of attention raises important mechanistic issues, and future research may inform novel treatment approaches.

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L.R. KINGERY, S. SATERI & D.J. SCHRETLEN. Word and Design Fluency Constitute a Distinct Cognitive Factor.

The cognitive operations involved in word and design fluency are poorly understood. One important question is whether fluency represents a distinct cognitive domain. Using principal components analysis, the aims of this study were to examine how word and design fluency relate to other cognitive measures, and to determine whether or not fluency tests cohere to form a distinct cognitive factor. The study sample included 248 healthy adults from the Johns Hopkins Aging, Brain Imaging and Cognition study (mean age = 55 ± 19 years; 46% male; 77% white). The tests used in this analysis were chosen to represent known domains of cognitive functioning. They included 20 common neuropsychological measures that assess a broad spectrum of cognitive abilities. The flu-

ency tests included word list generation to category (animals, supermarket items) and letter (s and p) cues, and number of novel designs from the Design Fluency Test. Factor analysis with varimax rotation yielded five factors that accounted for 71% of the total variance. Proposed factor labels (and percent of variance explained) were: visuospatial ability/memory (40%), verbal ability (12%), verbal memory (7%), fluency (6%), and attention (5%). All three fluency measures loaded most strongly on one factor that did not include the strongest loading of any other variable. These results suggest that word and design fluency constitute a coherent dimension of cognitive functioning that bridges verbal and nonverbal modalities, perhaps reflecting a fundamental capacity for generativity.

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S. SATERI, L.R. KINGERY, L.K. LANGLEY, S.M. MEYER & D.J. SCHRETLEN. Inter-Rater and Test-Retest Reliability of the Design Fluency Test.

The clinical use of the Design Fluency Test (DFT) developed by Jones-Gotman and Milner (1977) is constrained by the lack of information about its reliability. Previous inter-rater reliability studies yielded mixed results, and only one investigation reported data on the stability of the DFT over time. The aim of this study was to evaluate the inter-rater and test-retest reliability of the fixed condition of the DFT in a broadly representative sample of normal adults. The temporal stability of DFT performance was compared to the stability of 25 other neuropsychological tests, including seven subtests of the WAIS-R and tests of attention, language, verbal and visual memory, verbal fluency, executive functioning, and psychomotor speed. The sample included 254 healthy adults from the Johns Hopkins Aging, Brain Imaging and Cognition study (mean age = 56 ± 18 years, 46% male, 75% white), of whom 101 were tested twice (mean interval = 66 ± 10 months). In 50 protocols scored by five raters, the mean intraclass correlation coefficients (ICCs) were 0.99 for total designs drawn, 0.97 for novel designs, 0.94 for rule violations, and 0.82 for perseverative errors. Total number of designs drawn and novel designs were moderately stable over time (ICCs of 0.75 and 0.68, respectively). The ICCs for 25 other neuropsychological tests ranged from 0.25 to 0.88 with a mean of 0.67. This study demonstrates that fixed condition DFT protocols can be scored reliably. Further, test-retest reliability of the DFT over 5-6 years is both reasonable and similar to that of most other neuropsychological tests.

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L. LU, J. YUN, S.M. MEYER & D.J. SCHRETLEN. Inter-Rater Reliability, Construct Validity, and Normative Data for the Clock Drawings of Normal Adults.

Worldwide, clock drawing tasks (CDT) are among the most widely used measures of cognitive functioning. Although many different administration and scoring methods have been used, the 6-point scoring method proposed by Shulman (2000) has excellent sensitivity and specificity for dementia. However, normative data for the CDT are lacking, and precisely what it measures still remains unclear. The aims of this study were to assess the inter-rater reliability of Shulman's scoring method in conjunction with free hand clock drawings, investigate the construct validity of clock drawing, and provide normative data for this CDT. We administered the CDT (to request and copy) along with a battery of other neuropsychological tests to 183 community-dwelling adults between 20 and 96 years of age. Intra-class correlations for two independent raters ranged from 0.95 to 0.98. Further, CDT performance correlated in the

expected direction with age and years of education but not with sex or race. Even after controlling for age, CDT performance also correlated with many other neuropsychological measures, particularly those involving visual-constructional abilities, visual learning/memory, attention, psychomotor speed, and executive functions. Conversely, CDT performance did *not* correlate with IQ, verbal fluency, verbal learning/memory, or depression. Free hand clock drawings can be scored using a modification of Shulman's method with excellent inter-rater reliability. Clock drawing performance is relatively independent of IQ, but correlates with many other cognitive abilities in normal adults. We present normative data for CDT performance by a broadly representative sample of adults of all ages.

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A.D. RUEDA, S. LLANES, D. MUNGAS & B.R. REED. Components of Clock Drawing Performance Bear Different Relations to Cerebral Pathology.

The clock drawing task (CDT) invokes multiple cognitive abilities. The purpose of this study was to test whether different components of CDT performance are related to pathology of different brain regions. We modified Rouleau's scale (1992) to analyze clock drawings by 145 participants in a study of vascular contributions to dementia, including patients with ischemic vascular dementia, Alzheimer's disease, mild cognitive impairment (MCI) and normal persons. Evaluations included research MRI and neuropsychological tests. We rated the following clock indices: Executive Function Index (EFI), Spatial Index (SI), and Graphic Index (GI). MRI data were segmented and the following variables, normalized for head size, were created: white matter lesions (WML), cortical gray matter (CGM), hippocampal volume (HV), and volume of lacunes (LV). Correlations between the 3 indices were low to moderate (r 's < .43). A regression model was constructed for each clock index using age, education, cognitive syndrome (normal, MCI, demented) and the MRI variables as predictors. EFI was predicted ($R^2 = .38$) by CGM ($p < .0001$) and syndrome ($p < .005$). GI was predicted ($R^2 = .27$) by CGM ($p < .01$), LV ($p < .0004$) and marginally by syndrome ($p < .09$). Similar results were found for both indices when the subset of demented subjects was analyzed alone. The three CDT scales showed different relationships to cerebral pathologies. Counter to our hypothesis, EFI related to CGM but not to WML. CGM tends to be a stronger predictor of cognitive function than is WML; perhaps because only a minority of impaired subjects had high WML, while nearly all had cortical atrophy. WML effects were obscured. The relationship between GI and LV is consistent with prior research demonstrating effects of lacunae on motor skills. The lack of predictors for SI suggests this index is not a simple severity gauge, but does not offer clues as to exactly what it does measure.

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A.B. CHERVINSKY. Attention: Test Performance of Clinical and Forensic Groups, Intraindividual Variability.

This study addressed performance on several tests of attention including WAIS-III Digit Span (DS), Arithmetic (AR), Letter-Number Sequencing (LN), and WMS-III Spatial Span (SS). The objective was to evaluate group and individual differences among forensic and clinical cases. The sample consisted of 71 cases assessed in either clinical or forensic context. Group means were compared in regard to context of assessment (forensic vs. clinical), and presence of neurologic history or history of psychopathology. Individual test performance was evaluated relative to the magnitude of discrepancies between maximum and minimum age corrected scale scores (acss). Forensic cases showed significantly lower ($p < 0.05$) DS and LN

scores compared to clinical cases. Among forensic cases, presence of neurological history did not result in significant attentional score differences. Among clinical cases, individuals with neurological history showed lower DS and LN than those without. AR scores bordered significance. History of psychopathology did not significantly impact attentional performance among clinical or forensic cases. SS scores were not found to differentiate between groups. Substantial intraindividual variability was observed among test scores, with average discrepancy about 4 acss points, or 1.3 SD. The magnitude of the discrepancy was not found to differ relative to context, neurological history or psychopathology. Forensic cases showed lower attentional test performance regardless of neurologic history or psychopathology. History of psychopathology did not impact attentional test performance. Alternately, neurological history was associated with lower scores. While substantial, the magnitude of discrepancies among individual scores did not differ relative to assessment context or clinical history.

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M. HUSKEY & S. HALL. The Experience of Malingering: Test Performance, Coaching, and Strategy Utilization .

Two goals were addressed: (a) manipulate the amount of information regarding brain damage provided to uncoached malingers (UM) and coached malingers (CM), and (b) explore strategies utilized by malingers. It was hypothesized that coaching would improve test performance. Furthermore, it was predicted that malingering strategies would include feigned memory deficits and slow responding. Sixty-three college students were randomly assigned to the following groups: controls, uncoached malingers (UM), and coached malingers (CM). The students were administered the Victoria Symptom Validity Test (VSVT), Test of Memory Malingering (TOMM), Trail Making Test, Grooved Pegboard, and Controlled Oral Word Association. After test administration, participants completed a questionnaire that assessed all the strategies they used as well as the strategy used most often (primary strategy). They were also provided the opportunity to note additional strategies used that were not included on the questionnaire. ANOVAs showed that controls obtained significantly higher scores on all tests compared to both malingering groups. CM outperformed the UM only on the TOMM and VSVT. The 2 most frequently endorsed primary strategies included missed many questions and responded slowly. Chi-square indicated that a significant percentage of malingers also used the following strategies: feigned memory loss, missed more difficult than easy items, appeared confused/disinterested, and kept track of responses. This study indicates that coaching may increase performance on malingering tests but not on standard measures. Furthermore, a number of malingering strategies were identified which may be useful in understanding the process of malingering.

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M. HUSKEY & S. HALL. Warning Participants About the Existence of Malingering Tests: Timing, Test Performance, and Face Validity.

The impact of providing a warning regarding the existence of malingering measures either before or after testing was examined. It was hypothesized that providing this warning before testing would result in better test performance and more accurate face validity judgments. Eighty college students were randomly assigned to be a malingers or control. Half received the warning before testing (informed) while the other half received this information after testing (naive). The tests included the Victoria Symptom Validity Test, Test of Memory Malingering (TOMM), Trail Making Test, Grooved Pegboard, and Controlled Oral Word Association (COWA). After testing, participants were given a ques-

tionnaire assessing their beliefs regarding the purpose of the tests. ANOVAs showed a significant main-effect for instructions for all tests, indicating the controls outperformed the malingers. A significant main-effect also occurred for face validity for the TOMM and COWA, showing better performance for the informed participants. The warning did not impact the face validity of the tests. Chi-square analyses indicated that the malingering measures had good face validity as memory tests and the other measures were accurately viewed as standard neuropsychological tests. These results suggest that warning participants about the presence of malingering tests prior to testing does not affect the face validity of these tests. Moreover, test performance was affected on only two measures. Although patients may know that malingering tests will be included in an assessment, this knowledge may not assist them in distinguishing malingering tests from standard tests and has minimal effect on test performance.

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L.A. GALLO & P.J. DONOVICK. A Rare Disorder or Malingering? A Case Study.

We report a case study of mirror reading and inverse writing in a 58 year old man following a cerebral vascular accident. Patient D.D. is a 58 year old man who suffered a cerebral vascular accident in 1997. Following this incident, patient D.D. has presented with significant memory problems as well as difficulties with visual perception. Specifically, he sees visual images in reverse. For example, he cannot read printed material as he sees it in reverse, thus requiring the use of a mirror to aid in reading. In addition, when he writes, he writes completely inverted such that a reader is unable to read what he has written without the use of a mirror. Patient D.D. reports that he did not write in this manner prior to the CVA. In addition, he was left-handed prior to the CVA, however due to weakness of the left side of his body, he is now right-handed. A neuropsychological evaluation was conducted to assess patient D.D.s current functioning. Measures of Symptom Validity did not indicate malingering. Patient D.D.s visual perceptual deficits appeared to negatively affect his performance on several cognitive measures. However, even when permitted to use a hand-held mirror he performed in the low average and extremely low range of functioning. Although he appears to have adapted motorically to this visual deficit, he continues to have significant visual-perceptual deficits.

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B. GREUB & J. SUHR. The Validity of the Letter Memory Test as a Measure of Malingering: Robustness to Coaching.

The present study examined the utility of the Letter Memory Test (LMT) in the identification of malingered cognitive impairment, using a simulated malingering paradigm. The LMT is a computerized forced-choice test that includes two face validity manipulations: increase in stimulus length and increase of response choices. Performance on the LMT was compared in healthy controls (n=28) and in participants with history of mild head injury, some of whom were asked to perform with best effort (n=25) and others asked to simulate cognitive impairment following head injury (n=49). As an additional manipulation, a random 1/2 of those asked to simulate head injury were warned about the potential for malingering detection during the evaluation. The LMT was administered in the context of a clinically relevant battery of neuropsychological assessments, including an additional malingering measure (the 15 Item Test). As expected, the LMT was insensitive to head injury (0 false positives) but sensitive to malingering and robust to detection warning. The LMT was superior to the 15 Item Test in sensitivity to malin-

gering. Repeated measures analyses showed that, for the two best effort groups and the warned simulator malingerers, performance across target stimuli length and number of responses remained stable, while performance by the naive simulators worsened as stimulus length and number of response choices increased. Results further support use of the LMT as a measure of poor effort.

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J. BARRASH, N.L. DENBURG, D.J. MOSER & B.N. DOEBBELING. Assessing Credibility of Neuropsychological Performances of Gulf War Veterans and Military Controls Participating in Research on Gulf War Syndrome.

We investigated whether Gulf War veterans were more likely than Gulf era veterans to produce noncredible neuropsychological exams in a longitudinal study. 301 Gulf War and 98 Gulf era veterans (half of whom reported cognitive dysfunction) underwent extensive evaluation, including neuropsychological testing. Three neuropsychologists independently rated the credibility of neuropsychological performances based on test scores, effort ratings, AVLTX Exaggeration Index, MMPI2, psychiatric diagnoses and neurological history. Disagreements were resolved by conference. 198 veterans were impaired on one or more neuropsychological tests. Of these, three Gulf War and four Gulf era veterans were classified as having noncredible exams (not a significant difference). Interrater agreement (93%) and kappa (.76) were excellent. Compared to the impaired but credible group by conservative Mann-Whitney U tests, the noncredible group performed significantly worse on memory measures, Block Design and overall neuropsychological performance. Compared to the impaired-credible and normal groups, the noncredible group had lower effort ratings, higher Exaggeration Index scores, and more Cluster B personality traits, hypochondriacal predisposition, and mood disturbance. Of note, veterans with impaired but credible exams were highly similar to normals on non-cognitive features that characterized veterans with impaired but noncredible exams. Noncredible exams can be reliably identified in these samples. Gulf War veterans were not more likely than Gulf era veterans to produce noncredible exams. The validity of the judgments was supported by a pattern of findings indicating that the noncredible group was qualitatively different from veterans with impaired but credible exams in ways not easily attributable to an adult-onset illness.

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Forensic Neuropsychology/Malingering

D.E. TRAHAN & C. ROSS. Reliable Digit Span: Base Rates of Impairment in Normal Adults and Patients with Known Neurological Disease.

Detection of malingering is an essential component of neuropsychological examinations, especially when there is incentive for test "failure". One measure of potential malingering, Reliable Digit Span (RDS) was introduced by Greiffenstein, Baker, & Gola (1994). Studies have demonstrated the sensitivity and specificity of RDS in detecting malingering, but most have focused on patients with mild brain injury, and the samples have included mostly young adults under age 40. This study examines base rates of impairment in RDS in normal adults of all ages and a broader range of patients with known neurological disease. Group 1 included 81 normal adults (34 male, 47 female; age range 18-61). Group 2 included 359 outpatient adults (168 male, 191 female, age range 18-89) referred for evaluation for problems related to stroke, traumatic brain injury, Alzheimer's Disease, and mixed neurological problems.

Group 3 included 144 adults (59 male, 85 female; age range 22-95) who were admitted to inpatient rehabilitation for diagnoses identical to those in Group 2. All were administered RDS as part of a battery of neuropsychological tests. The recommended cut-off score of 7 (Greiffenstein et al., 1994) was used for data analysis. Among normal adults 80 of 81 (99%) scored at or above a score of 7. For outpatients, 304 of 359 (85%) scored at or above 7. When 31 patients with expressive dysphasia were excluded from the sample, 93% scored at or above 7. For inpatients, 89 of 144 (62%) passed the RDS test. With expressive dysphasics excluded, the pass rate was 82%. Within age groups, correlations between age and RDS ranged from -.14 to .06 and were non-significant. Results indicate that base rates of impairment on RDS are extremely low for normal adults (1%) and quite low for nonaphasic patients with known neurological disease (7-18%). However, caution should be applied when using RDS with individuals with expressive dysphasia, which can elevate base rates of impairment to 15-38%.

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R. VILAR, A. PUENTE, M. PEREZ-GARCIA, A. RODRIGUEZ-FERNANDEZ, C. RAMOS-FONT, J. GARCIA-RIVAS, M. CASTANEDA & M. GOMEZ-RIO. The Influence of Attentional Problems in a Malingering Test.

The b test have been proposed as an instrument for diagnosis malingering in post-concussion syndrome (PCS) after mild head trauma (MHT), which could be explored by neuropsychological and brain neuroimaging (regional Cerebral Blood Flow rCBF-SPECT). We hypothesize that the execution in the b test could be influenced by attentional problems. This work explores the possible relationship between the b test and attentional dysfunction. Twenty one participants diagnosed of PCS after MHT, were explored with the b test, d2, and regional cerebral blood flow tomography (rCBF-SPECT). These procedures were included in a comprehensive battery. After Pearson product-moment correlation analysis, the mainly variables of b test showed statistical significant correlation with d2 variables: e-score and commission errors ($r=0.768$; $p<0.000$); e-score and CON ($r=-0.724$; $p<0.000$); d errors and O errors ($r=0.659$; $p<0.001$); d errors and C errors ($r=0.686$; $p<0.001$); d errors and CON ($r=-0.685$; $p<0.001$); commission errors and C errors ($r=0.838$; $p<0.000$); commission errors and CON ($r=-0.632$; $p=0.003$). Three patients showed a high probability of malingering, but rCBF-SPECT and d2 was normal in two cases. The attentional function influences the scores in the b test. The results of the b test in patients with attentional problems should be interpreted with caution. Therefore, it is necessary for more research to be conducted in order to know which variables of the b test are influenced or not influenced by attentional deficits.

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H. OU, M. HONG, S. LEE, S. RYU, M. HO, Y. YANG & C. BRADSHAW. The Performance of Taiwanese Stroke and Head-injured Patients on Choice Reaction Time Tasks for Detecting Simulated Cognitive Impairment.

To evaluate the performance of Taiwanese patients with brain damage on a 'performance curve' method for detecting cognitive malingering. Thirty six healthy participants and patients suffered from cognitive impairments due to head traumas ($n=17$) and cerebrovascular accidents ($n=19$) were recruited. The method was based on quantitative analysis of choice reaction times in a series of eight matching-to-sample tasks of graded difficulty. Two separate sets of stimuli were used for measuring the choice reaction times on the tasks: one consisted of arrays of English letters, ranging from 1 to 10 letters; the other consisted of geometric designs. The participants also underwent a battery of neuropsychological assessment. The data were compared between groups using ANOVA with

post hoc analyses when appropriate ($\alpha = 0.05$). The results showed that the relationships between each participant's reaction times and the mean reaction times of a standardization sample on both tasks could be well described by a linear function in all three groups. Both patient groups showed steeper slopes of the linear functions than those obtained from the control group [$F_s(2, 74) > 12$; $P_s < 0.001$], but the intercepts did not differ between groups [$F_s(2, 74) < 2.1$; $P_s > 0.1$]. There were also significant differences between the groups in several measures of cognitive performance, including, IQs, memory, visuospatial functioning, and executive functions. Interestingly, however, a measure based on the proportionate increase in reaction time derived from the reaction time tasks, did not differ between groups [$F_s(2, 74) < 1.3$; $P_s > 0.2$]. This suggests that while the enhancement of reaction times has often been observed following brain damages in many studies, the proportion of increase in reaction times as a function of task difficulty was not altered after brain damage. The finding, in principle, offers the potential for sophisticated assessment of simulated cognitive impairments across different cultural backgrounds. Correspondence: *M-Y Ho, PhD, Institute of Clinical Behavioral Sciences, Chang Gung University, 259, Wen Hua 1st Road, Kwei Shan, Tao Yuan County 333, Taiwan. E-mail: myho@mail.cgu.edu.tw*

E.P. SPARROW, S. RZEPA, D. ERHARDT, G. SITARENIOS, C.K. CONNERS & J. SMITH. Detecting Attention-Deficit/Hyperactivity Disorder (ADHD) Among Adult Offenders with the Conners Adult ADHD Rating Scale (CAARS).

Recent publications have indicated higher rates of ADHD in adult corrections settings than in the general population (ranging from 9% to 39% based on current DSM-IV criteria, and from 43% to 63% based on retrospective recall of childhood symptoms). A diagnosis of ADHD impacts offender response to rehabilitation and release programs; therefore, it is important to identify ADHD among adult offenders. Our goal is to determine the appropriateness of the Conners Adult ADHD Rating Scale, Observer: Long (CAARS-O:L) version for use in the corrections setting. Forensic psychologists and psychiatrists in the United States completed the CAARS-O:L regarding 220 adult offenders (incarcerated or on probation/parole; 79% male, 52% white, 19 to 73 years old); 42 of these offenders had a previous diagnosis of ADHD. Crimes ranged from illegal substance possession to murder. Internal reliability of all factors on the CAARS-O:L was good (Cronbachs alpha ranged from 0.85 to 0.96). Discriminant function analyses of matched samples (offenders with ADHD vs. without ADHD) revealed that two CAARS-O:L indices (viz., DSM-IV Symptoms, ADHD Index) had good sensitivity (97.6% and 100%, respectively), specificity (86.1%, 73.2%), and overall correct classification rates (92.2, 86.7%). The CAARS-O:L is a reliable and valid screening measure for ADHD in the adult corrections setting. Elevated scores on the CAARS observer ratings of offenders indicate the need for further assessment. Appropriate identification of ADHD in the adult corrections setting will aid corrections personnel in planning rehabilitation programs, thus possibly reducing recidivism rates.

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K. TWEEDY, M.D. HORNER & L. HOLBROOK. Use of the California Verbal Learning Test Second Edition (CVLT-II) Forced Choice Recognition Subtest in Detecting Suboptimal Effort on Neuropsychological Evaluation.

Identification of effort indices that are embedded within standard neuropsychological tests would be an asset for clinicians. This study investigated use of the California Verbal Learning Test Second Edition, Forced Choice Recognition subtest (CVLTII FCR) for detection of suboptimal effort on neuropsychological examination. A sample of 127 U.S. veterans con-

secutively referred for outpatient neuropsychological evaluation was divided into two groups (poor ($n = 18$) versus good ($n = 109$) effort) based on neuropsychological evaluation including chart review, clinical interview, behavioral observations, neuropsychological test results and performance on at least one objective effort/malingering test (e.g., Test of Memory Malingering). Classification was made independently of the CVLTII FCR score. Ability of the CVLT-II FCR to correctly identify good versus poor effort cases was evaluated by calculating sensitivity and specificity, and positive and negative predictive values, for raw cutoff scores ranging from 11-16 out of a possible 16. Mean CVLT-II FCR performance of the poor effort group ($M = 12.4$, $SD = 1.8$) was significantly worse than the good effort group ($M = 15.4$, $SD = 1.1$), $t = -7.15$, $p < .01$. Though overall sensitivity of the CVLTII FCR to detect suboptimal effort was highest when the criterion was set > 14 raw correct, no single cutoff score sufficiently distinguished the poor effort group from the good effort group. A moderate to high rate of misclassification (8.7- 23.6%) across cutoff scores suggests that the CVLTII FCR might be insufficient for use as an independent measure of effort.

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V.L. VAGNINI, M.J. SOLLMAN, D.T. BERRY, R.P. GRANACHER, J.A. CLARK, R. BURTON & M.W. WETTER. Known-Groups Cross-Validation of the Letter Memory Test in a Compensation-Seeking Mixed Neurological Sample.

The past decade has seen increased interest in forensic neuropsychological assessment and associated concern with detection of malingering. Because of suggestions that well-established procedures (e.g. PDRT, TOMM) may in some cases be compromised by "coaching", there is a need to validate alternative motivational tests. The Letter Memory Test (LMT: Inman et al., 1998) is a forced-choice recognition memory procedure that manipulates face difficulty through increases in the number of letters to be recalled and in the number of foils presented in the recognition trials. The present report describes cross-validation of the LMT in compensation-seeking neuropsychological evaluatees classified as honest (HON: $n=69$) or probable feigners (PF: $n=53$) using standard cutting scores from the Victoria Symptom Validity Test and the TOMM as well as Slick et al.'s (1999) malingering criteria. The groups were comparable on demographic and injury severity characteristics. Relative to the HON group, PF participants scored significantly lower on several neuropsychological tests, significantly higher on most clinical scales and the F, Fb & FBS scales from the MMPI-2, significantly higher on the SIRS and M-FAST, and significantly lower on the LMT (PF = 79.9%, HON = 97.2%). Using the recommended cutting score for the LMT, sensitivity was .640 whereas specificity was .953. Hierarchical logistic regression showed the LMT providing a correct classification rate of .81; only the FBS increased this rate (.85). When considered along with previous publications on the test, the LMT appears to be a useful alternative motivational procedure.

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N. SILVERBERG & J. BARRASH. Further Validation of the Expanded Auditory Verbal Learning Test for Detecting Poor Effort and Malingering: Data from Temporal Lobectomy Candidates.

An earlier cross-validation study of the expanded Auditory Verbal Learning Test (AVLT) procedure for detecting malingering or inadequate effort yielded specificity of .97 (and .59 sensitivity) at the recommended cut-off in a large, Midwestern, clinically heterogeneous sample (Barrash, Suhr, & Manzel, 2004). The present study aimed to examine the generalizability of its specificity in a very different sample with unequivocal brain damage. Expanded AVLT and Recognition Memory Test data from a consecutive series of 56 Canadian patients with intractable epilepsy undergoing pre-surgical evaluation for temporal lobectomy was

analyzed. Specificity of the Exaggeration Index of the expanded AVL T at the recommended cut-off was excellent, .94, and comparable to that of another well-validated instrument to detect malingering, the Recognition Memory Test (.93). A detailed analysis of the individual inconsistencies comprising the Exaggeration Index revealed that those based on very low levels of performance rather than "atypical" patterns were relatively less specific to genuine memory impairment. Findings strongly support the generalizability of the specificity estimates obtained by Barash et al. (2004) and, more broadly, the diagnostic utility of the Exaggeration Index. Guidelines for interpreting the Exaggeration Index, based on all clinical cross-validation samples reported to date, will also be presented.

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E. SPIEGEL, S. TAN, K. BOONE, M.O. PONTON & R. GORSUCH. The Rey 15-Item Memorization Test: Performance in Under-Represented Populations in the Absence of Obvious Motivation to Feign Neurocognitive Symptoms.

To examine the false-positive rate of the Rey 15-Item Memorization Test, a measure used to detect noncredible memory performance, in understudied populations. Participants include approximately 350 patients who received comprehensive neuropsychological evaluations from the Harbor-UCLA Traveling Neuropsychology Clinic between 1996 and 2002. The effect of language (monolingual Spanish, bilingual), residence (homeless vs. stable housing), low intellectual level (i.e. <70), low educational level (<6 years), advanced age (>70 years), and psychiatric diagnosis (schizophrenia, bipolar, etc.) on Rey 15-item performance was examined. Patients with motive to feign cognitive impairment (i.e. in litigation or attempting to obtain disability) were excluded. Using the standard cut-off of <9 items correctly reproduced, false positive rates >10% were documented in several patient subgroups. False-positive rates did not differ based on diagnosis. Tables displaying specificity rates for various cut-off scores are reported for each subgroup. Use of the 15-Item Test in underrepresented/ minority populations should be approached with caution and requires adjustment of cut-off scores.

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K.B. BOONE, P. LU & J. WEN. Comparison of various RAVLT recognition scores in the detection of noncredible memory performance.

Total score on the recognition trial of the Rey Auditory Verbal Learning Test has been found to identify noncredible memory performance, with sensitivity of 67.2% (with specificity set at >90%) using a cut-off of <10 (Boone et al., in press). The present study examined whether sensitivity could be increased by adding measures of implicit and "automatic" memory to the recognition task, or by differentially "weighting" the 15 stimulus words when obtaining a recognition score total. Sixty-one "noncredible" patients (as documented by psychometric and behavioral criteria), 25 controls, and 88 "credible" clinic patients were administered the RAVLT. Noncredible patients scored significantly below the other two groups on most RAVLT scores, including added indices of implicit and "automatic" memory. A combination of "true" recognition (i.e., recognition minus false positives) + implicit memory score (i.e., the number of word stems completed with RAVLT items) + "automatic" memory score (i.e., the number of correct temporal order judgments) <23 was associated with 75.7% sensitivity at specificity of 91.5%. However, sensitivity was nearly as high when scores available from the standard RAVLT administration alone (i.e., no word stem or temporal order trials) were combined. Specifically, a cut-off of <13 for "true" recognition + "primacy" recognition (i.e., number of words rec-

ognized from the first third of the test) was associated with 73.8% sensitivity at 90% specificity. These results indicate that combined indices of recognition memory from the RAVLT are effective in identifying non-credible memory performance in "real world" samples and are modestly superior to the standard recognition score.

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O. PEDRAZA, D. BOWERS, M. MARSISKE, E.B. FENNELL & R.M. BAUER. Relationship between Intellectual Ability and Malingering on the LMT, WMT, and CARB.

Though extensive recent research has broadened our understanding of malingering during neuropsychological assessments, the relationship between intelligence and malingered performance remains to be systematically investigated. Prior studies have either matched participants on intellectual ability to control for confounding effects, or focused on participants' ability to feign impairment on intelligence tests. The current study evaluated participants with varying levels of intellectual ability on multiple malingering measures. It was hypothesized that intelligence would be significantly associated with malingered performance, such that participants with lower intellectual ability would exhibit a more easily discernible pattern of feigned performance. Participants were administered the Wechsler Abbreviated Scale of Intelligence (WASI) and then randomly assigned to an analogue malingering (n = 95) or control (n = 32) condition. Dependent measures included the Letter Memory Test (LMT), Word Memory Test (WMT), and Computerized Assessment of Response Bias (CARB). Results did not reveal significant relationships between Full Scale IQ (FSIQ; range = 83-128) and LMT (r = -.09), WMT Immediate Recall (r = -.04) and Delayed Recall (r = -.02) trials, or CARB (r = .09) in analogue participants. To evaluate malingering scores at the extreme ends of the intellectual ability distribution, analogue participants within the upper (n = 34) and lower (n = 32) two-thirds of FSIQ scores, and control participants, were then contrasted using Ryan's range test for post-hoc univariate comparisons. Across malingering measures, analogue participants differed from controls (p < .05) but not each other. Results suggest that intellectual ability is not associated with malingering performance.

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D. WHITESIDE, P. DUNBAR-MAYER & M. DULLE. Criterion Validity of the Rarely Missed Index: Correlation with the Test of Memory Malingering (TOMM).

Numerous measures of effort and motivation have been developed for use in neuropsychological assessment. One of the most widely used measures is the Test of Memory Malingering (TOMM; Tombaugh, 1996). The TOMM has shown generally good sensitivity and specificity to decreased effort in compensation seeking cases (Tombaugh, 1996). However, often psychologists have time constraints on the assessment process that preclude lengthy standardized measures of effort (e.g. Social Security Disability evaluations), thus alternative measures of effort are desirable. One approach (Scott-Killgore and DellaPietra, 2000) is labeled the Rarely Missed Index (RMI) which utilizes questions 12, 16, 18, 22, 24, and 29 from the Wechsler Memory Scale-III (WMS-III) Logical Memory Recognition subtest (Psychological Corporation, 1997). Specifically, the authors reported noted that these questions had high sensitivity and specificity to decreased effort, but no research has been conducted as yet on the criterion related validity of RMI. The current study examined the relationship between the RMI and the TOMM to assess criterion-related validity of the RMI. Participants were 101 consecutive adults referred for outpatient neuropsychological evaluation. WMS-III and TOMM were

administered as part of the battery. Results indicate modest correlations between these the RMI and TOMM delayed trial ($r = .50, p < .001$), indicating evidence for the criterion related validity of the RMI. A subset of 14 cases that were compensation seeking indicated evidence for stronger correlations ($r = .89, p < .001$). The results suggest that the RMI is an acceptable alternative measure of effort in compensation seeking cases, particularly when assessment constraints limit the utilization of instruments like the TOMM. A limitation of the current study is the small compensation seeking sample size, so replication with a larger sample is recommended.

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L. ASHENDORF, C. YANTZ & R.J. MCCAFFREY. Item Consistency on the TOMM.

The TOMM is widely used by neuropsychologists who wish to test effort put forth during an examination. Some researchers (e.g., Gervais, Rohling, Green, & Ford, 2004) have found that the TOMM, while highly specific, is less sensitive than other tests of the same construct, such as the Word Memory Test (WMT). An investigation was therefore conducted to determine whether a "consistency index" could improve the sensitivity of the TOMM. Archival data from 39 head-injury litigants (age = 42.3 years, SD = 13.22; education = 13.1 years, SD = 2.75) was examined. A consistency index for the TOMM was composed; this consisted of items which were correctly identified on trial 1 but not trial 2. An optimal cutoff was determined, and a comparison was made between performance on this index and performance on the WMT. The sensitivity of the consistency index, relative to performance on the WMT, was 73.0%, which was identical to the sensitivity of using trial 2 of the TOMM. Likewise, the index's specificity, 94.4%, was the same as that of TOMM trial 2. No one who failed the TOMM had a low consistency index score, and no one who passed had a high index score. While the results do not support any incremental utility of a consistency index for the TOMM, the study is preliminary. The objective of the index was to improve classification of individuals whose results are close to the cut-off or mixed on trials 2 and 3 of the TOMM. However, the present study had very few such individuals. Further investigation with larger samples is warranted to determine whether the index could be useful in these cases.

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A.H. HABER & N. FICHTENBERG. Cross-Validation of the TOMM in a Compensation-Seeking Sample.

The purpose of the current study was to replicate, cross-validate, and extend the clinical validation study of the Test of Memory Malingering (TOMM; Tombaugh, 1996). Fifty cases were selected from two different participant pools: medically documented traumatic brain injury patients (TBI group, $n = 22$) and independent examinations of compensation-seeking, mild head injury cases (IME group, $n = 28$). In addition, a subset of participants who displayed a high probability of malingering on the basis of Reliable Digits performance was drawn from the IME group (PM group, $n = 17$). Employing both IME and PM groups made it possible to examine the sensitivity of the TOMM to negative impression management in both the context of general risk for and high probability of malingering. Probability of malingering for various TOMM Trial 2 scores was calculated at two different base rates (0.4 and 0.2) according to the recommendations of Millis and Volinsky (2001). Results indicated that employing a Trial 2 cut-score of less than 45 provided adequate sensitivity (.64) and overall hit rate (80%), yielding a high probability of malingering for scores in this range in both moderate and low base rate populations while demonstrating an impressive

insensitivity to medically documented TBI patients (specificity = 1.0). Use of additional criteria to identify probable malingerers improved the sensitivity (.76) and overall hit rate (90%). These results provide convergent validity for the TOMM and demonstrate its robustness with cases involving a high probability of malingering.

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Z. CAMPBELL, D. JOVANOVSKI & K.K. ZAKZANIS. The Dementia Rating Scale-2: A Potential Measure for the Detection of Cognitive Dissimulation.

Tests used to detect the presence of cognitive malingering are increasingly in demand. The Dementia Rating Scale-2 (DRS-2) is normally used to assess the presence and nature of dementia in the elderly. In the current study, however, the ability of the DRS-2 to detect cognitive dissimulation, in the context of a hypothetical head injury, was investigated. Twenty undergraduates were randomly assigned to two groups that differed in the instruction set that was given to them. Those in the control group were told to do their very best; whereas, those in the cognitive malingering group were told to fake the presence of a head injury. Both groups were also told that, in addition to receiving a bonus course credit, they would be rewarded monetarily if they demonstrated either a successful or believable performance, respectively. Each participant completed the same battery of tests, which consisted of the DRS-2, the reading component of the Wide Range Achievement Test (WRAT), the Rey-15 Memory Test, the Test of Memory Malingering and the Personality Assessment Inventory. Significant differences were found between the two groups on all of the measures except for the WRAT. On the DRS-2, both groups could be discriminated on the basis of certain subtests scores. That is, the cognitive malingering group tended to do more poorly on specific subtests of the DRS-2. These preliminary findings suggest that the DRS-2 may be useful for the detection of cognitive malingering in the context of an alleged head injury. Lastly, preliminary cut-off scores for the detection of cognitive dissimulation are also proposed for the DRS-2.

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J. DENBOER, S. HALL, A. SHANDERA, J. BERGSTROM, S. NELSON & C. SIMONDS. Performance Characteristics and Detection Rates of Successful Malingering.

Attention has begun to center on suboptimal client effort in neuropsychological assessment. Despite this growing focus, the detection of malingering has proven to be challenging for researchers and clinicians alike. Research has, as yet, failed to explore the test characteristics of successful neuropsychological malingerers. The present study aimed to fill this empirical gap by examining performance characteristics and detection rates of successful malingerers. Coached malingerers ($n=56$) received detailed instructions to fake cognitive impairment; uncoached malingerers ($n=35$) received less comprehensive directions. All malingerers were offered extra course credit as an incentive to successfully convince the examiner that their test performance was valid. The Test of Memory Malingering (TOMM) was administered as part of a battery of standard neuropsychological measures. Successful malingerers (SMs) ($n=29$) were coached ($n=22$; 76%) or uncoached participants who performed at or above specified TOMM cutoff levels for adequate effort (Trial 2 \geq or = to 45). Using Tombaugh's criteria, 32% of analog malingerers were misclassified as controls (the SM group). SMs scored significantly better than unsuccessful malingerers on all measures, although they suppressed their scores relative to controls on the WCST. SMs also performed significantly poorer than controls (ranging from possible to

probable impairment) on Trails A ($T=36.48$, $p<.001$) and Trails B ($T=42.03$, $p<.001$); they performed below normal levels on Digit Symbol-Coding ($SS=7.48$, $p=.193$). Interestingly, the relatively high prevalence of undetected malingering in this analog study (32%) mirrors estimates of malingering in the clinical population.

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O. PEDRAZA, D. BOWERS, R.M. BAUER, E.B. FENNEL & M. MARSISKE. Classification Accuracy of Malingering Measures in a Yoked Control Group Design.

Previous investigations have explored the sensitivity, specificity, and overall classification accuracy of numerous measures designed to evaluate malingering during neuropsychological assessments. The majority of these studies have attempted to reduce the potentially confounding effects of demographic variables via analyses of covariance, with demographic variables entered as covariates, or matching the groups of interest by minimizing the group mean difference in these variables. A yoked control group design may provide an additional and more powerful alternative to these methods. The aim of this study was to investigate the classification accuracy of the Rey 15-item test, Reliable Digit Span (RDS), Letter Memory Test (LMT), Word Memory Test (WMT), and Computerized Assessment of Response Bias (CARB), in an analogue malingering design. Each analogue participant was yoked to a control participant of the same sex, with comparable years of age and education (most participants within ± 1 year), and selected from a larger study pool ($n = 129$). There were $n = 32$ analogue and $n = 32$ control participants. Cutoff values were determined from published studies or test manuals. Results suggested that the computerized measures (i.e., LMT, WMT, and CARB) performed best, with sensitivities between 90.6% and 96.9% and specificities between 96.9% and 100%. The Rey 15-item test performed worst overall, with sensitivity of 12.5% and specificity of 100% (overall hit rate = 59.38%). These results are consistent with prior analogue investigations and provide additional support for the use of these measures in the assessment of malingering of cognitive deficits. Correspondence: *Otto Pedraza, Ph.D., Psychiatry and Psychology, Mayo Clinic, 4500 San Pablo Road, Jacksonville, FL 32225. E-mail: otto.pedraza@mayo.edu*

P.S. MARSHALL & M. HAPPE. Performance of Mentally Retarded Patients on Five Common Tests of Malingering.

Occasionally individuals will feign having pervasive and severe cognitive deficits (including mental retardation) in an effort to appear incompetent to stand trial or to gain disability status. Many measures have been developed to identify individuals who are making inadequate effort on testing. This study was undertaken to determine the validity of several of these measures in detecting inadequate effort in patients who may be mentally retarded. 45 patients with developmental mental retardation and living in group homes were given malingering measures as a part of a comprehensive test battery. Using commonly employed cutoff scores, these patients were classified as making a bona fide effort at the following rates: 93% passed the California Verbal Learning test forced choice recognition test (Delis, 2000), 93% passed the WMS-III Logical Memory Rarely Missed Items test (Kilgore, 2000), 44% passed the original Rey 15 Item Memory test (Rey, 1964), 31% passed the Reliable Digit Span test (Greiffenstein, 1994), 30% passed the Dot Counting Test (Boone, 2002), and only 16% passed the revised Rey 15 Item test with recognition trial (Boone, 2002). These results suggest that failure to pass either the CVLT forced choice recognition test or the Logi-

cal Memory Rarely Missed Items test raises the strong possibility that an individual who is suspected of feigning pervasive cognitive deficits is making an inadequate effort on testing, particularly memory testing. The other malingering measures are invalid in the assessment of individuals who may be mentally retarded.

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G.J. LARRABEE. Depression vs. Malingering: Change in Zeitgeist, Change in Diagnosis.

"AB" was evaluated in 1987, following a fall without blow to the head, LOC or PTA in 1983. He had been previously diagnosed with brain injury by one psychologist, and with conversion disorder by two others. When examined in 1987, AB had severe psychomotor retardation, needing 7.5 hours to complete a "valid" MMPI ($F = 55$; Scale 2 (Depression) = 108). Test scores were inconsistent with history of no LOC or PTA (e.g. Trailmaking B of 5'46"). Since earlier testing in 1984 was normal (WAIS VIQ = 98, PIQ = 114, WMS MQ = 94), AB was diagnosed with psychotic depression. AB was reevaluated in 1996. Two-alternative forced choice odor identification was 4/20 in the left nostril ($p < .01$), and forced choice recognition of personal history was below chance (8/21; $p < .13$). Warrington Words was 22/50, Faces was 19/50 ($p < .01$), and Reliable Digit Span was 7. Trailmaking B improved (1'42", 18th percentile), as did COWA (34th percentile in 1996 vs. 3rd percentile in 1987). It was concluded that AB was malingering. Reanalysis of the 1987 data also showed evidence of probable malingering. AB had a Reliable Digit Span of 2, and a Lees-Haley FBS of 27. This unique case demonstrates a change in diagnosis due to advances in malingering research. Other cases of malingering evaluated prior to the proliferation of malingering research in the 1990s may well have been misdiagnosed as having legitimate clinical disorders. NA/case study, NA/case study. NA/case study.

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R.E. BASER, D.T. BERRY & J.C. RINALDO. Cross-Validation of NEO-PI-R Validity Scales for Detection of Feigned Psychological Symptoms.

Although the MMPI-2 is the most commonly used test of psychopathology in forensic neuropsychological assessment, it does not provide detailed information on personality disorders. The NEO-PI-R is a self-report inventory assessing the Five-Factor Model of Personality, and has proven useful in identifying personality disorders (Widiger et al., 2002). Although the authors of the NEO-PI-R deliberately eschewed validity scales, Schinka et al. (1997) developed indices of faking good (PPM) and faking bad (NPM) for the test. Berry et al. (2000) found NPM and a composite index, NPM minus PPM, to be fairly accurate for detecting feigned symptom reports (NPM: $SN=.485$, $SP=.919$; NPM minus PPM: $SN=.792$, $SP=.912$). However, their results have not been cross-validated to date. In the present study, data on PPM & NPM were collected from non-compensation-seeking psychiatric patients ($n=95$), students asked to respond honestly ($n=198$) and students asked to feign psychopathology ($n=564$). Patients were relatively chronic outpatients and inpatients. The analog malingering manipulation incorporated numerous methodological suggestions made by Rogers (1997). One-way ANOVAS and follow-up contrasts showed significant group effects on NPM and NPM - PPM ($p < .001$), with the feigning group significantly higher than the patient group. ROC analyses indicated AUCs of .889 &

.867 for NPM and NPM minus PPM, respectively. Cutting scores recommended by Berry et al. (2000) performed comparably for NPM (≥ 20 SN=.580, SP=.950), but had inadequate specificity for NPM minus PPM (≥ -2 SN=.880, SP=.660). These results provide cross-validation for NPM and suggest that it may have a role in screening for feigned self-reports when using the NEO-PI-R in forensic assessments.

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J. MCCARTHY & R. HEILBRONNER. A Comparison of MMPI-2 Symptom Validity Scales with Mild Traumatic Brain Injury Litigants Versus Migraine and Chronic Back Pain Patients.

The current study examined the capacity of the MMPI-2 to detect symptom exaggeration in mild TBI litigants and pain patients. Eight MMPI-2 validity scales were evaluated including: F, Fb, F(p), F-K, FBS, Ds, O-S, VRIN, and TRIN. Clinical scale scores were also examined, in addition to the Traumatic Brain Injury Forensic Scale [TBI(f)] and its three subscales. It was thought that due to the effects of possible secondary gain associated with each of these medical conditions that litigation status would have less additional effect on the scales in question than one might ordinarily predict. Subjects included 40 mild TBI litigants, 51 migraine patients, and 13 back pain patients that were extrapolated from archival data from 3 separate facilities. A one-way ANOVA procedure was employed for each validity scale. Results showed that none of the scales was able to reliably differentiate between the groups. However, there were some clinical scale profile differences. The TBI group exhibited significant elevations (>65) on the D and the Hy Scales; the pain groups exhibited elevations on those same scales in addition to an elevation on the Hs Scale. On the TBI(f) Scales, only the Cognitive subscale differentiated the groups, with the TBI litigants scoring significantly higher than the back pain patients. Results suggest that the MMPI-2 validity scales in question may be less useful indices of symptom magnification in personal injury litigants or with individuals who suffer chronic pain than previous studies have suggested. Some of the scales used to suggest symptom exaggeration in litigating patients appear to be contaminated with questions that might be endorsed by individuals with chronic medical conditions. Thus, elevations may be more representative of having a chronic medical condition rather than litigation status or genuine psychological distress. Thus, caution should be exercised when making statements about conscious symptom magnification when using these scales.

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C. BUBP. Cross Validation of the Minnesota Multiphasic Personality Inventory - 2nd Edition (MMPI-2) Malingering Cut-Off Scores in Coached Traumatic Brain Injury Malingering.

This study investigated the efficacy of recently proposed malingering cut-off scores on the MMPI-2 validity scales (F, F-K and Ds2) in detecting coached malingering of traumatic brain injury (TBI). It was hypothesized that undergraduate psychology students who are coached on how to simulate TBI would be unable to successfully simulate a TBI MMPI-2 profile, as defined by one or more validity scales which exceed Berry et al.'s (2001) proposed validity cutoff scores for malingering detection ($F > 29$, $F-K > 18$, or $Ds2 > 35$). The participants were sixty, male undergraduate students randomly assigned to either the coached simulation condition (CS) or the "normal" standard administration of the MMPI-2. The participants assigned to the CS condition were asked to role-play a TBI litigant who was trying to feign TBI on the MMPI-2 for monetary damages. They were provided with a TBI vignette, a \$25 incentive given to the participant who most successfully faked a TBI MMPI-2 profile, and information about TBI symptoms and the MMPI-2 validity system as obtained from readily accessible internet sources. Five of the 30 participants (16%) from

the CS condition met the proposed criterion and therefore, were correctly classified as malingering. All of the normal administration group were correctly classified (Chi Square=5.45, $df=1$, $p<.02$). The F, F-K and Ds2 scores were elevated by raw scores of 8, 9.4 and 14.9 respectively in the CS condition. The proposed MMPI-2 validity scale detection criteria for malingering does not have the sensitivity to detect feigned TBI in a coached population. The findings of this study illustrate the need for more effective MMPI-2 cutoff scores for detection of TBI malingering.

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L. BAUER, C. YANTZ, J.K. LYNCH & R.J. MCCAFFREY. The MMPI-2 Fake Bad Scale (FBS) for Detection of Incomplete Effort on Neuropsychological Testing.

The MMPI-2 is commonly used in neuropsychological evaluations as a measure of psychological functioning as well as assessment of symptom exaggeration. Several original scales have been used to detect aberrant patterns of symptom endorsement. Additional validity indices have been developed in an effort to increase detection of motivational bias. One index, the Fake Bad Scale (FBS), has been found to have impressive levels of sensitivity and specificity in detecting malingering. The present study sought to replicate and extend research on the FBS by analyzing the sensitivity, specificity, positive and negative predictive values (PPV and NPV) of the FBS in detecting incomplete effort on neuropsychological testing. MMPI-2 and symptom validity test data were extracted from case files of 32 personal injury litigants seen for neuropsychological evaluation in a private practice setting. Three different FBS cutoff scores were used to determine sensitivity, specificity, PPV and NPV associated with incomplete effort on cognitive symptom validity testing. Incomplete effort was defined as failure on 2 or more cognitive symptom validity measures. Using a cutoff score of 20, FBS had sensitivity of 67%, specificity of 45%, PPV of .38 and NPV of .73. With a score of 26, FBS had sensitivity of 50%, specificity of 70%, PPV of .45 and NPV of .74. Using a cutoff score of 30, FBS had sensitivity of 33%, specificity of 90%, PPV of .62 and NPV of .73. These data indicate that the FBS has a moderate NPV at all cutoff levels. The PPV of FBS was low using cutoffs of 20 or 26, but moderate when the cutoff was raised to 30. The likelihood of failed symptom validity testing is greater when using FBS cutoff of 30; however, a substantial number of personal injury litigants in this sample performed well on cognitive symptom validity testing even with these highly elevated FBS scores. Implications of these findings will be discussed.

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J.M. FOLEY, M. COLLINS, Z.E. PROCTOR-WEBER & C.J. GOLDEN. Neuropsychological Impairment as a Confound in the Interpretation of the Minnesota Multiphasic Personality Inventory, Second Edition, Infrequency Scale.

Lasting debate exists regarding the validity of the MMPI-2 F-scale to detect feigned or exaggerated symptomatology, with one possible confound being poor reading ability. Golden et al. (2000) reported that high Stroop Interference scores, in the presence of average Word and Color scores, may suggest underdeveloped reading skills. The present study addresses whether patients with elevated F-scale scores also show possible reading disability as indicated by significantly high Stroop Interference scores. This study suggests possible MMPI-2 interpretive considerations based on neuropsychological functioning. A sample of $n=130$ neuropsychiatric-referred community patients were given the MMPI-2 and Stroop Color and Word Tests. All patients with significantly low Color or Word scores were eliminated, as suggested by Golden et al.

(2000), resulting in an actual sample of $n=81$. A second group of $n=147$ completed the MMPI-2 and WCST in order to account for possible variance attributed high executive ability. In both groups, most were Caucasians, although other ethnic populations were represented. Partial correlation analyses yielded a moderate significant correlation ($r = .31$, $p=.005$) between the MMPI-2 F-scale and Stroop Interference. The analysis controlled for age and education in order to support the possibility of neuropsychological impairment (rather than lack of reading experience/opportunity). We did not reach significance with the WCST group, suggesting that performance was unrelated to executive processes. The present study demonstrates the utility of examining neuropsychological variables in the assessment of personality characteristics, and warrants caution in interpreting MMPI-2 protocols when feigned symptomatology is the question under investigation.

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T.J. WEGMAN, J.A. CLARK, L.J. SCHIPPER & D.T. BERRY. Possible Contribution of MMPI-2 Validity Indicators to the Detection of Malingered Neurocognitive Dysfunction.

Although validity indices from the MMPI-2 have been shown to be fairly accurate for the detection of feigned psychiatric disorders, their ability to identify other types of false symptoms, such as malingered neurocognitive dysfunction (MNCD), has been more controversial. Perhaps the most promising index has been the Lees-Haley Fake Bad Scale (FBS) which has been shown to be effective in the identification of somatic malingering by Larrabee (2004). However, other authors have argued that the FBS scale is invalid for the detection of feigning (Butcher et al., 2003). In the present study, patients undergoing forensic neuropsychological examinations were administered the MMPI-2 as part of the evaluation. The 15 who failed 2 or more standardized motivational tests (TOMM, WMT, CARB, etc.) were assigned to the probable feigning group (PF) whereas the 21 who passed all motivational tests were assigned to the honest group (HON). ROC analyses indicated the following AUC values for the MMPI-2 validity scales: FBS .862, F .752, F(p) .651. Although the PF group scored significantly higher on the FBS and F scales, there was not a significant difference on the F(p) scale. At a cutting score of >

22, FBS had a SN rate of .86 and a SP rate of .87. Stepwise forward logistic regression revealed that only FBS contributed significantly to increased classification rates, rising from .583 without FBS to .806 with FBS. These results suggest FBS may have a role in detection of MNCD.

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G.L. ARNOLD, K.B. BOONE & J. WEN. Prevalence, Fake Bad Scale Scores, and Noncredible Performance in Litigating and Non-litigating Patients with 1-3/3-1 MMPI-2 Code-type.

A high percentage of patients in litigation/seeking disability exhibit a somatoform pattern on the MMPI-2 (i.e., 1-3/3-1 code-type) and/or achieve elevations on the Fake Bad Scale (FBS). A large subset of these subjects also shows noncredible performance on neuropsychological tests. However, the prevalence of the somatoform pattern in a non-litigating/non-disability seeking sample, the frequency of "effort" test failure, and the frequency of FBS scores exceeding cutoffs in a non-litigating/non disability-seeking 1-3/3-1 subgroup is unknown. The sample consisted of 441 patients assessed in the Harbor-UCLA Medical Center Neuropsychology Clinic and in the second author's private practice. They completed the MMPI-2 and a neuropsychological assessment battery. Of the 441 patients, 18% ($N = 80$) displayed a 1-3/3-1 code-type. Of this group, 39% exceeded cut-offs on the FBS (>26 in women, >24 in men), and 25% failed at least two cognitive "effort" tests. 28% were not in litigation or seeking disability. Comparison of the patients who failed the effort tests (labeled "noncredible") versus the remainder of the 1-3/3-1 subsample revealed that the noncredible patients exhibited significantly higher FBS scores (27.71 versus 23.45, $F = 6.60$, $p = .01$). However, of concern, 35% of "credible" patients with this code-type exceeded cutoffs on the FBS. Results suggest that the 1-3/3-1 codetype is not rare in a credible patient population (nearly 20%). At the same time, one-quarter of the somatoform population is in fact not credible in regards to cognitive performance, which argues for the routine use of effort tests, even in cases with no apparent motive to feign. Finally, the results raise concerns regarding high false positives rate for the FBS as an indicator of non-credible cognitive symptomatology within the 1-3/3-1 subgroup.

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FRIDAY MORNING, FEBRUARY 4, 2005

Poster Session 6 /8:30–10:00 a.m.

Alzheimer's Disease

J.C. ARANGO, H. ROGERS, J. LENGENFELDER, J. DELUCA, S. MORENO & F. LOPERA. Cortical and Subcortical Diseases: Do True Neuropsychological Differences Exist?

To examine the validity of the cortical-subcortical distinction in patients with genetically confirmed familial Alzheimer's Disease (FAD) and Huntington's Disease (HD). Much of the previous work examining this distinction has not used genetic confirmation to identify dementia groups, controlled for age, or used a comprehensive battery to assess cognitive abilities. The present study is the first to include only genetically confirmed FAD and HD patients to examine this distinction. To evaluate this distinction, 10 patients with FAD, 11 patients with HD, and 17 matched healthy individuals were compared on a comprehensive neuropsychological battery that included tasks of language, memory, at-

tention, visual-spatial, and executive function. The only neuropsychological measures to differentiate the two dementia groups were Animal Fluency ($p<.05$) and Letter Fluency ($p<.05$). Performance on all other measures did not differ. Although the neuropsychological battery adequately distinguished between clinical and healthy individuals, it did not differentiate the cortical and subcortical groups. The results of the study suggest that FAD and HD have similar neuropsychological profiles and therefore the cortical vs. subcortical distinction may not be clinically meaningful.

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T. KAUSHIK, A. SCHAFER JOHNSON, P. LICHTENBERG & D. ERLANGER. Validation of the HeadMinder™ Dementia Screening Battery, DSB, –A 10-minute Computerized Screening for Primary Care. Early detection of dementia relies heavily on primary care physicians. However, the utility of the MMSE, the screening most frequently utilized by PCPs,

is limited. The HeadMinder™ DSB is a 10-minute computerized screening of reaction time, memory, and executive functions. The purpose of this study is evaluate the ecological validity of the DSB by comparing DSB results to level of functioning on instrumental activities of daily living. Patients over the age of 60 from primary care practices were offered the opportunity to participate. Forty-eight volunteers ranged in age from 62 to 97. In this double-blind study, patients were administered an instrumental activities of daily living questionnaire and the HeadMinder DSB. Individuals who were classified as *not impaired* according to the DSB obtained a mean IADL score of 1.19, *sd* = 1.32. In contrast, individuals were classified as *impaired* obtained a mean IADL score of 7.83, *sd* = 5.7. There was a significant linear relationship between patients rank ordered on cognitive findings and IADL functioning ($F = 20.42$, $p = .00$) with higher IADL difficulties associated with greater cognitive difficulty. Initial data indicate that the DSB is ecologically valid and holds clinical promise for detection of dementia in primary care. DSB results were strongly associated with day-to-day level of functioning. Future studies will focus on expanding the validation sample to include a more diverse sample and will include longitudinal data analysis to evaluate ability of the screen to identify change over time.

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J. BENGE, P.J. MASSMAN & R.S. DOODY. Principal Axis Factor Analysis of the Alzheimer's Disease Assessment Scale.

The Alzheimer's Disease Assessment Scale (ADAS)-cognitive subscale is one of the most frequently used outcome measures in pharmacological treatment studies of Alzheimer's disease (AD) patients. Despite the prevalence of its use, relatively little research has been conducted to study the underlying structure of the ADAS. The current study focuses on evaluating the factor structure of the ADAS in 380 probable AD patients with differing levels of cognitive impairment. The patients had a mean age of 73.53 years, a mean of 13.69 years of education, and were 70.5% female. ADAS error scores at intake (mean = 23.56) were analyzed using a principal axis factor analysis with oblique rotation for individuals above and below the median score (median = 21). Results indicated that ADAS scores of more severely impaired individuals exhibited a different factor structure than reported previously (Olin & Schneider, 1995; Kim, Nibbelink, & Solomon et al., 1994) namely a language factor (36.4% of the variance) with weaker memory and praxis factors accounting for a total of 60.0% of the variance. Individuals with less severe cognitive impairments showed a different four factor structure accounting for 50.7% of the variance. This structure showed a rather clear language factor, although the other factors were less easily interpreted. Interestingly, in both factor structures, the command subscale was more strongly associated with the praxis tasks than language tasks. In summary, the results indicate that the degree of cognitive impairment at baseline affects the factor structure of the ADAS.

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P. MASSMAN, J.F. BENGE & R.S. DOODY. Longitudinal Analyses of Alzheimer's Disease Assessment Scale Subtests in Large Samples of Mildly and Moderately Demented Patients.

The Alzheimer's Disease Assessment Scale (ADAS)-cognitive subscale has become the instrument of choice in evaluating the cognitive effects of potential anti-dementia medications. We aim to expand upon the little that is known about the correlates of its constituent subtests/ratings and longitudinal changes of these components. Participants were 350 probable AD patients who were given the ADAS at their initial evaluation and during a follow-up evaluation at least 9 months later (mean interval of 2.3 years). We compared 217 mildly demented (MILD) patients (MMSE scores > 20 , $M=24.7$) with 133 moderately-severely demented (MOD) patients (MMSE scores ≤ 20 , $M=16.0$). All 11 ADAS subtest error scores were examined, but to reduce the number of analyses, we computed summary scores informed by factor analyses: Memory (Word Recall+Word Recognition+Orientation+ Recall of Test Instructions), Language

(Naming+Speech Content+Aural Comprehension+Word Finding), and Praxis (Ideational Praxis+Commands+ Construction). In the MILD group, correlations between the summary scores were only 0.32 or lower, but in the MOD group, were 0.53 or higher. However, correlations between the summary scores' rates of change were very similar in the two groups (all $r's > 0.42$). Interestingly, Memory score rate of change did not differ significantly in the MILD ($M=2.48$ points per year) and MOD ($M=2.76$) groups, but the MILD group had significantly lower (better) change rates than the MOD group on the Language ($M=1.18$ vs. 2.03) and Praxis ($M=0.84$ vs. 1.96) measures. Demographic and neuropsychological predictors of summary score change rates in the two groups were also analyzed. ADAS subtest summary scores exhibited different rates and correlates of change in mildly versus moderately demented patients.

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D.E. GRANT, L.J. HEWETT, P.C. LEBBY, P.R. RUSSELL & D.E. TANNER. Cognistat References scores in Alzheimer's Disease at Different Levels of Severity.

The purpose of the current study was to examine Cognistat scores in a relatively large sample of patients with an autopsy confirmed diagnosis of AD or a diagnosis of probable AD. This study compared the performance of Cognistat scores in these two groups of patients and examined Cognistat scores at different levels of dementia severity, corresponding to Mild, Moderate, and Severe AD. Archival data from 62 patients with an autopsy confirmed diagnosis of AD and 57 patients with a clinical diagnosis of probable AD were collected from a university based research and diagnostic center. Data was included if the individual had an MMSE greater than 9, English was their native language, and if they had received an autopsy confirmed or a probable diagnosis of AD. Data was initially analyzed with MMSE as a covariate then data from these two groups were also combined and analyzed on the basis of dementia severity. As predicted, the autopsy confirmed AD group and the probable AD group did not perform statistically different from one another after controlling for dementia severity. Data was combined and reference scores for Mild, Moderate, and Severe AD were obtained. Multivariate analysis revealed statistically different results between these three groups. Post hoc analysis demonstrated significant profiles for the Mild and Severe groups. New prototypic profiles for mild and moderate AD are presented. Given the rising prevalence of AD in the world, quick and efficient screening tools are needed to identify and track the progression of AD. The Cognistat is an appropriate instrument as it provides a graphical profile of cognitive domains that are impaired. The results extend the results published in the Cognistat's manual and provide a reliable profile of impairment for Mild and Severe AD.

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M.G. MOREN, A.S. DAVIS & R.S. DEAN. The Predictive Ability of Neuropsychological Assessment and Single Photon Emission Computed Tomography in Differentiating Cerebral Perfusion Deficits in Dementia of the Alzheimers Type.

Functional imaging techniques, such as Positron Emission Tomography (PET) and Single Photon Emission Computerized Tomography (SPECT), have shown promise in the amount of relevant diagnostic information that can be obtained about patients with Dementia of the Alzheimer Type (DAT). Research has indicated that the perfusion deficits shown by the PET scan correlate with neuropsychological test deficits in Patients with DAT. However, there has been a lack of empirical research documenting the correlation of SPECT scan rCBF hemispheric differences with neuropsychological deficits in patients suffering from DAT. Eighty patients with DAT participated in this study and were placed in one of four per-

fusion groups, based on the results of a SPECT scan. Each patient received a comprehensive neuropsychological test battery. Patients with DAT categorized by SPECT scan data as having an absence of perfusion deficits exhibited significantly fewer neuropsychological deficits than the left hemisphere, right hemisphere, and diffuse perfusion deficit groups combined. Participants with left hemisphere perfusion deficits scored lower on the left hemisphere neuropsychological measures than the right hemisphere perfusion deficit group. Left hemisphere neuropsychological measures used in a discriminant analysis were more significant than right hemisphere measures in distinguishing between perfusion groups. The results of this study suggest that cerebral blood flow may be a determining factor in the severity of the cognitive impairment found in DAT, especially involving left hemispheric functioning. Implications for patients with DAT will be discussed in regards to the results of this and earlier studies.

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J.R. CROMER, N. SILVERBERG, M. SABBAGH, D. CONNOR & P.J. SNYDER. Prediction of Alzheimer's Patients' Future Mental State Using the Groton Maze Learning Test®.

It has been estimated that approximately 13.2 million people in the United States will suffer from Alzheimer's disease by the year 2050 (Hebert, 2003), and it is vitally important for us to develop and validate sensitive prognostic measures for predicting change in cognitive status over time. We report the results of a one-year study of general mental status deterioration in Alzheimer's disease. Twelve patients with Alzheimer's disease (mean [SD] age: 82.13 [5.04] years-old) completed the MMSE and ADAS-Cog at baseline and then again at 12 months post-baseline. In addition, all subjects completed the Groton Maze Learning Test® (GMLT) at each exam, a novel computer touch-screen administered measure of a subject's ability to acquire and efficiently use an internal spatial map of a complex hidden two-dimensional maze. Using a step-wise regression model, we found that three of the variables on the test created a powerful model of prediction of MMSE score at 12 months post-initial testing ($R^2 = 0.82$). The three variables that contributed to the variance were correct moves per second at delayed recall (0.25), total moves at delayed recall (0.44), and total perseverative errors (0.13). A similar result was obtained with regard to the prediction of ADAS-Cog score at 12 months, but with a moderate R^2 of 0.57. The GMLT may be a potential quickly administered, but sensitive measure that can be used to monitor and predict future mental status in persons with Alzheimer's disease. Correspondence: *Jennifer R. Cromer, B.S., Psychology, University of Connecticut, 125 Green Road, Manchester, CT 06040. E-mail: jennifer.leer@uconn.edu*

M.R. VILLANUEVA & T.L. SMITH. Caregiver Ratings of Cognitive Function of Patients Being Evaluated for Possible Dementia: Relationship to Objective Test Findings.

To summarize the relationship between caregiver ratings of cognition and behavior, using the Cognitive Behavior Rating Scale (CBRS) and neuropsychologic tests. Participants include patients referred for neuropsychologic evaluation to aid in the diagnosis of dementia. A consecutive series of 71 patients (41 m, 30 f; mean age 76, mean ed 14) who were able to complete basic testing and had a reliable informant were included. 57 ultimately were diagnosed with dementia, 14 had cognitively benign exams. Part I establishes the correlations between cognitive tests and CBRS variables. Part II summarizes the classification agreement into impaired and non impaired groupings using cognitive test findings and CBRS variables. Cognitive function was assessed using tests such as Similarities (SIMS), Logical Memory II (LM II), and Category Fluency (CAT - animals). The CBRS is a standardized questionnaire consisting of 170 items that are summarized into scales, including Memory Disorder (MD) and Language Disorder (LD). All tests of cognitive

function are significantly and positively correlated with one or more of the CBRS variables, with the exception of clock drawing. Pearson correlation coefficients range from .24 to .48. The cognitive variable that is associated with the most CBRS variables is Similarities, which is significantly associated with all CBRS variables except agitation. There was agreement regarding impaired/not impaired classification between MD and LM II for 39 of 71 participants. Using cut-offs from CAT and LD, 43 of 71 participants were placed in the same category. There is a positive and significant association between standardized family observations of patient behavior and cognitive test findings. Agreement, however, between ratings and test findings is low using cut-off scores creating impaired/not impaired groups. Family ratings provide information that is similar yet not redundant with commonly administered cognitive tests. Correspondence: *Michael R. Villanueva, Psy.D., Southern Oregon Neuropsychological Clinic, 955 Town Centre Dr. Ste C., Medford., OR 97504. E-mail: mvsone@wave.net*

B.R. REED, D. MUNGAS, J.H. KRAMER, W.G. ELLIS, H.V. VINTERS, C. ZAROW, M.L. WEINER, W.J. JAGUST & H.C. CHUI. Variability of Neuropsychological Profiles in Autopsy-defined "Pure" Alzheimer's Disease.

Memory impairment that predominates the neuropsychological profile may be a behavioral marker of Alzheimer's disease (AD). Our goal was to determine the frequency of this profile in proven AD. Subjects were 19 AD and 8 normal controls selected on the basis of neuropathological criteria from the brain bank of a study of vascular contributions to dementia. Cases were extensively and uniformly evaluated for vascular lesions, AD and non-AD degenerations. AD cases had minimal vascular pathology and no evidence of other degenerative processes. The severity of memory and executive function impairments was compared using Episodic Memory (EM) and Executive Function (EF), which are psychometrically-matched composite scales with linear measurement and uniformly high reliability across a 4 SD range of ability. Thus differences between them indicate true ability differences, free of measurement artifact. EM measures verbal delayed recall and EF measures working memory and verbal fluency. Mean is 100 and SD is 15. Three profiles were defined: "low EM", "low EF", and "flat" according to whether EM, EF or neither was greater than 0.5 SD lower than the other. The mean absolute value of the difference between EF and EM was 31 for low EM, 18 for low EF, and 4 for flat profile cases. The distribution of cases for AD was 11 low EM, 3 low EF and 5 flat; for controls 4, 2, and 2 cases respectively. Among AD cases flat profile cases differed little from the others in global severity (mean MMSE scores of 17, 18, 21 for flat, low EM and low EF, respectively) and floor effects did not explain profile differences. Quantitative MRI measures of white matter lesions, cortical gray matter, and hippocampal volume were highly similar for all profiles. Distinct profiles marking relative differences in EF and EM were evident. However, even in the absence of vascular lesions and other (non-AD) comorbid pathological changes, 40% of the AD cases did not show predominant memory failure.

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L.A. CUSHMAN, T. STEFFENELLA, W.J. VAUGHN & C.J. DUFFY. Psychophysical and Neuropsychological Measures Predict Navigational Ability in Alzheimer's Disease.

We combined a naturalistic spatial navigation test with visual motion perceptual threshold testing and neuropsychological testing in subjects with AD, MCI, and in 3 age groups of normal controls. Subjects were recruited from the university hospital community. Subject groups were: 34 AD, 31 MCI, 68 older normals, 39 middle-aged, and 85 young normals. The spatial navigation test is a 90 minute battery beginning with an experimenter-directed tour of the hospital

lobby on a fixed path. Tasks included: 1) Route Learning, 2) Free Recall, 3) Self Orientation, 4) Route Drawing, 5) Landmark Recall, 6) Photo Recognition, 7) Photo Location, and 8) Video Location. All subjects also completed 7 standard neuropsychological tests and 4 psychophysical threshold determination tasks using a 2-alternative forced choice paradigm. Visual motion coherence thresholds were determined for the perception of left/right horizontal motion, outward radial optic flow, and outward and inward radial optic flow. We found a significant ($r = -.64, p = .000$) correlation between total score on the navigational test and the combination of outward and in/out radial motion thresholds. Regression analyses showed that the largest amount of variance in total navigation scores ($R^2 = .63$) could be predicted from a combination of radial motion thresholds, and three neuropsychological tests: delayed verbal memory, figural memory, and word fluency. We have developed a standardized measure of navigation capacity that can be used to assess spatial orientation in AD. This test reveals a relationship between spatial disorientation and impaired visual motion processing of optic flow. Combining perceptual and neuropsychological measures of verbal memory, non-verbal memory, and language processing can predict navigational performance.

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S. DEY, M. O'CONNOR & B.D. OTT. Just Because I Got Lost Doesn't Mean I Can't Drive: A Neuropsychological Analysis of Driving in Patients With Alzheimer's Disease.

Various studies have suggested that drivers with Alzheimer's Disease are susceptible to greater risk for accidents compared to other drivers of the same age. The prime goal of this study was to examine medical records of patients with AD and identify the neuropsychological tests that best predict performance in actual driving conditions. The current study reviewed neuropsychological tests of 72 patients with AD and examined the relationship of them to patients' performance on an on-the-road driving test. Thirteen independent samples t-tests were performed to identify differences between the 13 neuropsychological tests between the patients who "pass" and patients who "fail" the driving test. Also, 2×2 chi-squares were conducted to assess whether neuropsychological tests were significantly different from chance. The analysis revealed statistically significant differences between the pass group and fail group on Boston Naming Test and Benton Facial Recognition Test. The current study established BNT and BFRT as a significant predictor of performance in driving. Language impairments as demonstrated by BNT could be an indirect marker of the severity of dementia that impairs driving. However, another possible explanation could be that poor performance in BNT could be due to the visuo-perceptual deficits, an important aspect of driving ability. This hypothesis could explain the performance in BFRT that relies on visuo-perceptual abilities. In conclusion, paper and pencil neuropsychological testing could assist clinicians in identifying patients with AD at-risk for driving problems.

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R.K. BHALLA & O.R. BRIAN. Alzheimer's Disease Patients' Self-ratings of Anxiety Before and After an On-Road Standardized Driving Test.

Little research exists examining the relationship between anxiety and driving performance in AD. The purpose of this study was to examine self-ratings of anxiety in AD patients and elderly controls prior to and following a standardized on-road driving assessment. We compared self-

ratings of tension and fear on a visual analog scale in 22 patients with possible AD, 57 with probable AD, and 38 age- and education-equated elderly controls (EC), prior to and following an on-road driving test. We examined the relationship between participants' driving performance (safe, marginal, unsafe), as rated by a professional driving instructor, and pre and post-driving test measures of anxiety. Spearman's correlations revealed no significant relationship between driving performance and anxiety measures in ECs, possible, or probable AD patients prior to the driving test. However, probable AD patients' driving performance was related to post-driving tension ($p = .009$) and fear ($p = .035$). Moreover, a one-way ANOVA revealed a significant difference between driving performance and measures of post-driving test anxiety in this group. Specifically, unsafe probable AD drivers had significantly more post-driving test fear and tension than did safe or marginal probable AD drivers. Probable AD patients do not experience greater tension or fear than possible AD or ECs before the on-road driving test. Thus, anticipatory anxiety does not appear to effect driving performance prior to testing. Following the driving assessment, however, unsafe drivers with probable AD have more anxiety, possibly related to their poor driving abilities. Standardized driving assessments and resulting anxiety from poor performance may be valuable in encouraging unsafe demented drivers to voluntarily stop driving.

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R.E. READY, B.R. OTT & J. GRACE. Factor Structure of Patient and Informant Ratings on the Dementia Quality of Life Instrument.

Preliminary evidence suggests that quality of life (QOL) reports from patients diagnosed with mild to moderate Alzheimer's disease (AD) are as reliable and valid as data provided by caregivers. The goal of this study was to compare the factor structure of patient- and caregiver-report QOL data. Participants ($N = 105$) were diagnosed with no cognitive impairment, Mild Cognitive Impairment (MCI), or mild to moderate AD. All participants were administered the Dementia Quality of Life scale (DQoL) by a neuropsychologist. Caregivers and knowledgeable acquaintances also participated by completing the DQoL. Principal axis factor analyses were run separately on patient- and caregiver-report DQoL data. Results of factor analyses were interpreted based on analysis of the scree plot and content analysis of the primary and salient item-loadings on the factors. The optimal factor solutions for patient- and caregiver-data were nearly identical. Four factors reliably emerged from each analysis: Negative Affect, Positive Affect, Aesthetics, and Self-esteem. Ninety percent of the items had similar factor loadings in both analyses. The four factors accounted for 59% of the variance in caregiver ratings and 49% of the variance in patient ratings. Self-report data from mild to moderately cognitively impaired elderly participants demonstrated a factor structure that was highly consistent with caregiver-report data and conformed to theoretical expectations. Until future research can more definitively determine the strengths and limitations of self- versus caregiver-report QOL data, investigators are strongly encouraged to consider gathering QOL information from both informants and patients.

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N. SESTITO, K. SCHMIDT, T. GIOVANNETTI, J. GALLO & D.J. LIBON. Using the Naturalistic Action Test (NAT) to Assess Everyday Action in Healthy Older Adults and Patients with Dementia.

In addition to memory impairment, a decline in activities of daily living (IADL) is a major hallmark of dementia. The Naturalistic Action Test (NAT; Schwartz et al. 2002) evaluates IADLs across three difficulty levels by asking participants to perform five tasks (i.e., making coffee, preparing toast,

wrapping a gift, packing a school bag, packing a lunch box). There is limited data, however, regarding the effect of age and how dementia patients perform in relation to age-matched normal controls. We administered the NAT along with a comprehensive neuropsychological protocol to 23 healthy older adults and 41 patients with mild-moderate dementia. Among healthy older adults, age alone accounted for 51% of the variance on the NAT Total Accomplishment score. In contrast to the younger control sample described in the manual where 71% of controls received a perfect score, only 48% of our older controls received a perfect score. Between groups, our healthy older adults outperformed dementia patients across all three NAT difficulty levels ($p < .001$). These controls obtained significantly different scores across all three difficulty levels, receiving higher scores on easier tasks. Dementia patients performed worse on level 3, but scores did not differ between levels 1 and 2. Furthermore, it is notable that 82% of the dementia patients exhibited floor effects on level 3. In summary, formal tasks of everyday action may help in differentiating dementia patients from healthy older adults; however, we suggest caution when employing the NAT with dementia patients due to the limited psychometric properties observed in our sample. Correspondence: Kara Schmidt, Ph.D., Center for Aging, UMDNJ-SOM, 42 E. Laurel Road, Suite 1800, Stratford, NJ 08084. E-mail: stutzschmidt@juno.com

M.E. GRISS & F.W. UNVERZAGT. The Influence of Depression and Cognition on Daily Functioning in Dementia Patients.

Depressive symptoms frequently co-occur in dementia and may contribute to impairment in activities of daily functioning. We report on the influence of depressive symptoms and cognitive function on basic and instrumental activities of daily living (ADL/IADL) in dementia patients. Indiana Alzheimer Disease Center participants with mild dementia (MMSE > 15) completed the CERAD battery which incorporates measures of language (Animal Fluency, Boston Naming Test), visuospatial ability (Constructional Praxis), and memory (Word List Learning). A self-report measure of depression, the Geriatric Depression Scale, was included. The Blessed Dementia Scale, an informant-derived assessment of ADL/IADL, was also obtained. The sample ($n = 209$) was primarily male (51.2%) with an average age of 71.4 years. The average MMSE score was 21.6. A series of regression analyses revealed that depressive symptoms had no independent relationship with ADL/IADL performance after controlling for age and general cognitive ability. An analysis limited to cognitive and demographic variables found that language (Boston Naming Test), visuospatial abilities (Constructional Praxis), and age accounted for 22% of the variance in ADL/IADL functioning in dementia patients. Short-term memory, as measured by the Word List Learning test, was not a significant predictor of activities of daily living. Depressive symptoms did not contribute to functional impairment among dementia patients. Age, linguistic skill, and visuospatial ability were found to be important determinants of basic and instrumental activities of daily living among dementia patients. Supported by Grant P30 AG 10133.

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M.R. VILLANUEVA & T.L. SMITH. Patients Referred for Evaluation of Dementia with Significant Depressive Symptoms have more Cognitive and Behavioral Problems Than those with Few Depressive Symptoms.

To evaluate differences in cognitive and behavioral function in two groups of clinical patients, based upon scores from the Geriatric Depression Scale (GDS). Participants were patients referred to the clinic because of possible dementia. Sixty-one consecutive patients (36 m, 25 f; mean age 76; mean ed 14) who were able to complete basic cognitive testing and who had a reliable informant were included in this

study. Forty-eight would ultimately be diagnosed with dementia, 13 had no dementia. Patients were divided into depressive and non-depressive groups based on their score on the GDS 30 item, using 11 as the cut-off point. A series of independent sample t tests was performed to see if the two groups performed differently on cognitive tests, and to determine if there were differences in the way family members rated them using the Cognitive Behavioral Rating Scale (CBRS). Using a cut-off point of 11, 21 patients were classified as having significant depressive symptoms, and 40 were not. Of the six tests of cognitive function administered, significant differences were noted on two, MMSE, and Similarities from the WAIS III. The CBRS is summarized in seven different scales. Of the seven scales, significant differences are seen in four: Depression, Dementia, Agitation, and Language Dysfunction. In all statistically significant comparisons, the patients reporting more depressive symptoms do worse on cognitive testing and are rated as being more impaired by family. Patients with suspected dementia who report significant depressive symptoms perform more poorly on cognitive testing and are more likely to be rated by family members as having cognitive-behavioral problems than those with few depressive symptoms. One explanation for findings is that patients with early signs of dementia are depressed about their symptoms. Related to this, the depression itself could be impacting cognitive function and limiting behavior.

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R. HOLTZER, N. SCARMEAS, D. WEGESIN, J. BRANDT, M. ALBERT, D. BLACKER & Y. STERN. Function But Not Cognition Predicts Depression in Alzheimer Disease (AD).

Estimates of the prevalence of depression during various stages of AD are variable. Moreover, prospective studies have yet to identify reliable predictors of depression in AD. The present study delineated the natural course of depression in a large sample of patients who were followed prospectively. Specifically, we evaluated whether changes in cognition and function predict depression in AD. Participants: 525 patients from the Predictors cohort participated in the study. All patients were diagnosed with probable Alzheimer Disease. Design: Patients were followed prospectively and evaluated at 6-month intervals (mean number of six-month visits=7.2; SD=5.8). Measures: Depression was assessed using selected items from the Columbia University Scale for Psychopathology in Alzheimer Disease (CUSPAD). The modified Mini-Mental Status (mMMS) assessed cognitive status. The Blessed Dementia Rating Scale (BDRS) assessed function. Results: The prevalence of depression ranged from 24 to 43 percent over the follow-up period. General Estimating Equations (GEE) revealed that time ($\beta = -.208$, $p < .001$, 95% CI = $-.268$ — $-.149$) and lower function ($\beta = .013$, $p < .001$, 95% CI = $.009$ — $.018$) were significant predictors of depression. However, cognition ($\beta = .012$, $p > .05$, 95% CI = $.000$ — $.025$) was not a reliable predictor of depression. Cox regression analyses predicted the first episode of depression using mMMS and BDRS scores as time-dependent covariates. Consistent with the GEE results, function ($\beta = .007$, $p < .01$, 95% CI = 1.003 — 1.010) but not cognition ($\beta = .008$, $p > .05$, 95% CI = $.998$ — 1.019) predicted the first episode of depression. Analyses controlled for demographic variables and medication use. Conclusion: function but not cognition predicts depression in AD.

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J. SUHR. Perceived Threat of Alzheimer's Disease (AD) and its Association with Personal AD Experience.

Research suggests perception of personal risk for and threat of Alzheimer's disease (AD) is influenced by personal experience with AD. Those without AD experience show a strong relation between perceived

AD threat and performance on cognitive tests, while in those with AD experience, perceived threat is related to self-reported cognitive ability but not actual cognitive performance. The present study further evaluated these relationships by dividing personal AD experience into genetic and nongenetic dimensions. 54 adults over 50 who responded to advertisements for free memory screening were divided into AD experience groups based on an interview. There were 22 individuals with no personal experience with AD, 12 with first or second degree family members with AD (genetic experience group), and 20 individuals with nongenetic experience with AD (friend, nongenetic family member). All were given a free cognitive evaluation including the RBANS and also completed several psychosocial self-report measures. In those with no AD experience, high perceived AD threat was related to higher age, more depressive symptoms, and worse performance on several neuropsychological tests. However, in those with both genetic and nongenetic personal experience with AD, higher AD threat was associated with more depressive symptoms and better performance on neuropsychological tests. In addition, in those with genetic AD experience, perceived AD threat was associated with personal belief that AD is genetic. Results demonstrate that personal experience with AD should be considered as a factor influencing individuals to present for cognitive evaluation due to personal fears about their own risk of AD. Findings also emphasize the importance of objective neuropsychological testing, rather than relying on self-reported cognitive symptoms, when assessing those with cognitive complaints.

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S.K. MILLER, R. ADAMS, W. BEATTY & R. BRUMBACK. Persistence of Asymmetric Deficits in a Patient with Autopsy-Proven Alzheimer's Disease.

A minority of mildly to moderately demented patients with Alzheimer's disease (AD) display asymmetric cognitive impairments (more severe deficits on tasks mediated by one hemisphere than on tasks controlled by the other). Initial detection and diagnosis of such cases by physicians can be particularly complicated in cases when deficits are primarily visual in nature, leaving verbal abilities spared. In addition, it is not known whether these asymmetries persist with disease progression. RH, a retired military pilot, was first evaluated seven years after a reported history of slow cognitive decline. After his initial neuropsychological examination, testing was repeated every two years for a total of three evaluations. Brain autopsy was completed upon death. For several years prior to his neuropsychological examination, RH's Alzheimer's disease went undetected by his physicians, who, in the presence of advanced verbal skills and good verbal memory, attributed his report of cognitive symptoms to psychopathology. Similarly, at the time of his initial neuropsychological evaluation, RH presented as articulate, with good orientation and memory during interview. However, he demonstrated dramatic differences in the functional status of the left and right hemispheres on testing (e.g. Verbal IQ = 125, Performance IQ = 68). On reevaluation two and four years later, overall cognitive function deteriorated, but the asymmetric pattern persisted. Neuropathological examination confirmed the diagnosis of AD. The case of RH demonstrates a pattern of asymmetric deficits in pathology-confirmed AD that persisted over the disease course. Moreover, the case illustrates the importance of careful testing in patients complaining of cognitive changes.

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D.E. CRAGAR, G.E. SMITH & R.J. IVNIK. Good Memory Performance Attenuates Risk of Dementia Associated with Age and Family History

To investigate the interaction of memory performance and family history on relative risk of developing cognitive impairment. We hypothe-

sized that good memory performance would attenuate the risk of developing cognitive impairment based on age and family history. Participants included 1019 subjects who were cognitively normal at the time of recruitment and who were followed for an average of 5 years. Participants completed the AVLT and a family history questionnaire at the time of initial recruitment. A total of 159 participants were eventually diagnosed with a dementia or mild cognitive impairment. Family history was operationalized as percent of parents and siblings with a history of dementia. Risk of developing cognitive impairment increases with age (Risk Ratio = 1.102; C.I. = 1.074-1.130) and family history (Risk Ratio = 1.011; C.I. = 1.001-1.021) and decreases with better memory performance, specifically increased percent retention in delayed recall (Risk Ratio = .348; C.I. = .794-.906). In multivariate modeling, risk of developing cognitive impairment increases with increasing age and proportion of family members with a history of dementia. However, good memory performance attenuates that risk. For example, the risk of developing cognitive impairment is roughly equivalent for a 75-year-old person with no family history scoring one standard deviation below the mean on memory testing, a 75-year-old person with 50% of parents and siblings with dementia who scores at the mean, and an 85-year-old without family history that scores one standard deviation above the mean. Knowledge of memory performance can be used to adjust risk estimates for developing cognitive impairment based on family history and age.

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D.B. HOWIESON, K.W. WILD, M.M. MOORE, A. DAME, J. QUINN, L.C. SILBERT & J.A. KAYE. Temporal Lobe Correlates of Memory Processes in Alzheimer Patients.

The relationship between memory performance and integrity of temporal lobe structures was studied in Alzheimer patients and elderly controls. We hypothesized that acquisition performance would be predicted by the volume of the parahippocampus, delayed recall by the volume of the hippocampus, while recognition would be predicted by the volumes of both the hippocampus and parahippocampus. Participants were 297 men and women ranging from 53 to 105 years who varied according to the presence and severity (very mild and mild) of Alzheimer dementia. Exclusion criteria consisted of stroke, depression, or other causes of cognitive impairment except Alzheimer type dementia. Staging of dementia was based on Clinical Dementia Rating scores: Mild (CDR 1), Very Mild (CDR .5), and Intact (CDR 0). CERAD Word-List Acquisition, Delayed Recall, and Recognition (yes/no) performances were obtained. MRI volumes were analyzed for hippocampus, parahippocampus, and the remaining temporal lobe (neocortex). As predicted, Acquisition was significantly related to parahippocampal volume in a stepwise multiple regression, but only weakly ($R^2=.037$). Acquisition was best predicted by the temporal neocortex ($R^2=.187$). Delayed Recall and Recognition were best predicted by the hippocampus ($R^2=.135$ and $.073$, respectively) and weakly by the temporal neocortex ($R^2=.070$ and $.024$, respectively). Distinct temporal lobe regions are differentially involved in word-list acquisition, delayed recall, and recognition. As expected, the integrity of the hippocampus best predicted delayed recall performance. The parahippocampus had little predictive value. The temporal neocortex was most important for acquisition, which may be based on its encoding functions.

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D.J. LIBON, K.S. SCHMIDT, J. GALLO, D.L. PENNEY, T. GIOVANNETTI & J. MILLER. The Prototypicality of Extra-List Intrusion Errors Produced on a Serial List Learning Task by Patients with Mild Dementia.

On verbal serial list learning tests Alzheimers disease (AD) patents make more extra-list intrusion errors than other dementia groups. Degrada-

tion of semantic knowledge is believed to underlie the behavior. We used the Francis & Kucera (1981) corpus of word frequency to assess the prototypicality of intrusion errors. We predicted that AD patients would not only produce more category-cued intrusion errors, but produce more prototypical errors of their respective categories as compared to VaD patients. 60 AD patients and 24 VaD patients underwent neuropsychological assessment including the Philadelphia (repeatable) Verbal Learning Test (PrVLT), a 9-word list drawn from 3 semantic categories. Both short and long delay category-cued conditions were administered. Patient groups were equated for age, education, and dementia severity (MMSE). All category-cued intrusion errors were scored using the Francis & Kucera corpus. As predicted, AD patients made more category-cued intrusion errors than VaD patients ($M_{AD}=6.2[3.6]$; $M_{VaD}=2.8[2.8]$; $p<.001$). On both short and long delayed cued recall, AD patients obtained higher overall Francis & Kucera values (combined short/long $M_{AD}=32.5[23.7]$; $M_{VaD}=13.6[14.6]$, $p<.001$) suggesting that the intrusion errors made by AD patients are more prototypical of their respective categories. As the prototypicality of intrusion errors increased, patients endorsed more semantic foils on the P(r)VLT delayed recognition tests ($\rho=.45$, $p<.001$). These results affirm the differential semantic impairment in AD and suggest that Francis & Kucera values may be a tool to operationally define the severity of semantic degradation in dementia.

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S.A. ROGERS, K.J. MILLER, L. ERCOLI, P. SIDDARTH & C.W. SMALL. Verbal Memory Among Those at Risk for Alzheimer's Disease.

Much research has suggested that declines in verbal memory appear in the early stages of Alzheimer's disease (AD), but little research has assessed if deficits in verbal memory represent a preclinical risk for AD. This study examined the verbal memory of asymptomatic individuals who were at preclinical risk for Alzheimer's disease due to a family history of AD or the APOE-4 allele. Of the 374 participants, 29% had a family history of AD and 32% were either heterozygous or homozygous for APOE-4. To assess verbal memory, each of the participants completed the Logical Memory subtest of the WMS-R, the Logical Memory and Verbal Paired Associates subtests of the WMS-III, and the Bushke Selective Reminding test. When controlling for demographic differences, those with APOE-4 had significantly lower scores on the total recall of the Bushke Selective Reminding test and the immediate total recall of the WMS-III Logical Memory compared to those without APOE-4, $F(1, 244) = 4.10$ and $F(1, 171) = 3.91$, $ps <.05$, respectively. There were no differences in memory for those with different levels of family history. These results suggest that subtle declines in immediate recall of contextual and list learning may represent preclinical signs of AD, and that these deficits are more likely to be observed in those with a genetic risk for AD than those with a family history of AD. Moreover, these findings suggest that verbal learning and encoding may be more impaired than retention and retrieval among those at risk for AD.

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M. HUA, C. YANG, M. CHIU, S. CHEN, P. YIP, T. CHEN, C. WU, M. WEN, H. TZENG, C. WANG & P. TU. Semantic Memory Deficits in Low-Educated Patients with Alzheimer's Disease.

It was evident that there was a deficit of semantic memory in the dementia of Alzheimer's disease (AD). However, the underlying neuropsychological mechanism for this deficit has still been a controversial issue. Some researchers proposed that the semantic network might break down during the course of AD. On the contrary, others argued that a

loss of ability to get access to the semantic information might account for semantic memory deficit in these patients. A methodological drawback, such as the demented severities of patients used in these prior studies were varying and incomparable, might account for inconsistent findings. In addition, there are few studies to examine whether there is a deficit of semantic memory in the low-educated patients with AD. The present study was to examine semantic memory across different degrees of demented severity in low-educated patients. One hundred and ninety seven adult subjects were recruited in the study, including 32 normal controls and 165 patients with AD who were divided into four subgroups according to their demented severity. All subjects received episodic and semantic memory tasks, as well as otherwise neuropsychological measures. Data analysis with one-way ANOVA revealed that only patients with moderate and severe dementia performed significantly poorer than their normal counterparts on semantic memory tests while episodic memory test scores of patients, regardless of the severity of dementia, were remarkably lower than those of their normal control subjects. The results revealed that our low-educated patients with moderate to severe dementia evidenced defective performances on the most of the semantic memory tests while demented patients irrespective of the degree of severity manifested impaired performances on the episodic memory tests. Our results thus seem to partially support the structural hypothesis of semantic deficit in patients with AD.

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R.F. ZEC, N.R. BURKETT & S.J. MARKWELL. Well-Preserved Picture Recognition Memory in the Majority of Patients with AD in the Mild to Moderate Stages of Dementia.

Progressive impairment in new declarative learning and memory is the cardinal feature of Alzheimer disease (AD). In this study, we tested the hypothesis that yes-no picture recognition memory (PRM) is often relatively well preserved in AD patients with mild to moderate dementia and better preserved than yes-no word recognition memory. We compared delayed retention on a yes-no recognition memory test for pictures of objects to delayed retention on a yes-no word recognition memory test in a group of 40 patients diagnosed with Probable AD and in 40 elderly control subjects. A majority of the AD patients studied (52%) have well-preserved PRM (90% or better correct) in the context of an anterograde amnesia on other more traditional measures of new declarative learning and memory. In fact, an appreciable number of the AD patients had perfect or near perfect scores on both short- and long-delay PRM. Performance was similar for both the short- and long-delay PRM trials. True-false PRM was considerably better preserved than true-false word recognition memory in the AD group. All elderly controls displayed well-preserved PRM. We theorize that AD patients with preserved PRM have less complete destruction of the medial temporal lobe memory system compared to patients with more impaired PRM. Having relatively preserved PRM likely is likely an asset in terms of everyday functioning in these otherwise severely memory impaired patients, whereas those patients in whom PRM is at or near chance performance can be characterized as having profound or end-stage impairment in new declarative learning and memory.

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T. GIOVANNETTI, N. SESTITO, D. LIBON, K. SCHMIDT, J. GALLO, A.M. DISIMONE & E. NICOLUCCI. The Influence of Personal Experience on Object Naming and Semantic Knowledge in Alzheimer's Disease and Mixed Dementia.

Case studies of semantic dementia patients show naming and object use is more accurate for personal objects than alternate exemplars of the

same objects (Snowdon et al., 1994; Bozeat et al., 2002). The personal advantage has not been explored in other dementia populations, and its mechanism is not well understood. This study examined the influence of personal experience on naming and semantic knowledge in patients with Alzheimer's disease (AD) and mixed (AD & vascular) pathology. Eight participants (6 AD; 2 mixed) with mild to moderate dementia (MMSE = 21.1; SD = 3.5) brought 15 personal objects to the laboratory. Identification (Is this yours?), naming, and semantic probe tasks were administered with personal objects and alternate matched objects as stimuli. Semantic probes queried where, when, and how each object is used. Only 63% of subjects were more accurate than chance at identifying their personal objects. Nevertheless, all participants generated more details for personal ($M = 7.7$, $SD = 4.2$) vs. alternate ($M = 6.8$, $SD = 3.8$) objects on the semantic task ($t = 3.7$, $p = .008$). Participants correctly named a comparable proportion of personal ($M = 79.8$, $SD = 7.8$) and alternate objects ($M = 80.4$, $SD = 12.1$) at a comparable rate (personal objects $M RT = 2.73$ sec, $SD = 1.5$; alternate objects $M RT = 2.7$ sec, $SD = .71$). In sum, the personal object advantage may be observed in AD, mixed, and other dementia populations. Repeated exposure to objects may augment semantic representations without influencing lexical representations or retrieval.

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S.R. WETTER, D.C. DELIS, W.S. HOUSTON, M.W. JACOBSON, A. LANSING, K. COBELL, D.P. SALMON & M.W. BONDI. Deficits in Inhibition and Flexibility Are Associated with the APOE-E4 Allele in Nondemented Older Adults.

To investigate potential difficulties on a new Stroop switching paradigm in individuals positive for the Apolipoprotein E (APOE) $\epsilon 4$ allele. This prospective study of nondemented older adults at genetic risk for AD and other types of dementia (i.e., APOE $\epsilon 4$ allele) utilized a new Stroop test, the Color-Word Inhibition Test from the Delis-Kaplan Executive Function System (D-KEFS), that includes a dual executive-function condition requiring both response inhibition and cognitive switching. 22 $\epsilon 4$ positive (mean age 75) and 29 $\epsilon 4$ negative (mean age 77.5) individuals participated in the study. Results indicated that, relative to non- $\epsilon 4$ subjects, the $\epsilon 4$ group committed more errors, but only on the new Inhibition/Switching condition. In addition, error-rate variance on this task was more heterogeneous for the $\epsilon 4$ compared to the non- $\epsilon 4$ group, and errors rates correlated significantly with global cognitive status (i.e., DRS scores) for the $\epsilon 4$ group but not for the non- $\epsilon 4$ group. These findings suggest that vulnerability to errors in response inhibition and cognitive flexibility is present in persons at risk for AD and may signal early emergence of executive dysfunction in preclinical AD. The association between these subtle executive-function deficits and the overall cognitive functioning of at-risk individuals provides further evidence of their utility as a possible preclinical marker of AD.

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R. ANAND, L.G. COOK & S.B. CHAPMAN. Dissolution of Discourse Gist in Early Stages of Alzheimer's Disease .

Fundamental to discourse gist is the ability to transform text information by processes of condensation and generalization. This study examined discourse gist in Alzheimer's disease (AD) by estimating the extent of transformation and degree of vagueness in summary production with the following hypotheses: (a) individuals with AD will have fewer transformed information units (TIU), and (b) will have increased vague information units (VIU). The study included 12 participants with mild probable AD and 12 cognitively normal elderly controls. A biographical narrative (578 words) of a third grade reading level was used to elicit

a summary (a shortened version of the story in their own words with a general idea of the story's content). Responses on summary production were analyzed to obtain transformation index (number of TIU/total information units) and vagueness index (number of VIU/total information units). Differences between groups were analyzed using t tests, yielding statistically significant differences for both indices. Individuals with AD transformed less information and produced more number of vague statements. The results imply that individuals with AD have difficulty transforming explicitly stated text information into generalized semantic representation. Also, greater number of vague responses in AD suggests excessive dependence on world knowledge as compensation for difficulty in assimilating specific text information. In accordance with discourse processing models, dissolution of gist in AD may reveal impairment in utilizations of controlled processes and logical inferencing. These findings highlight discourse gist measures as a possible diagnostic complement in identification of AD in its earliest stages.

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B. ALLY, G.E. JONES & J. COLE. The endogenously evoked P50 potential in patients with Alzheimer's disease and their biological children.

This study examined whether the endogenously evoked P50 component could correctly identify individuals with Alzheimer's disease (AD). In addition, the predictive possibility of P50 was examined in biological children of patients with AD. P50 is a sensory gating component that is generated through the ascending reticular activating system, and is modulated by the neurotransmitter acetylcholine (ACh). Sensory gating refers to the inhibition of a stimulus-related neuronal response if the stimulus is preceded by a warning stimulus. Recent studies have shown significantly diminished levels of ACh and related P50 suppression in subjects with AD, but there is no evaluation of this component in those at high risk for AD by familial connection. P50 was elicited using the standard auditory paired-click paradigm at three electrode locations (Fz, Cz, & Pz). There were twenty subjects in four groups (AD, AD-Control, Children of AD, & Children of AD-Control). P50 ratios were calculated (Click 2 / Click 1) for each subject. AD patients demonstrated less P50 suppression (Fz, $p = .122$, Cz, $p = .065$, Pz, $p = .008$) than their controls. There were no significant differences between the at risk group and their controls (Fz, $p = .690$, Cz, $p = .673$, Pz, $p = .274$). An evaluation of the response to both clicks was completed with all groups included. The results reveal significant differences in response to the second click, with the AD group demonstrating significantly increased P50 amplitudes than all other groups. These findings suggest that AD patients show significantly less P50 suppression than their controls, possibly resulting from cholinergic dysfunction. This deficit in sensory gating has several implications in sleep problems associated with AD. The P50 component, and possibly the cholinergic system, in asymptomatic children of AD patients is not similarly affected at this time.

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N.R. HORNE, C. FENNEMA-NOTESTINE, M.W. BONDI, D.P. SALMON, C.W. JENKINS & T.L. JERNIGAN. Differential White Matter Abnormalities and Hippocampal Atrophy in Young-Old and Very-Old with Alzheimer's Disease.

MRI studies of patients with Alzheimer's disease (AD) typically show gray matter volume reduction in the medial temporal lobes consistent with their memory impairment. However, extensive white matter (WM) abnormalities are also apparent and they may adversely influence cognitive domains in addition to memory. Furthermore, abnormal WM in-

creases with age, raising the possibility that concomitant WM pathology in the Very-Old may lower the threshold of AD pathology needed for the manifestation of dementia. We compared hippocampal and abnormal WM volumes in Young-Old ($n=14$) and Very-Old ($n=17$) individuals with AD (matched on education, gender, and dementia severity) using z-scores derived from respective age-, education-, and gender-matched Young-Old ($n=9$) and Very-Old ($n=13$) control groups. We found that despite similar levels of dementia severity, the Young-Old AD group had significantly more hippocampal atrophy ($p<.001$) and more subcortical ($p=.003$), temporal ($p=.013$), and total ($p=.031$) abnormal WM volume than the Very-Old AD group. In addition, the pattern of cognitive deficits differed across groups, with the Young-Old AD group performing significantly worse than the Very-Old AD group on tests of memory and executive functions. There were a greater number of significant correlations between abnormal WM volume and neuropsychological test scores in the Young-Old AD group than in the Very-Old AD group. These results suggest that abnormal WM volume may play a more prominent role in the neuropsychological impairment associated with AD in the Young-Old than in the Very-Old, and support the hypothesis that less AD pathology may be needed in the Very-Old to evince cognitive deficits comparable to those of the Young-Old.

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E.E. SUNDERMANN, P.E. GILBERT & C. MURPHY. The Effect of Estrogen Replacement Therapy on Recognition Memory for Olfactory and Visual Stimuli in Female Patients Diagnosed with Alzheimers Disease'.

Recent studies have shown that patients with Alzheimers disease (AD) exhibit a deficit in episodic recognition memory for odors. Studies have shown a higher rate of AD in women. It is hypothesized that this gender discrepancy is due to estrogen-deprivation in post-menopausal women. Since estrogen may exert neuroprotective effects on the brain, estrogen deprivation may render the brain more susceptible to degeneration. Past research has suggested that estrogen helps minimize the cognitive decline in AD as well as post-menopausal olfactory loss. The current study examines the effects of estrogen on recognition memory for olfactory and visual stimuli. Participants included 24 female AD patients who had taken any estrogen supplements at some point in their life and 79 female AD patients who had never taken estrogen supplements. Each participant completed a recognition memory task involving three categories of stimuli: odors, faces, and abstract symbols. Compared to AD patients who were non-estrogen users, AD patients who had used estrogen committed significantly fewer false positive memory errors for olfactory stimuli suggesting that estrogen may have a beneficial effect on recognition memory for odors in AD patients. Performance on the recognition memory task for visual stimuli was not able to differentiate between estrogen users and non-users. The results suggest that estrogen therapy could help ameliorate the earliest symptoms of AD, olfactory dysfunction, and memory impairment. This is likely due to the location of estrogen receptors in brain areas responsible for olfaction and memory.

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Executive Functions/Frontal System

E.C. CAREY. Age Related Cognitive Trends in the Maturation of the Prefrontal Cortex.

Until quite recently, it has been assumed that cognitive functions were fully matured by adolescence. However, neuroanatomical and neu-

roimaging studies have demonstrated continued maturation of the central nervous system into adulthood, particularly in the prefrontal cortex thought to be involved in executive functions. This study tested the hypothesis that executive functions continue to improve from early adolescence into young adulthood. It was hypothesized that older participants would do better than younger subjects on three neuropsychological measures of executive ability. Two age groups, ages 13 to 17 ($N=19$) and 20 to 25 ($N=20$) were compared on three neuropsychological measures involving working memory (Letter / Number Sequencing Test), response inhibition (Color Word Interference Test from the D-KEFS, a Stroop task), and problem solving (WCST variables). To control for differences in intellectual ability, all participants were administered three subtests of the WASI (Vocabulary, Similarities and Block Design). The two groups were compared on a total of 20 variables derived from the neuropsychological measures. Multiple analyses of variance and covariance, with Similarities and Vocabulary as covariates, were conducted. Gender differences were also examined. Analyses examined differences in speed, errors and general performance. The hypotheses were only partially supported. Young adults demonstrated longer spans on the letter / number Sequencing Test and faster processing speed on the inhibition task, but did not differ from the adolescent group with respect to errors on the CWIT or on the WCST variables. Improvement with increasing age was related to increases in Vocabulary but not to other measures of intellectual ability or gender.

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T.D. TOLAR, M.K. MORRIS & A.C. BLALOCK. Math Fluency, Working Memory Capacity, and Inhibition in College Students Referred for Learning Difficulties.

Math fact retrieval is a complex skill that has been associated with multiple cognitive components including working memory and inhibition. The purpose of this study was to investigate the possible main and interactive effects of working memory and inhibition on math fluency, and to compare the impact of working memory capacity on multiple measures of fluent semantic retrieval. 195 college students were referred for learning difficulties and tested using IQ, neuropsychological, and achievement measures. Measures of single digit math fluency (MF), working memory (WM), inhibition (I), and rapid automatized naming of digits, letters, objects, and colors (RAN) were available. We used 2 X 2 factorial ANOVA to test the effects of working memory capacity (Low WM, High WM) and inhibitory capacity (Low I, High I) on math fluency, and used repeated measures ANOVA to test the effects of working memory capacity across different semantic retrieval tasks (MF vs. RAN). Greater inhibitory capacity was more strongly associated with math fluency performance in the Low WM group than in the High WM group. A significant interaction between WM group and semantic retrieval task was also present, but only for rapid naming of objects. High and low WM groups consistently differed in performance on math fluency and RAN of letters, digits, and colors, but did not differ on RAN of objects. Inhibitory processes have a stronger effect on math fluency for adults with low working memory capacity compared to those with high capacity. Task differences related to working memory capacity may reflect the extent to which different semantic retrieval tasks involve response competition and the need for interference control.

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M. WELSH, Z. HOWELL, T. SARAH & J. EMICK. Formal Operational Thought and Executive Functions in College Freshmen and Seniors.

Two questions were addressed in this study. First, do senior-level college students outperform freshmen on tests of formal operations and ex-

ecutive functions? Second, to what degree do a range of executive functions predict formal operational thought in this population? Formal operations, the final stage in Piaget's theory of cognitive development, involve hypothetico-deductive reasoning, and executive functions are goal-oriented cognitive processes typically attributed to the prefrontal cortex. Thirty-five male and female freshman college students ($M_{age}=18.54$) and 35 male and female senior college students ($M_{age}=23.74$) were administered the Logical Reasoning Test of formal operational thought, and executive function tests of planning (Tower of Hanoi-Revised), working memory (Spatial Span), and inductive reasoning (Matrix Reasoning). Unexpectedly, no significant differences in performance between freshman and senior students were identified for any of the experimental tasks. Multiple regression analyses indicated that performance on all of the executive function tests together predicted 33% of the variance in formal operational scores. Performance on the Matrix Reasoning test predicted the greatest amount of unique variance (26%) in the formal operational scores, with the Tower of Hanoi-Revised performance explaining an additional 6% of unique variance. The spatial working memory scores added very little to this prediction. The failure to find expected performance differences between college freshmen and seniors may be due to differences between the groups that cannot be controlled. The results do suggest that formal operational thought shares substantial variance with the complex executive functions required by the Matrix Reasoning and Tower of Hanoi tasks.

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M. WELSH, D. DAVIS, L. COMER, B. AKI & D. VIGIL. Dietary Restraint and Working Memory Performance in Male and Female College Students.

Recent empirical evidence indicates an association between dieting and working memory performance in women; however, the nature of this relationship is unclear. Cognitive explanations suggest that preoccupying cognitions about food take up needed working memory capacity. Biological explanations propose that food restriction alters neurochemistry that is important for optimal working memory function. In this preliminary study, we examined the association between dietary restraint and working memory in both males and females. Eighty college students ($M_{age}=19.48$, $SD=1.67$) were administered the Modified Mental Counters (MMC) working memory test and an eating questionnaire. The MMC involves updating numbers in 2-, 3-, and 4-load conditions, and was administered to three groups under different interference conditions. The DEBQ-r yields a score indicative of current dieting behaviors, whereas the Restraint Scale score indicates both dieting behaviors and weight fluctuation, implying intermittent dieting failures or disinhibited eating. Analyses indicated no significant associations between errors on the working memory task and the DEBQ-r scores. In contrast, the Restraint Scale scores significantly predicted errors on the MMC, but only for females in the spatial interference condition. Given the specificity of these results, it appears that dietary restraint, per se, does not have a generalized negative impact on working memory performance, at least as measured by the MMC task. One interpretation of the results is that the women who diet but are also prone to disinhibited eating, may have subtle impairments in executive functions such as inhibition and working memory, and their eating patterns may simply be one manifestation of this impairment. Correspondence: Marilyn Welsh, Ph.D., Psychology, University of Northern Colorado, McKee Hall 14, Campus Box 94, Greeley, CO 80639-0121. E-mail: marilyn.welsh@unco.edu

A. BOEKA & K. LOKKEN. Executive Functioning Deficits in Women with Bulimia Nervosa.

There has been recent upsurge in the assessment of cognitive processes in order to explain clinical psychopathology specific to eating disorders.

Recently, investigation into the neuropsychological performance of individuals with bulimia nervosa (BN) has received considerable attention. Individuals with BN have been shown to perform poorly on tasks of executive functioning in areas such as attention, cognitive flexibility, and problem-solving. Several neuropsychological tests are regarded as measures of executive functions; however, there is evidence that such tests measure different constructs. The Wisconsin Card Sorting Task (WCST) has been employed as a measure of constructs such as concept formation, problem-solving, and cognitive flexibility while the Stroop test has been traditionally viewed as a measure of cognitive inhibition and selective attention. Three groups of women (Group 1: normal controls; Group 2: at-risk for BN; Group 3: BN) were administered the WCST and Stroop task as part of a larger neuropsychological battery. Women were matched on age, body mass index, and verbal ability. Results demonstrated that women in Group 3 made significantly more perseverative ($p=.001$) and overall errors ($p=.001$) and completed significantly fewer categories ($p<.005$) on the WCST than both groups 1 and 2. There was no significant difference between the three groups on the Stroop task ($p=.197$). In addition, the Stroop task and the WCST loaded on different components on a subsequent factor analysis. Such results emphasize the discontinuity of these two executive functioning tests and warrant further investigation of specific executive function ability in women with BN.

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H.J. FRIEDRICHSEN, N.L. DENBURG, E.C. RECKNOR, A.R. KAUP, D. TRANEL & A. BECHARA. Performance on the Iowa Gambling Task Declines with Age and Predicts Outcome on Other Measures of Executive Functioning.

The aim of the present study was to examine the effect of age on several "executive function" measures, namely, the Iowa Gambling Task (IGT), the intra- and extradimensional set shifting task (IDED), and the Wisconsin Card Sorting Test (WCST). Seventy healthy subjects aged 27 to 84 (66% female) participated. They were divided into two groups based on age: Younger (age 62 and under, $n=33$) and Older (age 63 and over, $n=37$). The IGT measures reasoning and decision-making, by having participants choose among four decks of cards of varying amounts of reward and punishment. We have demonstrated previously an age-associated decline on the IGT. The IDEED measures attentional set formation and shifting, using a visual discrimination task with stimuli of two different dimensions and two types of shifts. The WCST measures the formation, maintenance, and shifting of a cognitive rule. A MANOVA revealed a main effect of age on all 3 tasks (IGT ($F=8.16$, $p<.01$); WCST ($F=4.42$, $p<.05$); IDEED ($F=4.22$, $p<.05$), with the Younger participants outperforming the Older participants. The effect size was largest for the IGT; moreover, when the IGT score was used as a covariate, there was no longer a significant main effect of age on the WCST or IDEED. The age-related findings replicate and extend previous work demonstrating adverse effects of aging on various executive functions. Furthermore, our data can be taken to suggest that the decision-making processes tapped by the IGT are in some ways superordinate to the functions indexed by the other tasks.

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T. JOHN, J. SUHR & D. HAMMERS. Personality Dimensions Associated with Performance on the Iowa Gambling Task.

The present study explored the relation between personality characteristics and decision making skills as measured by the Iowa Gambling Task (IGT). Gray (1972) posited two fundamental dimensions of temperament that are in competition with one another to control behavioral output. The Behavioral Activation System (BAS) is hypothesized to be

a reward activated system, driven by the mesolimbic dopaminergic system and associated with impulsivity, while the Behavioral Inhibition System (BIS) is hypothesized to respond to punishment and is associated with anxiety. There is also research suggesting that state mood is strongly associated with performance on decision making tasks (the framing effect), suggesting a need to control for state mood when interpreting performance on decision making tasks such as the IGT. In this study, 69 undergraduate students at a medium sized university (age 18-28, 33 male) completed the IGT, the Positive and Negative Affect Scale, and the BIS/BAS scale. IGT was scored as total disadvantageous deck choices subtracted from total advantageous deck choices. Hierarchical linear regression results showed that the PANAS was highly related to performance on the IGT, accounting for 17% of the variance in scores, $F=12.5$, $p<.001$. BIS/BAS scores significantly accounted for an additional 7% of the variance in IGT performance, even after controlling for state mood, $F=5.5$, $p<.05$. Results suggest future studies should consider the contribution of state mood when attempting to understand patterns of performance on decision making tasks. In addition, our findings suggest that variations in IGT performance can be related to differences in personality characteristics, even in a nonclinical population.

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L.B. BROWN, J. STOUT, J. GRACE & R. DUPONT. Frontal Systems Behavioral Functioning in Unipolar Depression, Bipolar Disorder, and Frontal Systems Damage.

The Frontal Systems Behavior Scale (FrSBe; Grace & Malloy, 2001) measures Apathy, Disinhibition, and Executive Dysfunction, related to three distinct frontal-thalamic-striatal neuronal circuits (Cummings, 1993). Frontal circuitry dysfunction is hypothesized in patients with unipolar depression and bipolar disorder. The present study compares neurobehavior in participants with unipolar depression, bipolar disorder, frontal systems damage, and controls. Participants included 35 with unipolar depression, 39 with bipolar disorder, 30 with frontal systems damage and 32 healthy controls. A family member rated the participant's current behavior on the FrSBe. MANOVA indicated main effects of group on Apathy (A), Disinhibition (D), Executive Dysfunction (ExD), and Total (Tot) scores. Post-hoc analyses revealed bipolar and unipolar participants were rated higher than controls on A, ExD, and Tot, though the frontal participants were rated higher than any other group. Bipolar (but not unipolar) participants were rated higher than controls on D, though again, the frontal participants were rated the highest. To place these findings in clinical context, based on age-, sex- and education-corrected T-scores, 75% of the frontal group had Tot T-scores in the clinically elevated ($T \geq 65$) range, whereas only 17% of the unipolar, 31% of the bipolar, and 3% of the control participants were in the clinically elevated range. Consistent with findings of frontal circuitry dysfunction in unipolar and bipolar depression, frontal behavioral syndromes are present in these disorders. Although similar neurobehavioral symptoms are evident in psychiatric and focal lesion patients, those with frontal systems damage have more pronounced behavioral abnormalities.

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A.J. VERDEJO, E.C. RECKNOR, C. RIVAS, M. SANCHEZ-BARRERA, M. PEREZ-GARCIA & A. BECHARA. The Role of the Personality Traits of Sensitivity to Reward and Punishment on the Decision-making Deficits of Substance Abusers.

Personality traits within the impulsivity spectrum and decision-making deficits have been consistently associated with addiction. The aim of this study is to examine if the personality traits of sensitivity to reward and

sensitivity to punishment play a role in the decision-making deficits observed in substance abusers. Thirty-three (32 males) abusers of alcohol, cocaine and heroin were consecutively recruited as they joined inpatient addiction treatment. Mean age was 29.81 ($SD=6.13$), and mean years of education was 9.78 ($SD=2.82$). The Iowa Gambling Task (IGT) and the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ) were administered to all participants. Descriptive analyses were used to examine participants performance on both tests and regression analyses were used to study the influence of drug use history on the tests. To test the main hypothesis the participants were classified into four groups according to their scores on the SPSRQ: high sensitivity to reward (HSR), low sensitivity to reward (LSR), high sensitivity to punishment (HSP), and low sensitivity to punishment (LSP). Two one-way ANOVAs were carried out to examine possible differences in IGT performance as a function of group (HSR vs. LSR, and HSP vs. LSP). Mean scores were 1.57 ($SD=28.82$) for the IGT, 16.39 ($SD=3.46$) for the SR subscale, and 11.48 ($SD=6.25$) for the SC subscale. IGT and SPSRQ scores were not related to previous history of drug abuse. HSR abusers performed significantly worse than LSR abusers in the IGT ($F=8.552$, $p<.01$). By contrast, HSP abusers performed better than LSP, though this pattern did not reach statistical significance ($F=3.650$, $p=.065$). These results suggest an asymmetrical role of sensitivity to reward and punishment on decision-making in substance abusers: while high sensitivity to punishment seems to play a beneficial role in decision-making, high sensitivity to reward significantly worsens the decision-making patterns in the IGT paradigm.

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A. SHELTON & S.K. ACHESON. The Neurocognitive Effects of Alcohol-Related Blackouts.

Those that experience alcohol-related blackouts report more positive and more negative consequences from alcohol use (Buelow & Harbin, 1996). We hypothesized that individuals that report blackouts are inattentive to future consequences and therefore exhibit poorer adaptive decision-making (ADM). Furthermore, due to evidence that those that report alcohol-related blackouts do not exhibit other cognitive deficits (Tarter & Schneider, 1976; Zucker, Austin, & Branchey 1985), we hypothesized that no other cognitive processes would discriminate between those that have blackouts and those that do not. Eleven participants were non-drinkers (Group 1), twenty-nine participants were drinkers that did not report blackouts (Group 2), and 35 participants were drinkers that reported blackouts (Group 3). Each subject was given a demographics, drinking behavior and alcohol blackout questionnaire and several neurocognitive tests (including the Gambling Task, a measure of ADM). The ANOVA was significant ($F(2, 74) = 3.172$, $p < .05$). Group 3 performed significantly worse than group 1 ($p = .038$) on the gambling task; however, the difference between group 2 and all other groups was non-significant ($p = .211$ for group 1 vs. group 2 and $p = .549$ for group 2 vs. group 3). The MANOVA revealed that there were no other cognitive processes that differed significantly between any of the groups (Wilks's Lambda = .818, $F(11, 63) = 1.273$, $p = .261$). Findings show that those that have blackouts exhibit poorer ADM than those that do not drink. Furthermore, ADM is the only cognitive process that discriminates between those that have blackouts and those that do not drink. Follow-up analyses revealed that the gambling task is uncorrelated with recency or number of black-outs. Based on these and other findings, we propose that the ADM deficit is a predisposition that leads to problem drinking.

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A. KELLER, J. SUHR, J. TSANADIS & D. HAMMERS. The Relation of Substance Use to Decision Making Ability in a Nonclinical Sample.

The Iowa Gambling Task (IGT) has been shown to be a good measure of decision making skills in patients with frontal lobe lesions, as well as patients with purported frontal lobe dysfunction, such as those diagnosed with substance dependence. In the present study, we explored whether substance use is related to decision making skills and executive functioning abilities in a nonpatient sample. We also explored whether certain personality characteristics, such as engagement in risky behaviors and approach/avoidance tendencies, are related to substance use. 39 undergraduate students (ages 18 to 27 years) completed several self-report measures, the IGT, and the Wisconsin Card Sorting Test (WCST). The sample was divided by self-reported use of illegal substances ($n=15$ no use, $n=24$ past or current use). There were no age or gender differences between groups. As predicted, those who reported substance use were more likely to endorse a tendency towards approach behavior (Behavioral Inhibition Scale/Behavioral Activation Scale, $p<.001$) and reported more engagement in risk-taking behaviors in everyday life (Cognitive Appraisals of Risky Events Scale, $p<.001$). They also scored higher on a measure of alcohol abuse tendencies (Alcohol Use Disorder Identification Test, $p<.001$). On neuropsychological tests, those who reported substance use performed worse on the IGT ($p<.01$) and the WCST (categories completed $p<.05$, percent perseverative errors $p<.05$). Results are consistent with findings in patient samples, suggesting a relationship between engagement in illegal substance use, executive function and decision making skills, and dispositional characteristics tied to behavioral activation, impulsivity, and risk-taking tendencies, even in a nonclinical population.

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K. RANDALL, K. KERNS & L. SMITH. Multimodal Response Inhibition using a Computer Conflict Paradigm.

Inhibition is an important cognitive construct frequently assessed by such tests as the Stroop. This study analyzed the dissociation hypothesis (Nas-sauer & Halperin, 2003) that motor inhibition (inhibition of inappropriate motor responses) and perceptual inhibition (inhibition of irrelevant stimuli) are separable cognitive processes. As the original Stroop used color as a primary stimulus, color was also investigated in this study. Psychology students ($N=106$) completed the Golden Stroop and 8 computer tasks with differing stimulus modalities (location, color, direction), response instructions, and conflicts. Tasks included correct responses and inhibition to colored arrows pointing left/right in the center of the monitor, and colored boxes appearing on the left/right of the monitor. Responses were made on a color button bar. 2 X 2 repeated measures ANOVA were conducted on stimulus modalities and on overall perceptual X motor conflicts. Overall results support previous research that motor inhibition and perceptual inhibition can be dissociated, indicated by main effects for perceptual and motor conflicts without an interaction effect. Results also revealed an intriguing color effect. Color revealed the greatest motor inhibitory effect, regardless of the framework that it was processed in. Findings indicate that motor inhibition and perceptual inhibition are separable cognitive processes. The color effect suggests that inhibition of color within a motor context involves more complex cognitive processing than the processing required to inhibit cues of direction or location. These results provide promising avenues for future research and suggest that color processing may play a more prominent inhibitory role than other stimulus modalities.

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W. WATSON & Y. SUCHY. Reexamination of the Interhemispheric Transfer Hypothesis of Switching (ITS).

Previous studies have suggested that switching to a new activity requires both inhibition (right frontal) and initiation (left frontal). As a result,

switching from a right- to a left-hemisphere activity has been found to be faster than switching in the opposite direction, presumably due to lesser demands on interhemispheric transfer (ITS: Suchy et al., 2003, 2004). However, because stimuli in some prior studies consisted of shapes presented at the global level vs. numbers presented at the local level, it was not clear whether the ITS effect could be due to the level of stimulus presentation (i.e., local vs. global), or stimulus type (i.e., numeric vs. spatial). To address this question, a modified switching task was administered to 29 college students ages 18-26. The task consisted of classifying hierarchically organized stimuli containing all possible combinations of spatial and numeric components. Participants were required to switch between local (left-hemisphere) and global (right-hemisphere) classifications as well as spatial (right-hemisphere) and numeric (left-hemisphere) classifications. Left- and right-hemisphere classifications were equally difficult. Consistent with prior research, repeated measures analysis of variance using switch direction (right to left vs. left to right) and stimulus manipulation (global/local vs. spatial/numeric) as within-subjects factors showed a main effect of switch direction, with right to left switches being faster, $F(1,28)=4.28$, $p=.049$. No main effect of stimulus manipulation and no interactions were found. The results provide further support for the ITS hypothesis and demonstrate that the ITS effect is not specific to stimulus type or local/global components of the task.

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A. EASTVOLD & Y. SUCHY. The Trail Making Test - Part B and its Relationship to the Prefrontal Cortex.

Performances on Trail-Making Test Parts A and B (TMT-A and B) are known to be sensitive to age-related declines in cognitive efficiency and are affected by education. Research also suggests that performance on the TMT-B, but not TMT-A, is sensitive to the integrity of the prefrontal cortex. However, research is inconsistent regarding what specific prefrontal areas subserve TMT-B performance. The objective of this study was to further elucidate the relationship between TMT-B and the prefrontal cortex. To address this issue, 47 healthy volunteers (ages 18 to 68) were administered the TMT-A, TMT-B, and three electronic executive tasks purported to differentially tap into the three main convexities of the prefrontal cortex (N-Back Task: dorsolateral; Stroop: medial; and Reversal Learning Task: orbitofrontal). Stepwise Multiple Regressions were conducted, using TMT-A and TMT-B as criterion variables, and age, education, and the three electronic executive tasks as predictors. As expected, Stepwise Multiple Regression yielded only age and education as predictors of TMT-A performance, accounting for 33% variance, $F(2,52) = 14.07$, $p<.001$. In contrast, the N-Back and Reversal Learning Tasks together accounted for an additional 12% of the TMT-B variance above and beyond that accounted for by age and education, $F(4,50) = 12.63$, $p<.001$. The final model accounted for 46% of the TMT-B variance. These results corroborate the relationship between TMT-B and the prefrontal cortex, and further suggest that TMT-B may be specifically related to the dorsolateral and orbitofrontal regions of the prefrontal cortex.

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C.R. MARTIN & R.A. BORNSTEIN. The Effect of Executive Function on Use of Semantic Clustering.

Clinical inferences often assume executive function (EF) impacts organizational demands of certain memory tasks (list learning) more than others (paragraph recall). Several studies have examined the role of EF on memory performance, comparing frontal-lesion patients with healthy controls. Few have, however, stratified by EF performance. Therefore,

this study examined the effect of EF on learning strategies, hypothesizing that subjects with better EF would utilize semantic clustering more, increasing overall memory performance. Subjects were 165 subjects from a larger sample of 249 in a study of neuropsychological aspects of HIV. The entire sample distribution of WCST perseverative error scores was examined, and top (<10 errors) and bottom (>25 errors) thirds of the distribution were selected. Subjects were further stratified on serostatus (HIV+ n=127, HIV- n=38). Groups were compared on CVLT performance. ANCOVA was used, controlling for age, education and VIQ. Semantic clustering was strongly related with total learning ($r = .42, p < .001$). Serial clustering was negatively related to performance ($r = -.17, p < .01$). Compared to poor EF groups, normal EF groups utilized semantic clustering more and had better overall memory performance. No group differences on serial clustering existed. These data demonstrate EF is related to use of semantic clustering, which is related to list learning. EF was not, however, related to use of serial clustering. Although frontal lobe dysfunction is common in HIV, the impact of EF was also found in HIV- controls. This suggests the impact of EF on use of semantic clustering is not disease-specific.

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R.M. ROTH, P.K. ISQUITH & G.A. GIOIA. Initial Development of a Behavior Rating Inventory of Executive Function for Adults.

The ecological validity of executive function assessment can be substantially enhanced through the use of rating scales (Silver, 2000). Furthermore, providing feedback about an individual's perspective on their own self-regulation can inform assessment and facilitate a collaborative working relationship that serves as a starting point for intervention. Indeed, an individual's level of self-awareness helps gauge the amount of support they require. We developed parallel self-report and informant-report measures of executive function for adults aged 18 years and above as a tool for external validation of clinical assessment and as an easily administered, psychometrically sound means of evaluating executive difficulties in this age group. The measure is based on its predecessor designed for children and adolescents, the BRIEF (Gioia, et al. 2000), and includes 74 items within 9 non-overlapping scales (Inhibit, Shift, Emotional Control, Self-Monitor, Initiate, Working Memory, Plan/Organize, Organization of Materials, Task Completion), each with 5 to 10 behaviorally anchored items. Item-total correlations for a combined clinical and normative group ($N = 150$) were in the appropriate range ($r = .40$ to $.75$). Internal consistency ranged from .75 to .90 (.95 overall) for the self-report measure and .83 to .95 (.97 overall) for the informant report measure. Correlations between informant and self-report forms ranged from mid .3's for the Emotional Control, Self-Monitor and Shift scales, to over .50 for the Task Completion, Plan/Organize, Initiate and Inhibit scales, and to over .65 for the Working Memory Scale. Preliminary data support further efforts to standardize and validate a BRIEF for adults.

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J. NEUDECKER, C. PILARSKI, K. PYTLAK, N. SMITH & R. SKEEL. The Prediction of Risk-Taking Behavior: Personality Variables Versus Behaviorally Based Measures.

The five-factor personality model has demonstrated effectiveness in the prediction of adolescent risk-taking behavior (Gullone and Moore, 2000). The Bechara Gambling Task (BGT; Bechara, Damasio, Damasio, & Anderson, 1994) and the Balloon Analogue Risk Task (BART; Lejuez et al., 2002) are two behaviorally based measures that have also demonstrated some effectiveness in the prediction of risk-taking (Bechara, 2003; Lejuez et al., 2003). The current study compares self-report and

performance-based measures in the prediction of risk-taking in a college based sample. It was hypothesized behaviorally based measures would account for variance in risk-taking beyond that accounted for by personality variables. Participants included 69 undergraduates at a mid-sized midwestern university. The Adolescent Risk Questionnaire (ARQ; Gullone, Moore, Moss & Boyd, 2000) was used as the criterion measure. The ARQ assesses both risk perceptions and risk behaviors for four domains of risk taking behavior, in addition to total scores. The NEO-PI was used to measure the five-factor model of personality (Costa & McCrae, 1992). Risk-taking was measured with the BGT and the BART. Regression models were constructed for each domain, with NEO-PI variables entered in block 1, followed by risk-taking measure variables in block 2. Personality factors explained 14.6% to 23.6% of the variance for ARQ behavior domains. Risk-taking measures added 11.3% to the explanation of one domain (rebelliousness), but failed to explain significant amounts of variance beyond the NEO for the other domains. The utility of the BART and the BGT in the prediction of self-reported risk-taking in a normal sample is explored.

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D. DAWSON, N. ANDERSON, P. BURGESS, B. LEVINE, D. REWILAK, E. COOPER, S. FARROW, K. KRPAN, M. PEER & D.T. STUSS. The Ecological Validity of the Multiple Errands Test - Hospital Version: Preliminary Findings.

One of the great challenges for neuropsychology has been to develop tests that elucidate cognitive problems and that are highly correlated with real-world problems. Recently the Multiple Errands Test-Hospital Version (MET-HV), a test of real-world multi-tasking, was shown to be a valid test of executive dysfunction and to discriminate between persons with acquired brain injuries and normal controls. The purpose of this study was to assess further the ecological validity of the MET-HV. We predicted that performance on the MET-HV would be correlated with instrumental activities of daily living (IADL), health-related disability, and social participation. Ten adults with acquired brain injury (stroke, traumatic brain injury) at least one year post-onset and three age and education matched controls have been assessed to date. Testing included: a) MET-HV, b) a standardized performance based assessment of IADL, the Assessment of Motor and Process Skills-AMPS, c) two self-report measures of real-world difficulties, the Sickness Impact Profile (SIP) (health-related disability) and the Mayo Portland Adaptability Inventory (MPAI) (social participation). Non-parametric statistics were used for all analyses. The total number of errors on the MET-HV was significantly associated with the SIP total score ($p \leq 0.05$) and the MPAI adjustment and social participation subscores ($p \leq 0.001$). The total number of rule breaks on the MET-HV was significantly associated with the process score of the AMPS ($p \leq 0.05$). The temporal organization score on the AMPS showed a moderately high (although not significant) correlation ($p \leq 0.10$) with the number of inefficiencies on the MET-HV. These data provide preliminary evidence for the ecological validity of the MET-HV. Strongest associations are with the MPAI measure of social participation, suggesting that performance on the MET-HV is indicative of the problems people with executive dysfunction face in their day to day life.

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M.C. GIBBS, P. LEE, L. GILOTTY, G. WALLACE, D. BLACK, A. NYE & L. KENWORTHY. Assessing Executive Dysfunction Across Neuropsychological Domains.

Although many tests are available that specifically assess EF, interpretation of strengths and weaknesses on tests assessing other neuropsychological domains may also yield valuable information about EF. A

clinically referred sample of 78 high functioning children with Autism Spectrum Disorders was administered a neuropsychological test battery. A discrepancy score assessing the difference between performances on two measures of short term auditory memory from the Wide Range Assessment of Memory and Learning was created. Sentence Memory was used as a measure of the ability to manage simple information, with Story Memory used as a measure of the ability to manage more complex information. The discrepancy score was created by subtracting the Story Memory scaled score from the Sentence Memory scaled score. Negative values indicated poorer Story Memory performance. Parent report on the Behavior Rating Inventory of Executive Function was also obtained. Regression analysis indicated that the discrepancy score was predictive of the Metacognition Index of the BRIEF ($R^2 = .07$, $p < .01$). Results provide support for the assessment of the discrepancy between performance on WRAML Story Memory and Sentence Memory subtests as an indicator of executive dysfunction in this population when taken within the context of other consistent findings. Moreover, results emphasize that EF can be assessed by carefully evaluating performance across neuropsychological domains as opposed to a solely within domain focus.

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J.M. FOLEY, M. COLLINS, Z.E. PROCTOR-WEBER & C.J. GOLDEN. The Sensitivity and Specificity of the WCST to Detect Executive Dysfunction in Adults.

Previous research has examined executive functioning deficits within childhood developmental and psychiatric disorders, particularly with regard to learning and attentional disabilities. Attempts have been made to identify the extent to which executive functioning assessment accurately and sensitively evaluates frontal lobe deficits commonly associated with childhood disabilities. The present study was designed to examine the usefulness of WCST variables in discriminating between different types of Mood and Cognitive disorders in an adult population. Participants included 106 neuropsychiatric-referred patients, 47.2% of which were male with 82.1% being right handed. The mean age was 34 years ($SD = 13$) and mean education was 13.8 years ($SD = 2.8$ years). Most participants were Caucasian. From the sample, 8.5% were diagnosed with Vascular Dementia, 51% with a Learning Disability, 16.1% with Mood Disorders, 6.6 with Mental Retardation, and 17.8% with Cognitive Disorder NOS. Alpha levels were adjusted to account for family-wise error variance, and Levene's was non-significant. Results from four one-way ANOVAs indicate that WCST variables can successfully differentiate between adults suffering from Mood and Cognitive disorders, suggesting that executive dysfunction may present differently in these populations. Analyses showed significant discrimination at the $p = .05$ level between adults suffering from Vascular Dementia, Mental Retardation, Learning Disorders, and various mood disorders. These results suggest sensitivity of the WCST to detect subtypes of executive deficits between Mood and Cognitive Disorders and within Cognitive disorders in adults. Clinical implications of these findings will be discussed.

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E. CHANG, Y. KANG, Y.J. KIM, H. MA & B. LEE. The Relationship between Frontal Lobe Functions and Intelligence: Comparisons of the College Students, the Normal Elderly, and the Parkinson's Disease Patients.

Recent studies (e.g., Obonsawin et al., 2002) have indicated that performance on tests of frontal lobe function is highly associated with intelligence. The present study was conducted to explore how the rela-

tionships between frontal lobe functions and crystallized/fluid intelligence are influenced by aging and frontal lobe deficits. The subjects were 50 college students (CS), 40 normal elderly (NE), and 40 Parkinson's disease patients (PD). There was no significant difference in mean age or education level between the NE and the PD. The Vocabulary subtest of the Korean-WAIS as a measure of crystallized intelligence and the Colored Progressive Matrices as a measure of fluid intelligence were administered with various tests of frontal lobe function. From the hierarchical multiple regression analyses, it was found that the NE and the PD depend on the intelligence to perform the tests of frontal lobe function more than the CS. However, the explained variance of intelligence for the tests of frontal lobe function in the PD was smaller than that in the NE. While both the crystallized and the fluid intelligence explained significant variances for the performance of the tests of frontal lobe function in the NE, only the crystallized intelligence explained a significant variance in the PD. The same results were confirmed by the partial correlation analysis. The results suggest that both the crystallized and the fluid intelligence may compensate for the functional deterioration of frontal lobes due to the normal aging in the NE, while the PD suffering from the frontal lobe dysfunction due to the aging process and the pathological deficits may depend on only the crystallized intelligence.

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A.C. GLEASON, M. HISCOCK & C.A. MEYERS. Personality and Behavior Changes in Patients with Primary Brain Tumors.

Striking changes in behavior and personality can occur with frontal-lobe pathology, and these changes have been documented in studies of patients with damage attributable to a variety of etiologies. However, behavior changes and their implications for adaptive functioning have not previously been investigated systematically in patients with frontal-lobe brain tumors. In the present study, we utilized two recently developed measures of behavioral changes associated with the frontal lobes, the Frontal Systems Behavior Scale (FrSBe) and the Iowa Scales of Personality Change (ISPC), to examine behavior in 39 brain tumor patients with frontal and non-frontal brain tumors. These questionnaires were used, along with selected neuropsychological test scores, to predict adaptive functioning as measured by the Community Integration Questionnaire (CIQ) and supervision needs as measured by the Supervision Rating Scale (SRS). After accounting for 20 percent of the variance with neuropsychological measures of executive functioning, indices of behavioral changes from the FrSBe explained an additional 11 percent of variance in CIQ scores; whereas behavior-change indices from the ISPC explained 6 percent of additional variance in CIQ. Behavioral change indices from the FrSBe along with measures of executive functioning, also significantly predicted supervision needs as reported on the SRS. Self-awareness of behavior change was found to be inversely related to supervision needs, but not community integration. The 22 patients with tumors in the frontal lobe differed significantly from the 17 patients with non-frontal tumors only in SRS scores and performance on one neuropsychological test (Controlled Oral Word Association). Findings were in agreement with previous research in dementia and traumatic brain injury that has shown similar neurobehavioral changes to be predictive of functional status, residential placement, caregiver burden, and vocational outcome.

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J.E. KANZ, J.S. PAULSEN, E.M. ALTMAIER, A. BECHARA & T. ANSLEY. The relationship between decision making and self control in incarcerated offenders .

Incarceration rates in the United States are at an all-time high, although cognitive and personality correlates of criminality are poorly understood.

96 participants recruited from the Iowa Medical and Classification Center (Department of Corrections) were assessed on self-control, academic achievement, intelligence, and decision-making (measured by the Iowa Gambling Test). The sample was primarily male (82.3%), and Caucasian (71.9%), ranging in age from 18 to 63. Less than half (43%) of the inmates had significant elevations on MMPI-2 psychopathic deviate scale. Although IQ estimates were within the average range, and average education was 11.3 years, achievement scores rated the inmates overall academic functioning at the 8th grade level. Findings suggested that incarcerated felons performed significantly worse on the Gambling Test compared with a demographically matched comparison sample ($n=123$). Although the pattern of performance suggested that understanding and acquisition of the task was normal, significant differences emerged as the healthy volunteers demonstrated more choices from the "advantageous" decks and the felons continued to make disadvantageous choices on the task. When the criminal group was divided by ratings on the self-control scale, the participants most likely to perform poorly on the GT were those with lower self-control. Results suggest that criminal offenders may disregard future consequences in the presence of immediate rewards and that this may be particularly true in offenders rated worse in self-control. Future research is needed to more clearly understand the association among decision-making, self-control, and criminality in the context of overall neuropsychological performance and brain functioning. Correspondence: Jason E. Kan, Ph.D., Neurology, Medical College of Wisconsin, 9200 West Wisconsin Avenue, Milwaukee, WI 53226. E-mail: jkan@umich.edu

A. MARGOLIS, M. DONKERVORT, M. KINSBOURNE & B.S. PETERSON. Interhemispheric Connectivity and Executive Functioning In Adults with Tourette's Syndrome.

Tourette syndrome (TS) is thought to involve disturbances in cortico-subcortical circuits, hemisphere connectivity, and prefrontal cortical volumes. Little is known about the effects of these deficits on neuropsychological functioning. To assess interhemispheric integration and prefrontal functioning, performance was evaluated on Kinsbourne's Dual Task and the Perdue Pegboard. The performance of 38 subjects with TS and 34 control subjects, 18 to 63 years of age, was evaluated on Kinsbourne's Dual Task and the Perdue Pegboard. Correlations between neuropsychological test performance and volumes of relevant brain structures were evaluated across groups. The TS group evidenced abnormalities on both behavioral measures of interhemispheric connectivity. On the Dual Task, the TS group did not demonstrate the relatively better left-hand than right-hand performance seen in normal subjects. The TS group did worse than the control group on the bimanual Pegboard task, suggesting an impaired ability to coordinate and integrate information across motor portions of the two hemispheres. On the Dual Task, left hand interference scores were inversely correlated with DLPFC volumes in the control group only, suggesting that success on the tasks depended on contributions from the DLPFC. Performance differences between the TS and control groups may relate to structural abnormalities in prefrontal cortex, a structure which enables the individual to overcome the interference effects such as those that characterize the dual task and coordinating movement of the two hands.

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F.E. KLEIN, B.K. LEBOWITZ, P.K. SHEAR & S.M. STRAKOWSKI. Self-Reported Impulsivity and Executive Difficulty in Healthy Adult Smokers.

Several studies have reported weaknesses in executive functioning among adult smokers. Additionally, adult smokers report higher levels of impulsivity and everyday executive difficulty in comparison to non-smokers. Existing studies, however, have frequently not addressed comorbid

substance use and other psychiatric disorders. Because smoking has been associated with comorbid use of other substances of abuse as well as psychiatric difficulty, and these issues independently have been associated with impulsiveness and executive difficulty, removing these potentially confounding factors is a necessary step in understanding the neuropsychological correlates of smoking. Using the Structured Clinical Interview for the DSM-IV, we identified 9 smokers and 16 non-smokers who were free of any psychiatric or substance abuse history. We hypothesized that, consistent with the literature, smokers would report higher levels of impulsivity and executive weakness than a group of non-smokers, as assessed by the FrSBe and BIS-11. A 2 (Smokers, Non-Smokers) X 2 (task) repeated measures ANOVA was performed, revealing a significant main effect of group $F(1, 23) = 9.05$, $p < .01$. As hypothesized, the results of this study revealed that adult smokers with no lifetime history of substance use disorders or other significant psychopathology report higher levels of impulsivity and executive weakness than non-smokers.

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A. SLACHEVSKY, M. PENA, C. PEREZ, E. BRAVO & F. RAVERA. Neuroanatomical Correlates of Behavioural Dysfunction and Dysexecutive Syndrome in Patients with Prefrontal Lesions: Preliminary Results.

Exploring neuroanatomical correlates of behavioural dysfunction in patients with prefrontal lesions 27 patients with prefrontal lesions were evaluated with: i) questionnaires to evaluate behavioural dysfunction secondary to prefrontal lesions (Inventaire du Syndrome Dysexecutif Comportemental); ii) neuropsychological tests to evaluate executive function [Mattis Dementia Rating Scale, Modified Version of the Wisconsin Sorting Test, Verbal Fluency, Trail Making Test and frontal behaviours (prehension and imitation behaviour)], and iii) 3-D Magnetic Resonance Imaging to localize prefrontal lesions. The localization of the frontal damage was generated by visually guided classification of the lesion over three criteria: i) anatomic areas; ii) Brodman areas and iii) white matter. The performance in behavioural evaluations was correlated to injured brain areas. Multivariate analysis was applied with lesion-localization as fixed factor and educational level and age as co-variables. Our results show that there were not significant effects by hemisphere. Most significant differences were obtained when we grouped patients in two clusters: dorso-lateral or ventro-medial lesion. The performance in matris and frontal behaviours are significantly higher in patients with dorso-lateral lesion as compared to patients with ventro-medial lesion. The score in TMTB is significantly higher in patients with ventro-medial lesion as compared to patients with dorso-lateral lesion. Patients with dorso-lateral lesion tend to have a higher score in ISCD as compared to patients with ventro-medial lesion ($P < 0.09$). Taken together our results suggest that patients with ventro-medial lesion have more cognitive dysfunction than patients with dorso-lateral lesion. Our results suggest that executive function involves also ventro-medial regions of the frontal lobe. However, our results will be certainly best fitted increasing the number of patients with a lesion over a particular area.

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B. STRATTON & M. HARTMAN. Age Differences in Concept Formation.

Healthy older adults exhibit decline in a number of cognitive abilities, one of which is concept formation, the ability to identify abstract relationships. Tests of concept formation require a number of cognitive abilities, including concept identification, selective attention, and

working memory. Older adults' deficits in any or some combination of these component skills could be responsible for their reduced performance. Participants included 42 younger adults aged 18-30, and 42 older adults aged 60 and over. Using a new, computerized Concept Matching task, we evaluated whether older adults exhibit a deficit in concept identification, the ability to generate abstract concepts from features of different stimuli. By manipulating stimulus complexity, we also examined whether older adult performance declined with increasing irrelevant information. Further evidence for the role of attentional deficits in concept formation was established by examining the relative contributions of performance on the Concept Matching task and independent measures of selective attention to performance on a standardized test of concept formation, the Sorting Test of the Delis Kaplan Executive Function Scale (D-KEFS, Delis, Kaplan, & Kramer, 2001). Older adults overall did more poorly in the Concept Matching task, but showed only a non-significant trend toward age differences in the condition with minimal demands on selective attention. In addition, as stimuli complexity increased, older adults' performance was negatively impacted more than younger adults'. Although concept identification was a significant predictor of D-KEFS Sorting Test performance, it had a minimal impact on the age effect; rather, selective attention accounted for a large proportion of older adults' poorer performance on the Sorting Test, reducing the effect of age from 50% to 14%. Older adults' deficits in selective attention account for a large proportion of age differences on the D-KEFS Sorting Test.

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Paper Session 7/8:45-10:15 a.m.

HIV/AIDS

A.M. LLORENTE & P. BROUWERS. Effects of Polymorphisms of Chemokine Receptors CCR2 and CCR5 on Neurodevelopment and the Onset of Encephalopathy in Children with Perinatal HIV-1 Infection.

Infants and children with perinatal human immunodeficiency virus type-1 (HIV-1) infection may exhibit CNS abnormalities. Mutations in chemokine receptors, particularly polymorphisms in CCR2 and CCR5, may play a role in susceptibility to neuropathology, and the ability of HIV-1 to infect CNS monocytes-macrophages, the main cells in the brain that are infected with HIV-1, influencing neurodevelopmental manifestations. This study examined whether selected CCR2 and CCR5 polymorphisms are capable of modulating neurodevelopment and the onset of encephalopathy between birth and age 72 months in HIV-1-infected children. HIV-1 infected children ($n=121$) were categorized into dichotomous groups (heterozygous or homozygous mutant versus homozygous wild type) for each CCR2 and CCR5 allele. Neurodevelopment was assessed with the Bayley Scales of Infant Development (BSID) Mental (MDI) and Motor (PDI) Indexes for children < 30 months of age and the McCarthy Scales of Children's Abilities (MSCA) General Cognitive (GCI) and Perceptual-Performance (P) Indexes for children >30 months of age. A linear spline was used to model the mean value at each visit for the relevant test index. Mixed model ANOVA was used to compare differences between slopes/intercepts according to the presence/absence of the specified polymorphism. Survival analysis was employed to compare the onset of encephalopathy by chemokine receptor allelic grouping. After adjusting for confounds, statistically significant differences emerged in CCR5-39353, -39356, and -39402. Children

with mutant CCR5 genotypes exhibited better neurodevelopment than children with the wild type alleles, although in some instances, these results may be transient. Polymorphisms did not impact the onset of encephalopathy. Although possibly a transient effect, children with mutant chemokine receptor polymorphisms CCR5-39353, -39356, and -39402 appear to have better neurodevelopmental outcome than children with the wild type allele.

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T.D. PARSONS, R.J. ELLIS, S. EVANS, J. MCARTHUR, Y. YANG, K.R. ROBERTSON & ACTG A5001 TEAM, NARC 007 TEAM. Prevalence and Incidence of Neurocognitive Impairment in users of HAART.

Since the introduction of highly active antiretroviral therapy (HAART), studies of HIV-positive patients have shown improved HIV suppression, decreased incidence rates of HIV-associated neurological disease and central nervous system opportunistic infections, and increased survival. However, with prolonged medication exposure, these patients may have increased risk of neuropathy and HIV encephalopathy. The extent to which HAART leads to a reduction in incidence and prevalence of HIV related cognitive decline remains unclear. The aim of this study was to evaluate whether HAART-induced virologic suppression is associated with incident and prevalent neurocognitive impairment. One thousand, five hundred and six subjects were evaluated. A brief neuropsychological (NP) battery and a short distal-polyneuropathy (DSPN) questionnaire comprised the neurological component in ACTG A5001. Viral suppression was not found to be associated with prevalent neurocognitive impairment. However viral suppression was associated with incident neurocognitive impairment. For each of these syndromes, a subject with a detectable viral load had an increased risk relative to a subject with undetectable virus. In addition, results from multivariable analyses also suggested that: (1) non-white race, CD4 less than 300, and higher education are associated with prevalent neurocognitive impairment; and (2) non-white race, higher education, and being ART naive are associated with incident neurocognitive impairment. HAART-induced virologic suppression is associated with incident, but not prevalent neurocognitive impairment. However, prevalent neurocognitive impairment does appear to be associated with non-white race, CD4 less than 300, and higher education. Additionally, incident neurocognitive impairment appears to be associated with non-white race, higher education, and being ART naive.

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H. NIXON, B. BUICAN, N. RAINS, D. PITRAK, G. NUNNALLY & E. MARTIN. Prospective Memory and Risk Behavior in HIV-Infected Drug Users: A Preliminary Report.

1) To evaluate the integrity of prospective memory (PM), or "remembering to remember," among HIV+ and HIV- drug abusers; 2) to examine the relationship between two types of PM with level of self-reported risk behavior. PM is considered an executive memory process mediated primarily through prefrontal-subcortical circuitry and has been implicated in models of treatment adherence and risk behavior. 30 HIV+ and 31 HIV-polydrug users matched on demographic and substance abuse variables completed measures of event-driven PM, which employs environmentally-cued retrieval of an intention for future action; and time-driven PM, requiring internally (subject) generated retrieval cues and with greater processing demands. Subjects also completed a standardized measure of self-reported HIV risk behavior. HIV+ subjects made significantly more errors on the time-driven PM task compared to controls, $p < .05$, but groups did not differ significantly in performance on the event-driven task. Additionally, scores on the time-driven PM task correlated significantly and

inversely with subjects' self reports of risk behavior, $p < .05$ HIV+ drug users showed demonstrable deficits compared with HIV- controls when required to form and maintain actively an intention for a future action, but performed comparably to controls when provided with reminder cues. Consistent with recent speculation, PM deficits were associated significantly with increased risk behavior. These findings are relevant to HIV and hepatitis C prevention among drug users and suggest that cognitive interventions to enhance PM function might be a useful adjunct to prevention programs. Supported by the National Institute on Drug Abuse

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E. MARTIN, J. O'NEILL, L. SWOROWSKI, S. GRBESIC, M. FENDRICH & D. MCKIRNAN. Working Memory Performance in HIV-Seropositive MDMA Users.

To evaluate the association between working memory (WM), HIV serostatus and MDMA (Ecstasy) use in a sample of self-identified men who have sex with men (MSMs). Both MDMA use and a positive HIV serostatus are associated with a higher prevalence of neurocognitive deficits but few studies have evaluated their possible combined effects. We tested 263 MSMs with a history of MDMA use, drug abuse but no MDMA use or no drug abuse using the Letter Number Span Task and the Delayed Non Match to Sample Task. Subjects completed the SCID-R Substance Abuse Module and an index of drug abuse severity was derived to control for the nonspecific effects of drug abuse on neurocognition, because MDMA users typically abuse multiple drugs. HIV+ subjects showed significant deficits on both WM measures compared to controls, but there were no significant overall main effects or interactions with MDMA history. However, when scores were compared according to the number of risk factors for each subject (none, HIV+ or MDMA+, MDMA+ and HIV+) WM performance declined significantly as the number of risk factors increased, $p < .01$. In this sample HIV serostatus but not MDMA use was associated systematically with cognitive impairment. However, WM impairment was most prominent among HIV+ users of MDMA compared with subjects with 0 or 1 risk factors. Findings suggest that MDMA and HIV exert additive effects on neurocognition. Future studies with more detailed analyses of MDMA use characteristics are needed. Supported by the National Institute on Drug Abuse.

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Paper Session 8/8:45–10:15 a.m.

Epilepsy

G.P. LEE, C.L. CLASON, M. WESTERVELD, L.B. BLACKBURN, Y.D. PARK & D.W. LORING. Level of Preoperative Ability Predicts Postoperative Memory Decline in Pediatric Epilepsy Surgery Patients.

Investigations in adult epilepsy surgery patients have consistently shown that patients with higher preoperative memory functioning are at greater risk for memory decline after surgery than patients who have lower preoperative memory levels. The current study was to determine whether these results were also accurate for children who undergo surgery for intractable seizures. Pre- and post-operative memory test data was collected on 81 children between the ages of 8 and 16 years from three comprehensive epilepsy surgery centers. Mean seizure duration was 8.52

years. The majority of children had complex partial seizures. Mean WISC FSIQ was 87.68. All children underwent focal resective surgery in either the left (N=46) or right (N=35) hemisphere. 57 children (70%) underwent anterior temporal lobectomy while 24 had extra-temporal lobe resections. Verbal memory was assessed using CMS-Stories, WRAML-Story Memory, CVLT-C, or CAVLT. Visuospatial memory was measured with Rey CFT or WRAML-Design Memory. Children with preoperative verbal memory standard scores > 90 showed the greatest postoperative memory score declines (passages [$p = .01$] and word list [$p = .0001$]) compared to children with preoperative scores in the 80 to 89 range or < 79 , who both improved after surgery. Although the identical pattern was obtained with visuospatial memory tests, results were less robust. Side of surgery was less important than level of preoperative performance in predicting decline. Children with average or above average memory skills have a greatest risk for memory decline following focal epilepsy surgery than children with below average memory.

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J. FARGO & B.K. SCHEFFT. Clinical Neuropsychological Versus Statistical Prediction of Seizure Organicity.

Over the past 10 years, more than 40% of those individuals referred to a Midwestern U.S. epilepsy monitoring unit for seizure evaluation were diagnosed with psychogenic non-epileptic seizures. However, the relative accuracy of clinical neuropsychological versus statistical methods of classification in correctly diagnosing the nature of the seizures as epileptic or non-epileptic is currently unknown. In the present study a clinical neuropsychologist formulated diagnostic predictions of seizure organicity for 352 individuals based on limited demographic information and the results of a comprehensive neuropsychological assessment. The clinician was blinded to the patient's confirmed seizure diagnosis and medical history. Accuracy of clinical prediction was determined by comparing the neurologically confirmed seizure diagnosis to the diagnostic classifications made by the neuropsychologist. Accuracy of statistical prediction of seizure organicity was obtained from the results of a linear discriminant function analysis using the same data available to the clinician. The hit rate was 84% for clinical neuropsychological prediction and 71% for statistical prediction of seizure organicity. For clinical methods, positive predictive value (PPV) reached 92% for both epileptic and non-epileptic seizures. For statistical methods, PPV was 72% for epileptic and 69% for non-epileptic seizures. Predictive accuracy was better than chance for both clinical (38%) and statistical (24%) methods. Results highlight the utility of clinical neuropsychological methods in the differential diagnosis of seizure organicity. Future research should explore use of alternative statistical methodologies in the classification of seizure organicity.

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T.T. LINEWEAVER, R.I. NAUGLE, H.H. MORRIS, I.M. NAJM & B. DIEHL. "Wada" Small Difference the Wada Test Makes in Predicting Memory Outcome Following Anterior Temporal Lobectomy.

This study compared the relative contributions made by baseline scores on the Wechsler Memory Scale-Third Edition (WMS-III), MRI-based hippocampal volumetric analysis, and Wada test results to predicting memory outcome following anterior temporal lobectomy. Side of resection, MRI, and pre-surgical memory were expected to be good predictors of outcome, with Wada test results failing to improve prediction above and beyond these other factors. 87 patients underwent MRI and

the Wada procedure during their standard pre-surgical evaluation. Memory abilities were assessed prior to and after surgery. Changes in memory were measured using standardized regression-based norms. Side of surgery, baseline memory scores, and MRI volumes were entered into logistic regression analyses in Block 1. Wada test results were added in Block 2 to determine whether they improved the prediction of outcome. Block 1 variables significantly predicted memory outcome for the four primary WMS-III Memory Indices. Adding Wada test results into the analysis did not significantly improve the prediction of outcome for three memory variables. For Visual Delayed Memory, adding Wada results into the prediction equation did significantly improve the correct classification rate from 78% to 81%. Wada test results did not typically emerge as significant predictors of memory outcome once baseline memory and results from MRI volumetric analysis were taken into account. The only exception was for delayed visual memory where the improvement in prediction accuracy was relatively small. Results call into question the benefits of using Wada test results to predict memory outcome relative to the risks inherent in the procedure. Support:EFA

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D.S. SABSEVITZ, S.J. SWANSON, T.A. HAMMEKE, E.T. POSSING, M.V. SPANAKI, G.L. MORRIS, W.M. MUELLER & J.R. BINDER. Predicting Verbal Memory Outcome Following Left Anterior Temporal Lobectomy Using fMRI.

Left anterior temporal lobectomy (L-ATL) has been associated with decrements in verbal memory. The goal of the present study was to determine whether preoperative functional magnetic resonance imaging (fMRI) could be used to predict verbal memory impairments following L-ATL. Forty-nine consecutive L-ATL patients who underwent preoperative fMRI and pre- and postoperative neuropsychological testing were examined. In the fMRI study, activation during a semantic decision task was compared to a sensorimotor control task. Normative studies have shown that this task contrast produces widespread activation lateralized to the language-dominant hemisphere. A laterality index (LI) was calculated using the normalized left-right difference in number of activated voxels over the entire brain. Analyses showed a significant relationship between verbal memory outcome (post-pre) on the Selective Reminding Test (SRT) and the fMRI LI ($r = -.45$, $p < .005$). That is, greater preoperative activation in the left relative to the right hemisphere was related to greater decline on the SRT. Stepwise regression indicated that the fMRI LI contributed to prediction of verbal memory outcome even after other known risk factors, such as age at seizure onset, preoperative memory performance, and lateralization of Wada memory scores, were entered into the equation. These results suggest that an fMRI language mapping procedure may aid in predicting verbal memory outcome following L-ATL. Language shift to the right hemisphere may indicate greater pathology in the left hemisphere and therefore less risk for verbal memory decline after L-ATL. Correspondence: *D.S. Sabsevitz, Ph.D., Dept. of Neurology/Division of Neuropsychology, Medical College of Wisconsin, MCW Clinic at Froedtert, 9200 W. Wisconsin Ave, Milwaukee, WI 53226. E-mail: dsabsevitz@neuroscience.mcw.edu*

Paper Session 9/8:45–10:15 a.m.

Emotion and Laterality

S. WOOD & M. KISLEY. The Negativity Bias is Eliminated in Older Adults: Age-Related Reduction in Event-Related Brain Potentials Associated with Evaluative Categorization.

Studies of younger adults have found that negative information has a stronger influence than positive information across a wide range of do-

main. At the evaluative categorization stage, Ito, Larsen, Smith, and Cacioppo (1998) reported that extreme negative images produced greater brain activity than equally extreme positive images in younger adults. Older adults have been reported to optimize affect and attend less to negative information. We examined the negativity bias in 20 older versus 20 younger adults at the evaluative characterization stage of processing, roughly 500 ms after presentation of visual stimuli. Our results demonstrated a significant decrease in brain activity to both positive and negative stimuli ($p < .05$) and an elimination of the negativity bias in older adults. The negativity bias has been described as multidetermined (Rozin & Royzman, 2001). Work with older adults may allow for dissociations across mechanisms and may shed light on the mechanisms underlying the negativity bias in younger adults. Our results suggest that the findings from the typical sample used for these types of studies may not generalize across the lifespan.

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J. PENDERGRASS, H. GARAVAN, J. KAUFMAN & R.C. RISINGER. A Comparison of Neural Structures Involved in Emotion and Motor Inhibition.

Initial research investigating neural structures subserving emotion regulation have identified similar prefrontal regions found to underlie response inhibition; however, paralleled processing of affective and motor inhibition has not been examined. The present study examined neural regions underlying response inhibition and hypothesized that affective and motor inhibition would activate similar prefrontal circuits. Fifteen healthy right-handed volunteers performed affective and motor inhibition tasks within one fMRI session. Twenty-one contiguous slices were obtained on a 1.5 T GE scanner using an EPI pulse sequence (TE=40 ms, TR=2000, FOV=24 cm, 64x64, 3.75x3.75x4.4 mm in-plane resolution). For the go/no-go task, volunteers button pressed to a 1 Hz stream of alternating letters except when the alternation order was broken. During the emotion task, symbols surrounding emotional pictures signaled volunteers to inhibit emotion or let emotional responses develop. Images were coregistered, 3D-motion corrected, and spatially normalized. One sample t-tests against the null hypotheses of no effect were performed on a voxel by voxel basis to produce activation maps for both tasks. Clusters of significant voxels of >150 ul were preserved. Comparisons of maps revealed two overlapping regions of activation under both inhibitory conditions: pre-SMA and right DLPFC. In addition, emotional experience and inhibition elicited increased right DLPFC activity; however, inhibition of emotion elicited a significantly greater neural response. The present study extends the neural mapping of seemingly disparate processes and identifies common neural regions underlying affective and motor inhibition. Furthermore, the data suggests that similar processing networks involved in response inhibition exist within the discrete neural circuitry underlying cognition and emotion.

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D. BOWERS, D. GOKCAY, U. SPRINGER, G. GHACIBEH & W. TRIGGS. A Cortico-Motor Hypothesis for Face Expression Asymmetries: Converging Data from TMS and Face Digitizing.

Numerous studies over the past 25 years have found that the left side of the face is more emotionally expressive than the right. The most popular neuropsychological interpretation for this left face asymmetry relates to the role of the right hemisphere in emotion. We propose an alternative hypothesis whereby expression asymmetries occur because the left hemiface receives greater corticomotor input than the

right. This hypothesis is based on a recent study from our lab in which TMS over the motor cortex elicited larger motor evoked responses (MEPs) from the left than right lower face. The focus of the present study was to learn whether TMS-elicited MEP asymmetries correspond to facial movement asymmetries during posed emotions. We evaluated facial expression in 42 healthy Ss who had previously undergone a TMS-MEP study. Ss were asked to pose voluntary facial expressions (fear, anger, disgust, happy) while being videotaped. Computer imaging methods, developed in our lab, were used to digitize and quantify dynamic movement over distinct facial regions of interest. The d.v. was entropy, a computer derived index of facial movement. Entropy over the lower face was analyzed using an Affect (4) X Face Side (R,L) repeated-measures ANOVA. In line with previous findings, movement change was significantly greater over the lower left than right hemiface during posed facial emotions ($F=12.03, p<0.001$). Of critical importance, these facial movement asymmetries (entropy) significantly correlated with the TMS-elicited MEP asymmetries ($r=.51, p<.03$). We found that facial expression asymmetries during posed emotions significantly correlated with TMS-elicited MEP asymmetries. Although correlational, our findings are consistent with the hypothesis that increased cortical influence on the left lower face may contribute to facial movement asymmetries during the expression of emotion. This cortico-motor hypothesis will be discussed in relation to other potential models.

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T. WILLIAM, G. GHACIBEH, U. SPRINGER & D. BOWERS. Lateralized Asymmetry in Motor Control over the Lower Face: A TMS-MEP Study.

In the classic view of motor localization, primary motor cortex is organized along the central sulcus with each hemisphere having predominantly contralateral control over voluntary distal movements of the limbs and lower face. The purpose of this study was learn whether there were hemispheric asymmetries in lateralized control over the two sides of the lower face. We hypothesized that the left side of the face receives greater cortical influence than does the right. To test this hypothesis, we studied $N=42$ normal adults who underwent transcranial magnetic stimulation. TMS was applied over the face area of the left or right motor cortex, and motor evoked potentials (MEPs) were measured from electrodes attached to the left and right orbicularis oris (mouth area). We followed the methods of Wasserman et al. (1994) and Triggs (1999) for eliciting MEPs with cortical stimulation. The MEP data were analyzed using Face (R,L) X Hemisphere Stimulated (R,L) repeated-measures ANOVA. Our findings were significant and robust. In line with the prediction that the left hemiface receives more cortical input, we found that MEPs from the left orbicularis oris were significantly larger than those from the right ($F[1,41]=39.5, p<0.000$). Thirty-eight of 42 Ss showed this pattern. This asymmetry was not due to differences in peripheral innervation of CNVII. To determine the reliability of this phenomenon, we re-tested a subgroup on the TMS protocol. Every re-tested S demonstrated the same pattern, suggesting that this phenomenon is stable and perhaps hardwired. Our TMS-MEP findings empirically document for the first time that the lower left hemiface receives more cortical influence, contralateral and ipsilateral, than does the right hemiface. The basis for this asymmetry in corticomotor excitability is unknown. Our findings possibly relate to the well-documented phenomenon that the left hemiface is more intensely expressive than the right. *Supported by R01MH62539 (DB).*

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Poster Session 7/10:15 a.m.–12:00 p.m.

Dementia: Primary Progressive Aphasia, Frontotemporal Dementia, Vascular Dementia

G.R. FINNEY & K.M. HEILMAN. Artwork Before and After Onset of Primary Progressive Aphasia.

To rate and compare four qualities of art in paintings done before and after onset of primary progressive aphasia (PPA), a variant of frontotemporal lobar degeneration (FTLD). Digital images of seven paintings by the same artist were obtained. Three paintings were done in the six years prior to onset of non-fluent PPA, one was done the year of onset, and three were done in the five years after onset. Seven college-educated raters, five men and two women, with no significant art background rated using a 1-5 point scale four qualities of the paintings: representation, aesthetics, novelty, and closure (completeness). No subject had previously viewed these paintings. One expert in art also rated the paintings on these four qualities. Quality ratings in relation to disease onset did not differ for three of the four qualities. There was a statistically significant difference in the rating of novelty, with less novelty appreciated over time. The art expert found all qualities remained stable, giving novelty a very low rating for all works. Artistic ability did not improve in this trained artist over time. Further, the novelty of her work did not increase, but rather decreased over time. It did not appear that there was any gain in artistic ability in this patient with PPA. Observations of this patient suggest FTLD may not lead to improved artistic skills in those who already possess them and that there can be an actual decrease in one quality strongly related to creativity; the ability to produce novel works.

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M.L. JACOBS, M.E. HAINES & L.M. SHEEHY. An Unusual Presentation of Primary Progressive Aphasia?

To describe PM, a 47-year-old man who is experiencing a progressive dementia with primary deficits in speaking and writing abilities. Primary progressive aphasia is thought to be a progressive dementia, not due to head trauma, in which deficits are seen in speech and language. Mesulam (1982) describes primary progressive aphasia as declines in articulation with no other significant cognitive impairments for at least two years. Comprehension remains relatively intact through the progression of the disease. The individual described in this case began experiencing steady declines in articulation in 2003, without any readily apparent losses in memory, visual spatial skills, or processing speed, though neuropsychological evaluation did reveal deficits in these areas. At the time of the evaluation, PM's speech was very slowed, moderately dysarthric, and notable for word retrieval difficulties. He used head and hand gestures or one word answers whenever possible. Testing revealed mild deficits in visual perceptual abilities, immediate auditory attention, visual recognition, and auditory memory. His performance was profoundly impaired on a writing task, and was notable for dysfluency, poor spelling, poor grammar, and poor construction. He performed in the average range on language tasks of confrontation naming, verbal abstract reasoning, general fund of information, auditory comprehension, but had difficulty with a conceptualization task. Although, PM's initial presentation seemed to be primary progressive aphasia, his deficits appear more global than what is typically seen in PPA. The breadth of his deficits seems to suggest Alzheimers Disease, but again his presentation is not what is typically seen in AD. His neurologist diagnosed PPA.

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T. HUH, M. CORNO-TEMPINI, H.J. ROSEN, K.P. RANKIN, J. KRAMER & B.L. MILLER. Relationship Between Structural Changes on MRI and Naming in SD vs. FTD, AD, and PPA.

Confrontation naming problems are a salient feature in many dementias. The underlying contribution may differ in these disorders. Understanding the contribution of structural brain changes to language performance may help distinguish SD from other neurodegenerative diseases. We compared the relationship between neural structures in different dementias and their contribution to naming ability. We hypothesized different structures would contribute to naming in Semantic (SD) compared to Frontal Temporal (FTD) dementia, Alzheimers Disease (AD), and Primary Progressive Aphasia (PPA). We assessed 25 SD, 24 AD, 40 FTD, and 7 PPA patients. Structural MRI yielded quantitative measures of right and left anterior temporal, right and left frontal and posterior parietal regions. Head sizes were volume-corrected. 15-item Boston Naming Test (BNT-15) was used. Multiple regression determined which MRI variables predicted correct number of words. There were no group differences in age or MMSE; mean age = 62.9; mean MMSE = 22.5. Left anterior temporal lobe only contributed to BNT in SD ($\beta = .630$, $p = .033$; 36.1 % variance explained). For all other dementias, only posterior parietal cortex contributed to BNT performance ($\beta = .284$, $p = .025$), 26.2 % variance explained). The naming deficit in SD is likely related to underlying semantic knowledge impairments and mediated by the anterior temporal lobe. The naming deficit in other dementias may be more related to retrieval deficits associated with parietal atrophy. Thus, while different neurodegenerative disorders may have similar cognitive phenotypes (e.g., impaired naming), the underlying anatomy of these deficits may vary as a function of etiology.

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L. QUITANIA, J. KRAMER, C. WYSS-CORAY, J. MERRILEES & B. MILLER. Which Cognitive Domains Best Predict Daily Functioning in Alzheimer's Disease and Frontotemporal Dementia?

Little is known about how neuropsychological testing relates to daily functioning. The purpose of this study was to investigate which cognitive domains best predict functional impairment in patients with Alzheimer's disease (AD) and Frontotemporal Dementia (FTD). Congruent with the primary clinical symptoms of these disorders, we hypothesized that memory would be the best predictor in AD, and executive functioning would be the best predictor in FTD. Participants were 79 patients with AD and 28 with FTD from the UCSF Memory and Aging Center. Functional capacity was measured with the informant-based Functional Activity Questionnaire (FAQ). Separate multiple regressions predicting FAQ were run for AD and FTD, simultaneously entering variables measuring verbal and spatial episodic memory, executive function, and verbal and design fluency. The model for AD explained 11% of the variance ($p < .05$), with delayed verbal memory being the only significant predictor. The model for FTD was also significant ($p < .05$), with 32% of the variance in FAQ explained. In contrast to AD, however, executive functioning, as measured by a set shifting task, was the only significant predictor. Results indicate that neuropsychological test scores successfully predict daily functioning, but that the relationships between neuropsychological testing and daily functioning are different for different diagnostic groups.

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M. MCKINNON, E. SCHELLENBERG, D. TALMI, G. TURNER, B. MILLER & B. LEVINE. Further evidence of deficits in social reasoning in patients with frontotemporal lobar dementia.

Recent work suggests that patients with frontotemporal lobar dementia (FTLD) exhibit deficits across multiple domains of social reasoning, including theory of mind and recognizing emotions in facial expressions. We sought to extend these findings by examining performance in two related areas of social cognition: (1) recognizing emotions conveyed by music and the musical elements of speech (prosody), and (2) moral reasoning. The participants were 7 patients with FTLD and 10 age- and education-matched control participants. Participants made same-different and 2/4 AFC judgments of the emotional content of music and speech excerpts. The moral reasoning tasks were the *Social Reflection Questionnaire* (Gibbs, Basinger, & Fuller, 1992) and an experimental measure of moral reasoning supplied by Greene and his colleagues (Greene et al., 2001). Relative to control participants, FTLD patients were impaired at decoding the emotions conveyed by speech prosody, and, to a lesser extent, by music. Similarly, when FTLD patients were tested on two different measures of moral reasoning, performance deficits emerged. Relative to control participants, FTLD patients demonstrated a concrete style of moral reasoning involving the reiteration of simple rules and social conventions. Patterns of regional brain atrophy correlated with performance across tasks. These results provide further evidence of deficits in social reasoning in FTLD. Moreover, the underlying processes involved in social reasoning appear to extend across domains (vision, audition, morality).

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R. SPRENG, H. ROSEN, T. CHOW, S. MORELLI, M. FREEDMAN, S. BLACK, B. MILLER & B. LEVINE. Career Selection in Frontotemporal Lobar Degeneration: Relationship to Localization of Atrophy.

To investigate the relationship between location of cortical degeneration and career choice in patients with frontotemporal lobar degeneration (FTLD). 150 patients diagnosed with FTLD according to standard criteria from four North American clinics were included in this chart review study. Occupations were coded according to the Occupational Information Network (ONET). A factor analysis of the ONET data from our sample revealed visuospatial/nonverbal and verbal/social factors. Brain images were acquired by SPECT, PET, or MRI. Images were coded in a binary fashion according to the area of greatest degeneration (left frontal, left temporal, right frontal, right temporal), under the assumption that neurodegeneration occurred in this region before others. When available, quantitative data from brain image analysis were also analyzed. Significant relationships between occupational selection as defined by ONET factor scores and location of atrophy were noted in males with unilateral temporal lobe degeneration. Right degeneration was associated with visuospatial/nonverbal professions and left degeneration was associated with verbal/social professions. This pattern was reversed in left-handed males. We also found evidence for elevated incidence of male gender and left-handedness in FTLD. The results indicate a relationship between temporal lobe degeneration and career choice in males with FTLD. These preliminary data suggest that either incipient neuronal changes bias career choice decades before the onset of FTLD, or that oxidative stress due to neuronal processing associated with certain careers may influence the location of the onset of neurodegeneration in males prone to FTLD.

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M.B. SPITZNAGEL, G. TREMONT, R.O. TEMPLE, L.B. BROWN, J.J. GUNSTAD, H.J. WESTERVELT & D.D. JENNIFER. Cognitive Reserve Moderates the Relationship Between Depression and Awareness of Deficits in Dementia.

Research links impaired awareness in dementia to depressive symptoms; however, this relationship is not consistently replicated. Recent work shows better awareness of deficits in dementia is related to higher cognitive reserve. The relative contributions of cognitive reserve and depression to awareness have not yet been simultaneously examined. The current study investigated the role of depressive symptoms and cognitive reserve in awareness in questionable and mild stages of dementia. Sixty-seven individuals diagnosed with questionable or mild dementia participated. Dementia severity was measured using the 3MS, awareness by average item discrepancy scores (i.e., family minus patient ratings) on the Cognitive Difficulties Scale, cognitive reserve by Wide Range Achievement Test reading performance, and depressive symptoms by the Beck Depression Inventory-II. Regression analyses demonstrated cognitive reserve ($\Delta R^2=.08$, $p<.05$) and the cognitive reserve/depression interaction ($\Delta R^2=.09$, $p<.05$), accounted for significant proportions of the variance in awareness, above and beyond the contribution of dementia severity. In contrast, depression alone did not significantly contribute to awareness. The sample was then divided into high and low cognitive reserve groups. Bivariate correlations between awareness and depression differed significantly between high ($r=0.34$) versus low ($r=-0.35$) cognitive reserve groups ($p<.01$). These findings suggest cognitive reserve moderates the relationship between depression and awareness of deficits in dementia, such that depression and awareness are positively related in high cognitive reserve individuals, but negatively related in low cognitive reserve. This effect may offer an explanation for inconsistent findings in previous research. Correspondence: Mary B. Spitznagel, PhD, Neuropsychology, Brown Medical School, 593 Eddy Street, Physician's Office Building Suite 430, Providence, RI 02903. E-mail: Mary_Beth_Spitznagel@Brown.edu

E. OH, Y. KANG, E. CHANG, A. PARK, J. PARK, K. YU & B. LEE. The Relationship between Depression and Cognitive Functions in Vascular Dementia.

Depression and dementia are the most frequently occurring psychiatric and neurological syndromes in elderly populations. The two disorders often coexist. Depression has been regarded as a cause of cognitive dysfunctions, especially memory problem and frontal executive dysfunction. Although patients with vascular dementia (VaD) often have depressive disorders (Sultzer et al., 1993), our understanding of the relationship between depression and cognitive symptoms in VaD is very limited. The present study was conducted to examine how depression is correlated with cognitive impairments in VaD. A comprehensive neuropsychological examination was administered to 132 vascular dementia patients (mean age 71.98 ± 7.40 years, mean education 6.54 ± 5.33 years). The level of depression was assessed by the Geriatric Depression Scale (GDS). The total subjects were divided into 3 subgroups based on the CDR score; very mild (0.5), mild (1.0), and moderately (2.0+) demented groups. Three subgroups did differ in education and sex ratio, but not in age and the GDS score. The total subjects showed significant correlations between the GDS score and the measures of attention, confrontational naming, verbal/visual memory, and frontal executive functions. Examining three subgroups separately, the same results were found in the "very mild" VaD after controlling the educational level and sex ratio as covariates. In the "mild" VaD, however, the GDS score was significantly correlated with only visual memory and the explained variance of depression for the cognitive functions was remarkably reduced than that in the "very mild" VaD. There was no significant correlation between the GDS score and the cognitive measures in the "moderate" VaD. The result showed that the influence of depression on cognitive functions in VaD differs according to the severity of dementia. It suggests that the less the severity of dementia is, the stronger the influence of depression on cognitive functions is.

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S. MOELTER, A.L. JEFFERSON, B. FLOYD, G. GUILA & M. GROSSMAN. Dissociation of Semantic and Phonemic Fluency in Dementia.

We compared performances on semantic and phonemic fluency tests across five neurodegenerative conditions. We tested the hypothesis that distinct fluency performance profiles are associated with dementia. Semantic (animal) and phonemic (FAS) fluency was compared in participants diagnosed with Alzheimer's disease (AD, $n=28$), corticobasal degeneration (CBD, $n=14$), and three variants of frontotemporal dementia: semantic (SD, $n=12$), nonfluent (PNFA, $n=16$), and non-aphasic (NAPH, $n=8$). Correct output was converted to z scores based on matched control subjects and analyses were conducted on the transformed data. Repeated measures ANOVA revealed a significant main effect of task, $p<0.001$, with semantic fluency more impaired than phonemic and a group by task interaction, $p<0.005$. Significant group differences on phonemic fluency were observed; the PNFA group showed greater relative phonemic impairment than the AD or SD groups ($p<.05$) and the NAPH and CBD groups ($p<0.10$). Analyses of the percentage of impaired performances (i.e., $z \leq 1.95$) showed that the AD and SD groups were characterized by more impaired performance on semantic than phonemic fluency. The PNFA group was associated with equally impaired performance on phonemic and semantic fluency, suggesting dysfunction of general lexical retrieval and a phonologically based retrieval process. In contrast, the AD and SD groups showed less impairment on phonemic than semantic fluency, perhaps due to dysfunction of a semantically guided retrieval mechanism that is distinct from the general or phonologically guided process.

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H. WESTERVELT, G. TREMONT, M.B. SPITZNAGEL, J.M. HOWARD & R.A. STERN. Differential Odor Identification Performance in Dementia Subtypes.

Odor identification deficits are common in neurodegenerative disorders, especially in diseases known to potentially cause dementia. The degree of impairment is not uniform across dementia subtypes; however, few studies to date have investigated the ability of odor identification tasks to distinguish various forms of dementia. The current study examined performance of different dementia subtypes on odor identification. The Brief Smell Identification Test (BSIT), a 12-item, multiple choice, odor identification task, was administered to dementia patients ($n=143$) and elderly healthy controls ($n=25$). Diagnostic subtypes included were: 1) Alzheimer's disease (AD; $n=73$), 2) vascular dementia (VaD; $n=14$); 3) mixed AD and VaD ($n=24$); 4) possible diffuse Lewy body dementia (DLBD; $n=18$); and probable DLBD ($n=14$). For the initial analyses, groups 2 and 3 were combined, as were groups 4 and 5. All combined dementia groups performed worse than controls. The combined DLBD group performed worse than the other groups. There was no significant difference between AD and VaD/mixed groups. When the five dementia groups were analyzed separately, only VaD (64% accurate BSIT performance) did NOT differ statistically from controls (82% accurate). Probable DLBD (31% accurate) was worse than all other groups, except possible DLBD (47% accurate). There were no other significant group differences. Odor identification is significantly poorer in DLBD than healthy controls and other dementia subtypes. This finding is consistent with recent research suggesting that anosmia in dementia is more closely related to Lewy body than Alzheimer's pathology, and may be clinically useful in distinguishing DLBD from other forms of dementia.

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O. KLANG, S. ROLSTAD, A. NORDLUND & A. WALLIN. Different Profiles on Rey Auditory Verbal Learning Test (RAVLT) Indicate Different Profiles of General Cognitive Impairment in a Mild Cognitive Impairment (MCI) Population.

MCI subjects display different profiles on RAVLT. Can these different profiles be associated with different neuropsychological profiles in general? The objective of this study was to investigate whether any group differences regarding neuropsychological profiles could be seen between subjects with low learning ability (MCI-A), with low results on delayed recall (MCI-B) and no memory impairment (MCI-C). Hundred-and-twenty-five consecutive subjects, MCI-A (N=25), MCI-B (N=42) and MCI-C (N=58), were included in the study and assessed with tests of episodic memory, speed/attention, visuospatial function, language and executive function. The three groups did not differ regarding age or education. The analysis showed that MCI-A performed significantly worse on tests of speed/attention and executive function as compared to MCI-C. Compared to MCI-B, MCI-A performed significantly better on tests of visuospatial function and language. On further analysis, a greater proportion of MCI-A had clinical and/or brain imaging signs of significant cerebrovascular disease. MCI-A, MCI-B and MCI-C constitute three distinct groups, exhibiting differences in neuropsychological result profiles. Clinically MCI-A show a greater proportion of vascular disease. The differences seen between the groups are in agreement with most reports on the neuropsychological differences between vascular dementia (VaD) and Alzheimer's Disease (AD). These findings call for further investigation into whether a specific profile on a memory test could be an indicator when identifying VaD and AD at their preliminary stages. Correspondence: *Ola Klang, MA, Institute of clinical neuroscience, Sahlgrenska Academy, S-413 45, SE-413 45, Sweden. E-mail: ola.klang@vggregion.se*

D.A. CARONE, R. ZIVADINOV, B. SINGH, J.L. AMBRUS & R. BENEDICT. Severe Bilateral Temporal Lobe Atrophy and Amnesia in a Case of Lymphomatoid Granulomatosis Confined to the Brain.

Lymphomatoid granulomatosis (LG) is a rare disease characterized by lymphocytic infiltration of vessel walls, angitis, and widespread lesion formation. Although often a multisystem disease, some cases are confined to the brain. In such cases, little is known about the course of neuropathological and cognitive changes. We report the first detailed neuropsychological (NP) and serial quantitative magnetic resonance imaging (MRI) findings from a patient (JT) with LG confined to the brain. JT, a 29-year-old woman, underwent NP testing two years after symptomatic onset. Quantitative MRI measures were assessed five times over two years and included lateral and third ventricle volume, bicaudate ratio, lesion volume, and brain parenchymal fraction. Serial ordinal scale atrophy ratings, using a previously validated scale, were also obtained. JT presented with modest lesion volume and normal brain parenchymal volume. Subsequent imaging showed dramatic increases in lesion volume followed by severe progression of brain atrophy, most prominent in the bilateral mesial temporal lobes. NP testing revealed marked amnesia, spared executive functioning, and mild impairment in other cognitive domains. To our knowledge, this is the first reported case of LG in which severe bilateral temporal lobe atrophy is evident and accompanied by anterograde amnesia. Progression of lesion burden was rapid and followed by brain atrophy, suggesting a causal link between angiodestruction and neurodegeneration. Some aspects of higher intellectual functioning were spared, perhaps due to relative preservation of the prefrontal cortex. We speculate that temporal lobe atrophy was influenced by the established susceptibility of this region in various neurological diseases.

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Developmental Disorders

P.E. DIXON, J. PANDEY, J. KLEINMAN, E. ESSER, L. WILSON, H. BOORSTEIN, M. BARTON, S. HODGSON, T. DUMONT-MATHIEU, J. GREEN, K. CHAWARSKA, F. VOLKMAR, A. KLIN & D. FEIN. Presence of DSM-IV Criteria in Two-year olds with ASD.

Toddlers with Autistic Spectrum Disorder (ASD) present differently than older children with ASD, and some of the DSM-IV criteria for Autistic Disorder may not be applicable to very young children. For example, young children with ASD may not display repetitive behaviors and restricted interests, impaired conversational ability, stereotyped language, or adherence to routines (Lord, et al., 1993; Cox, et al., 1999; Stone, et al., 1999; Rogers, 2001; Charman & Baird, 2002). The purpose of the current study is to investigate which of the DSM-IV criteria for Autistic Disorder are applicable to toddlers. Seventy-one toddlers with ASD participated in the study. All of the children failed the Modified Checklist for Autism in Toddlers (M-CHAT) and received a developmental/diagnostic evaluation at the University of Connecticut or Yale University Child Study Center. Mean age at evaluation was 27 months, ranging from 18 to 31 months. The mean number of criteria endorsed by the evaluating clinician in the social, communication, and repetitive behaviors domains (out of 4 possible in each domain) were 2.81, 1.69, and 1.46, respectively. A majority of these 2-yr-olds with ASD did NOT display impaired conversation (97.2%), stereotyped language (87.3%), restricted interests (74.6%), adherence to routines (84.5%), or preoccupation with parts of objects (62.0%). However, more than 50% displayed symptoms relating to non-verbal communication, peer relationships, joint attention, delayed language, pretend play, and stereotyped or repetitive motor mannerisms. Frequency tables will be presented for each individual criterion. Many of the DSM-IV criteria for Autistic Disorder may not be applicable to toddlers, especially the ones from the repetitive behaviors and restricted interest domain, suggesting that separate diagnostic criteria may be needed for very young children.

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D. DEWEY & S.G. CRAWFORD. Motor and Praxis Skills in Children with Autism Spectrum Disorder: A Comparison with Developmental Coordination Disorder.

To examine the motor and praxis skills of children with autism spectrum disorder (ASD) compared to children with developmental coordination disorder (DCD). Participants included 49 children with ASD (43 males and 6 females; mean age = 10.2 years, sd = 3.4), 21 children with DCD only (12 males and 9 females; mean age = 11.1 years, sd = 1.6), and 38 children with DCD+ADHD (26 males and 12 females; mean age = 11.3 years, sd = 1.7), and 78 nonDCD children (59 males and 19 females; mean age = 11.3 years, sd = 2.4). All children were given the Bruininks Oseretsky Test of Motor Performance Short Form (BOTMP-SF), and a praxis battery including transitive and intransitive gestures performed to command and imitation. The children with ASD, DCD only and DCD+ADHD scored significantly lower than the nonDCD children on the BOTMP-SF. Results showed that the ASD group scored significantly lower than the other three groups on both transitive and intransitive gestures to command. Significant differences also emerged for transitive and intransitive gestures to imitation, with the ASD group scoring significantly lower than the three other groups. On transitive gestures to imitation, the DCD+ADHD group scored significantly lower than the nonDCD group, whereas on intransitive ges-

tures to imitation, the DCD+ADHD group scored significantly lower than the DCD only group. The children with ASD and the children with DCD showed deficits in motor coordination relative to the nonDCD controls. On the tests of praxis, however, the children with DCD only did not display any significant difficulties. This suggests that the deficits in gestural performance displayed by the children with ASD and DCD+ADHD are not attributable to a problem in motor coordination.

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M.C. GIBBS, P. LEE, L. GILOTTY, G. WALLACE, D. BLACK, A. NYE & L. KENWORTHY. Toward a Neuropsychological Explanation of Repetitive Behavior in Children with Autism Spectrum Disorders.

This study investigated the relationship between repetitive and stereotyped patterns of behavior in persons with Autism Spectrum Disorders (ASD) and neuropsychological measures of cognitive flexibility and generativity. A clinically referred group of high functioning children with Autism, Pervasive Developmental Disorder-Not Otherwise Specified, and Aspergers Disorder ($n=35$) were administered the Social Communication Questionnaire (SCQ) and a neuropsychological test battery. The Behavior Rating Inventory of Executive Function (BRIEF) Shift Scale was used as a measure of cognitive flexibility and the Contingency Naming Test and NEPSY Verbal Fluency were used as measures of generativity. Multiple regression analysis indicated that the combination of neuropsychological indices of cognitive flexibility and generativity was predictive of ratings on the SCQ Repetitive Behavior scale ($R^2 = .59$, $p < .05$). These findings support a link between the neuropsychological concepts of cognitive flexibility and generativity and the repetitive and stereotyped behavior that is characteristic of persons with ASD. A better understanding of the underpinnings of these behaviors may help in the development of novel and more efficacious interventions.

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A. HILLIER, H. CAMPBELL, N. PHILLIPS, K. RENNER & D.Q. BEVERSDORF. Autism Spectrum and Susceptibility to the Visual False Memory Effect.

When encountering a series of semantically and associatively related words, participants develop illusory recognition of a critical lure, a word not on the list but closely related to those which are, referred to as false memory. Those with autism spectrum disorders (ASD) have been found to be less susceptible to the false memory effect, possibly due to restricted semantic networks. This study investigated whether the false memory effect could be replicated with visually presented material with minimal semantic representation. Fourteen participants with ASD and fourteen matched controls were shown slides of geometric figures. Twenty four sets of twelve slides were presented, each depicting different sets of geometric shapes which varied in number, size, position, shape, and color. Within each set the design of the critical lure was closely related to each of the presented slides but was not presented. Following the twelve slides in each set recognition was tested with five test slides, two of which had been shown in the set, two had not, and one was the critical lure. Results were similar to those demonstrated with the verbal paradigm with those on the autism spectrum evidencing less susceptibility to the critical lures than those in the comparison group ($t = 2.81$, $p < 0.01$). Results did not differ between groups for true recognition of previously presented slides and rejection of slides not presented. These results provide further evidence of restricted networks among those with ASD, even with visual stimuli with minimal semantic representation.

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J. PANDEY, K. TOTH, J. KLEINMAN, P. DIXON, M. BARTON, S. HODGSON, E. ESSER, H. BOORSTEIN, L. WILSON, J. GREEN, G. DAWSON & D. FEIN. Detecting Autism Spectrum Disorders in Young Siblings of ASD Children .

Early diagnosis of Autism Spectrum Disorders (ASD) is crucial for optimal prognosis. The current study used the Modified Checklist for Autism in Toddlers (M-CHAT) to screen younger siblings of children previously diagnosed with an ASD. Siblings of children diagnosed with ASD are considered to be at relatively high risk for ASD. Of the families recruited, some families were asked to fill out the screener for their younger child when the ASD child was brought for clinical evaluation or research participation. Others were contacted through autism organizations or because their ASD child had been previously evaluated or participated in research. 85 MCHAT screeners were collected for the sibling cohort, who ranged from 16 to 30 months, with a mean age of 23 months. Failure on the screener is defined as any three of twenty-three total items failed or any two of six critical items failed. Fifty-six siblings passed the MCHAT and 29 failed the MCHAT; thus, the fail rate was approximately 34%. This rate is probably higher than would be found in a population screening of younger siblings because screeners were collected from many parents who were already concerned about their younger child and from families with more severely affected older children. 28 of the 29 children who failed the MCHAT received a developmental evaluation at a mean age of 25 months. Subjects were evaluated with developmental and diagnostic instruments, including the ADOS, ADI-R, CARS, clinical judgment based on DSM-IV criteria, Mullen and Vineland. Twenty-one siblings were diagnosed with ASD, 3 siblings were diagnosed with a language delay, and four siblings were determined to be typically developing. These diagnoses suggest a screener hit rate of 75% and false positive rate of 25% for this sample. Thus, the M-CHAT appears to be an effective screener for ASD in this high-risk sample of children. Specific screening items failed by siblings will be compared to items failed by non-sibling ASD children.

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E. ESSER, H.C. BOORSTEIN, P.E. DIXON, J.M. KLEINMAN, J. PANDEY, L.B. WILSON, M. BARTON, T.M. DUMONT-MATHIEU, J.A. GREEN, S. HODGSON, G.A. MARSHIA & D.A. FEIN. Predictors of Diagnosis in Four-year-olds with Symptoms of Autism Spectrum Disorders.

Early predictors of later diagnosis in children with symptoms of autism spectrum disorders (ASD) are important in determining prognosis. The purpose of the current study was to determine if IQ, adaptive functioning, and number of failed critical items on the Modified Checklist for Autism in Toddlers (M-CHAT: Robins, Fein, Barton, & Green, 2001) as a measure of severity at age two can predict diagnosis at age four. Forty-five children were evaluated at age two after failing the M-CHAT and were re-evaluated at age four. Instruments included the Vineland Adaptive Behavior Scales, and the Bayley Scales of Infant Development or the Mullen Scales of Early Learning. A discriminant function analysis was conducted to determine whether the three predictors at age two can predict a diagnosis of either ASD or non-autism (typical development, language delay, motor delay, and global delay). The overall Wilks' Lambda was significant, $\lambda = .576$, $\chi^2(3, N = 48) = 22.87$, $p < .01$, which indicates that the predictors differentiate between the two diagnostic groups. A table summarizing the within-group correlations between the predictors and the discriminant function, as well as the standardized weights, will be presented. Adaptive functioning has the strongest correlation with the discriminant function,

with the non-autism group showing higher scores. Of the total 45 cases, the three predictors, together, correctly classified 89% of the cases. One limitation of this study is the floor effect of scores on the cognitive predictor variable. The results of this study suggest that adaptive functioning is the most salient predictor of later diagnosis in children who present with symptoms of autism spectrum disorders early in development.

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H.C. BOORSTEIN, E.L. ESSER, P.E. DIXON, J.M. KLEINMAN, J. PANDEY, L.B. WILSON, M. BARTON, T. DUMONT-MATHIEU, J.A. GREEN, S. HODGSON, G.A. MARSHIA & D.A. FEIN. Predictors of Cognitive Functioning in Children with Autism Spectrum Disorders.

Cognitive functioning is one of the most important factors in the prognosis of children with autism spectrum disorder (ASD) as higher cognitive ability is associated with better outcome. Participants were part of a larger study that used the Modified Checklist for Autism (M-CHAT; Robins, Fein, Barton, & Green, 2001) to screen children at age 2. Children who failed the M-CHAT were evaluated at age 2 and at age 4. The 33 participants were diagnosed with ASD at their 2-year-old evaluation. A multiple regression analysis was conducted to determine which variables at age 2-cognitive functioning, adaptive functioning, and number of failed critical items on the M-CHAT-best predicted cognitive functioning at age 4. Cognitive functioning at age 2 was measured by the Bayley Scales of Infant Development or the Mullen Scales of Early Learning, while cognitive functioning at age 4 was measured by the Mullen or by the Differential Ability Scales. Adaptive functioning, as measured by the Vineland Adaptive Behavior Scales, was the only significant predictor of cognitive functioning at age 4 ($R^2=.306$, $F(3, 22)=3.238$, $p<.05$, $t(25)=2.786$, $p<.02$). Scores on the cognitive battery at age 2 yielded little predictive value, $t(25)=1.422$, n.s. This suggests that, for young children with developmental disorders, scores on measures of cognitive functioning can be inconstant and affected by various factors, including educational and behavioral interventions. Treatment effects may be less on adaptive functioning. Further research is necessary to elucidate other predictors of cognitive functioning.

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S.L. PROVENCAL, M.A. FEARING, J.L. JOHNSON, S. MORTENSEN, C. HEIDELBERGER, E.D. BIGLER, W. MCMAHON & J.E. LAINHART. Basal Ganglia Morphometry in Autism With and Without Attention Deficit/Hyperactivity Disorder.

The basal ganglia (BG) have been implicated in disorders with symptoms of poor cognitive control and repetitive behaviors such as Tourette syndrome and attention deficit/hyperactivity disorder (ADHD). Some speculation has been made implicating an association of BG abnormalities with autism; however, not all neuroimaging studies have demonstrated the presence of volumetric differences. Most neuroimaging studies of autism have not considered the co-occurrence of ADHD and the overlap in disorder-related differences in brain morphometry in these disorders. Three groups of children and young adults (age range = 7-25 years) participated in the study: autism with comorbid ADHD ($N=14$), autism without a history of ADHD ($N=24$), and typically developing controls ($N=24$). Autistic participants met ADI-R and ADOS criteria for autism and demonstrated average non-verbal ability skills. Scores from several parent-report measures (Conners, K-SADS) determined the presence of comorbid ADHD. MRI scans were obtained on a 1.5 Tesla scanner and analyzed by two independent raters following an established protocol. Measured volumes included total BG volume, caudate, putamen, and globus pallidus. After controlling for age, nonverbal IQ, and total intracranial volume, results suggested no statistically significant differences between the three groups regarding total BG

volume or component volumes. Pearson correlations found no significant correlations between the ADI Repetitive Behaviors score and total BG, caudate, putamen, or globus pallidus volume for individuals with autism. In summary, findings are consistent with past literature reporting no differences in basal ganglia volume in autism, even after controlling for comorbid ADHD. Also, gross structural volume of the BG was not related to the clinical presentation of repetitive behaviors observed in autism. Funded by NICHD 5 U19 HD035476-07, the NICHD Collaborative Programs of Excellence in Autism, and the Ira B. Fulton Foundation.

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M. MILLER, E.D. BIGLER, S. NEELEY, S.L. PROVENCAL, W. MCMAHON & J.E. LAINHART. Frontal Lobe Development in Autism Relative to Head Size.

The prevalence of macrocephaly is significantly greater in individuals with autism. In this study, frontal lobe volume was examined in macrocephalic autistic, normocephalic autistic, typically developing, and benign macrocephalic subjects. The major research question was whether macrocephalic autistic subjects had frontal volumes disproportionate to brain size when compared to normocephalic autistic subjects. Also, this investigation examined whether subjects with autism exhibit any distinct frontal lobe size differences compared to typical developing individuals. Male subjects, ages 7-31 years, were assigned to 4 groups according to head circumference and diagnosis: normocephalic autism ($N=28$), macrocephalic autism ($N=13$), normocephalic comparison ($N=22$), and macrocephalic comparison ($N=8$). Magnetic resonance imaging at 1.5 Tesla was the basis for quantitative neuroimaging analysis that determined frontal gray and white matter volumes for each frontal lobe as well as total frontal volumes for each tissue type. There were no differences between the four groups on gray, white, or total frontal volumes after controlling for age, intelligence, and head-size measures including head circumference, total brain volume (TBV) and intracranial volume. The relationships between age and frontal gray/white matter were similar for macrocephalic and normocephalic subjects. When normocephalic and macrocephalic subjects were combined, there were no volumetric differences between autistic and control subjects on any frontal lobe measure. Frontal volumes of total white or gray matter in childhood and adulthood in autism do not show evidence of selective overgrowth. This could result from growth of frontal lobe in proportion to TBV throughout development, selective early overgrowth followed by normalization, or different patterns of growth and regression within frontal subregions which cancel out overall volumetric differences. Funded by NICHD 5 U19 HD035476-07, the NICHD Collaborative Programs of Excellence in Autism, and the Ira B. Fulton Foundation.

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L. KENWORTHY, D.O. BLACK, P. LEE, G.L. WALLACE, L. GILOTTY & C. GIBBS. Why are tower tasks difficult for children with autism?

Claims of executive dysfunction in children with autism spectrum disorders (ASD) have relied heavily on their deficient performance on two types of tasks: the Wisconsin Card Sorting Test and towers. Bishop et al. (2001) have pointed out that tower tasks, typically purported to measure "planning" abilities, require specific EF abilities, such as inhibition and working memory. In this study we hypothesized that specific EF abilities, such as flexibility and spatial working memory would relate to tower performance among children with ASD. Children ($n=21$; mean age = 10.8(1.25); 19 male; Full Scale IQ = 98(18.1)) diagnosed with high functioning autism completed tasks tapping a range of EF abilities (i.e., cognitive flexibility, verbal working memory, spatial working memory, attention, verbal fluency, and pro-

cessing speed). All EF measures were used in a linear regression to predict tower performance. The overall model was significant ($F = 4.67, p = .02$, R -square change = .76). Large effect sizes were observed for flexibility (partial $r = .75, p = .01$), attention (partial $r = .40, p = n.s.$), and spatial working memory (partial $r = .48, p = n.s.$); medium effect sizes were evident for processing speed (partial $r = -.31, p = n.s.$), and verbal fluency (partial $r = .32, p = n.s.$). There was no effect for verbal working memory. In this sample of children with autism, cognitive flexibility was most important to performance on the Tower of London, indicating that weakness on this "planning" task may be effectively addressed by targeting flexibility skills.

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J.M. WOLF, Y. KAMIO & F. DEBORAH. Awareness Threshold for Face Processing in Individuals with Autism.

Numerous studies have demonstrated face processing deficits in individuals with autism. The present study investigated speed of face processing in Japanese and American children and adults with autism and typically developing controls. Participants viewed a target photograph of a face or an object displayed on a computer screen at exposure durations ranging from 10 ms to 160 ms. Participants were then shown two alternatives and were asked to indicate which one matched the target. Foils were photographs depicting a different facial identity, facial emotion, or object. The awareness threshold was defined as the exposure duration at which a participant was able to consistently identify the target. Analysis of variance revealed that adult participants had lower thresholds than children across task and diagnostic group, suggesting a developmental progression in speed of face processing. A significant main effect of task was found, such that the awareness threshold for identification of objects was lower than for both facial identity and emotion, and the threshold for facial emotion was lower than for facial identity. Participants with autism were found to be slower than controls across tasks, and no diagnosis \times task interaction was found (i.e. no face-specific deficit was found). No differences were found between Japanese and American controls. Japanese participants with autism were found to have lower thresholds than American participants with autism, which is probably attributable to an age difference between the two groups. Findings are discussed in relation to the amygdala theory of autism.

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G. LOCASCIO, G.T. VOELBEL, L. DAPUZZO, R.L. HENDREN & M.E. BATES. Lateral Ventricle Enlargement in Children with High Functioning Autism.

Prior magnetic resonance imaging (MRI) research found that individuals with autism have increased volumes of the fourth ventricle, cerebellum and pons. It has been suggested that enlargement of the lateral ventricles (LV) is associated with neurodevelopmental disorders; however, only a few studies reported significantly enlarged ventricles in autistic individuals while other studies reported no differences. Investigations of lateral ventricles in bipolar patients also reported mixed results. The current study examined LV volumes in children aged 7-13 diagnosed with High Functioning Autism (HFA), Asperger's Disorder (AD), and Bipolar Disorder (BP) compared to normally developing control children (NC). Eighty-three children were included: 31 diagnosed with AD (29 males; mean age 10.48 ± 2.05); 11 with HFA (11 males; mean age 10.09 ± 1.76); 20 with BD (15 males; mean age 10.65 ± 1.46); and 21 NC (14 males; mean age 10.38 ± 1.91). Each participant underwent MRI of the brain. Controlling for total brain volume, it was found that the HFA group had significantly larger ventricle volumes than the control group (age and gender were not significant predictors of LV). Additionally, a significant interaction between total brain volume and HFA diagnosis

suggested that this was most pronounced for HFA children with large total brain volumes. A trend toward statistical significance for larger ventricle volumes was also found in the BP group. Differences in ventricular volumes in the HFA group, and possibly in the BP group, suggest potential neurodevelopmental divergence in the affected groups. The differences may also reflect abnormalities in peri-ventricular structures and/or pathways.

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D. CROCETTI, J.C. GIDLEY LARSON, M.C. GOLDBERG, M.B. DENCKLA & S.H. MOSTOFKY. Impaired Rotary Pursuit Learning in Children with High-Functioning Autism .

Motor impairments are commonly reported in autism. One of the most frequently reported findings is impaired performance of complex motor skills and gestures. Given that autism is a developmental disorder, we hypothesized that deficits in motor (procedural) learning may contribute to impaired acquisition of complex motor skills. In the present study motor sequence learning was assessed by comparing performance on a Rotary Pursuit task in 18 males with high-functioning autism and 24 male controls, aged 8-13 years. The task consisted of four successive blocks of four 20 second trials, during which subjects tracked a moving light in a continuous pattern at a speed of 20 rpm. A circular pattern was presented during blocks 1, 2, and 4; in block 3 a square pattern was presented. Repeated measure ANOVA indicated a significant difference between groups on overall performance measured by time on-target, with the autism group less on target than controls ($p = .03$). There was a trend towards significance for an effect of diagnosis on change in performance over blocks of trials ($p = .06$); children with autism showed less improvement across successive blocks of trials than did controls. These findings suggest that children with high-functioning autism are not only impaired in motor execution, but are also impaired in motor learning.

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C. O'CALLAGHAN, R. CALVANO, H. FISHBEIN, C. GRANT & M. LEVINE. Comorbidity in Asperger Students Detected through Simultaneous Electronic Monitoring (SEM).

To clarify how Asperger symptoms can be influenced by comorbid disorders, including ADHD, OCD, ODD, PTSD, anxiety, bipolar disorder and/or medication problems. Subjects: 20 Asperger/HFA students with comorbid diagnoses, including ADHD, OCD, ODD, Bipolar Disorder, Anxiety Disorder, PTSD, Motor Dyspraxia, Seizure Disorder and NVLD. Medications included atypical antipsychotics, antidepressants, psychostimulants, antiepileptics/mood stabilizers and alpha adrenergic agonists. Teachers and students rated students' emotions (Happy/Sad, Calm/Nervous, Peaceful/Angry, Energetic/Sleepy and Motivated/Bored) and behavior (Cooperation, Self-Expression, Self-Control, Social Interaction and Attention) twice daily for 4 weeks, using handheld computers (SEM) and SynTrend software. The data were evaluated with cluster, t-test, correlation and regression analyses. 4 groups emerged based on the degree of positive or negative emotion ratings and the concordance of Student-Teacher ratings. 9 students ("Calms") showed high positive emotional ratings and high S-T agreement. 4 students ("Coverts") showed higher negative ratings by students, but not by teachers. 5 students ("Non-Reporters") showed more positive ratings by students than by teachers. 2 students ("Reporters") showed equally high S-T negative emotional ratings. The 11 students with negative emotional ratings showed one of four profiles: Depression Masking as Anger (3), Covert Depression (4), Anxiety (2) and Hypo-Arousal related to Over-Medication (2). SEM is an efficient method for clarifying comorbidity

in Asperger students. The quantitative, individualized data were not available from classroom observation alone or from standardized rating scales. The data helped to determine the most appropriate psychopharmacological and behavioral interventions. Using handheld computers was well accepted by the students, permitting some of them to share feelings that they were not able to share directly with their teachers.

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B. KLEIN-TASMAN, F. GALLO & P. CURRAN. Early Williams Syndrome Phenotype: Heightened Startle Reactivity?

Studies of the behavior of children with Williams syndrome (WS) indicate elevated levels of sociability, anxiety and heightened sensitivity to sound. Research with children developing normally is suggestive of a relationship between startle sensitivity and anxiety. The goal of this study was to compare startle reactivity of children with Williams syndrome to that of children with other developmental disabilities (DD). Participants were 12 children with WS and 10 children with other DDs (ages 2.5 to 6), exposed to noisy toys during a structured play interaction. The frequency of startle reactions to child and examiner initiated stimuli was examined. Participants with WS startled more; it was possible to distinguish between the groups based on the number of startle responses ($D = .82$, $p = .01$). However, sensitivity and specificity of startle response to identify children with WS were only moderate ($Se = .75$, $Sp = .60$). A 2-way ANOVA comparing rates of startle of participant groups to child versus examiner-initiated stimuli found a main effect of group ($F(1, 20) = 10.84$, $p = .004$), but no significant interaction between group and initiation status ($F(1, 20) = .085$, $p = .77$). Observations of responses to a set number of stimulus instances distinguished well between the groups ($D = .90$, $p = .002$). A threshold of startle more than 50% of the time to the presentation of stimuli yielded a Se of .93 and a Sp of .87. Children with WS startle easily to even mildly noisy toys. Given that difficulties with anxiety are often seen in individuals with WS, the observed startle reactions of young children with WS may be an early psychobiological indicator of later anxiety.

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K. PHILLIPS, B. KLEIN-TASMAN, C. MERVIS & M. ROWE. Investigation of the Williams Syndrome Personality Phenotype Using the Children's Behavior Questionnaire.

Williams syndrome (WS) is a rare genetic neurodevelopmental disorder resulting from a hemizygous microdeletion on chromosome 7q11.23. Research has shown that 8- to 10-year old children with WS exhibit a unique personality profile, including being less shy and more empathic, on the Children's Behavior Questionnaire. The CBQ assesses several dimensions of the child's behavior, including negative affectivity, extraversion/surgency, and effortful control. In this study, we sought to determine whether the profile also captures the personality characteristics of younger children with WS. We are also interested in examining developmental trends in the personality characteristics of children with WS, as well as exploring psychometric properties of the CBQ in children with WS. Participants were 102 4- to 10-year-old children with WS. The CBQ Long Form was completed by parents. The personality profile had a sensitivity of .88 across the sample, with some variability with age. Approach, Inhibitory Control, Perceptual Sensitivity, and Guilt/Shame showed significant positive correlations with age, whereas High Intensity Pleasure, Activity, and Shyness showed significant negative correlations with age. Exploratory factor analysis revealed three factors similar to those in Rothbart's analyses with typically developing children. The findings suggest that the profile originally seen in 8- to

10-year-olds is characteristic of children of a broader age range, lending support for the role of genetics in personality development. Several of the CBQ scales showed increases or decreases with age, suggesting developmental variability within gene-brain-behavior relationships. Additional aspects of construct validity of the CBQ will also be discussed. Correspondence: *Bonita Klein-Tasman, Ph.D., Psychology, University of Wisconsin - Milwaukee, PO Box 413, Milwaukee, WI 53201. E-mail: bklein@uwm.edu*

V.J. HINTON, S. CYRULNIK & R. FEE. Selective Phonological Processing Deficits in Children with Duchenne Muscular Dystrophy.

To examine phonological processing skills in children with Duchenne muscular dystrophy (DMD) and average intellectual level. Children with DMD have poorer academic achievement skills and deficits in verbal immediate memory when compared to unaffected siblings of comparable IQ and age. The hypothesis that children with DMD are selectively impaired on tests of phonological memory was tested. Seventeen pairs of boys with DMD and one unaffected sibling control, between 6 and 16 years old, were tested. All participants received the Ravens Coloured Matrices (RCM) and the Woodcock-Johnson Analysis-Synthesis (W-J AS) subtest as measures of nonverbal intellectual function, and the Peabody Picture Vocabulary Test - III as an estimate of verbal IQ (PPVT-III). The Comprehensive Test of Phonological Processing (CTOPP) and the Woodcock-Johnson reading composite score (W-J Read) were the outcome measures. Between-group comparisons were done using t-tests. The two groups did not differ on age, or measures of intellectual function (RCM, W-J AS, PPVT-III). The W-J Read standard score was lower in the DMD group, as expected (mean + standard deviation: DMD = 92 + 14; controls = 103 + 8; $t = 2.53$, $p = .02$). Additionally, the DMD group did more poorly than their siblings on both CTOPP phonological composite scores (Phonological Awareness - DMD = 84 + 10, ctrl = 97 + 9, $t = 3.9$, $p = .00$; Phonological Memory - DMD = 87 + 8, ctrl = 93 + 10, $t = 2.1$, $p = .04$), but not on Rapid Naming (although there was a trend toward the DMD group doing worse). DMD is a neurogenetic disorder that has selective cognitive effects. Even though the children with DMD performed within the average range on the measures examined, they were significantly worse than their siblings on tests of phonological processing and reading. It is presumed that the dystrophin products missing in the development of their central nervous system are necessary for optimal phonological processing.

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S. CYRULNIK, R. FEE, J. KIEFEL & V.J. HINTON. Early Language and Social Deficits in Duchenne Muscular Dystrophy.

To examine language and social development in preschool children with Duchenne Muscular Dystrophy (DMD). Twenty preschool children with DMD ($N = 20$, mean age = 66 months) and seventeen matched controls (siblings where available, $N = 17$, mean age = 66 months) participated in the study. As part of a larger battery, children were administered the Clinical Evaluation of Language Fundamentals (CELF), a measure of expressive and receptive language skills. Parents completed two questionnaires relating to social skills: the Social Communication Questionnaire (SCQ) and the Social Skills Rating System (SSRS). The SCQ evaluates the development of communication skills and social understanding, while the SSRS determines the levels of social skills and problem behaviors exhibited by the child. Preschool children with DMD exhibit a significant delay in expressive and receptive language skills as measured by the CELF [$F(1,33) = 8.08$, $p = .008$]. According to parental report, preschool children with DMD also show lower levels of social understanding as measured by the SCQ [F

(1,28)=11.31, $p=.002$]. In addition, they show lower levels of social skills [$F(1,28)=6.69$, $p=.015$] and higher levels of problem behaviors [$F(1,28)=8.81$, $p=.006$], as measured by the SSRS. The DMD group was further subdivided into High Language (Total CELF Scores > 85) and Low Language (Total CELF Scores < 85) groups. Preschool children with DMD in the Low Language group exhibited significantly fewer social skills than preschool children with DMD in the High Language group [$F(2,15)=7.25$, $p=.006$]. Preschool children with DMD show significant impairments in language and social skills when compared with controls. This combination of deficits is suggestive of a profile characteristic of Pervasive Developmental Disorder (PDD). Early intervention in preschool children with DMD should address both the deficits in communication and in social skills, in order to best serve the needs of this population.

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L.B. WILSON, P.E. DIXON, J.M. KLEINMAN, J. PANDEY, H.C. BOORSTEIN, E.L. ESSER, D.L. ROBINS, M. BARTON, T.M. DUMONT-MATHIEU, J.A. GREEN, S. HODGSON, G.A. MARSHIA & D.A. FEIN. Overview of the M-CHAT.

Autistic Spectrum Disorders (ASDs) are often not diagnosed until after the age of 3 years, although early intervention is important. The Modified Checklist for Autism in Toddlers (M-CHAT) (Robins et al., 2001) is a parent-report checklist for toddlers. It can be used in unselected or high risk populations. Children who fail the checklist and a confirmatory telephone follow-up receive a developmental and diagnostic evaluation. All of the children screened between 16 and 30 months are re-screened with the M-CHAT between 42 and 48 months. At present, 2840 children have received an initial M-CHAT screening by their primary care provider and 621 by their early intervention service provider. Of the 214 children evaluated to date, 153 were diagnosed with an ASD, 53 with language, motor, or global developmental delay, 5 with other disorders (e.g., Attachment Disorder, ADHD, Regulatory Disorder, Broader Autism Phenotype), and 3 were found to be typically developing. Fifty-seven children have now been re-evaluated around the age of 4 years. Based on 4-year old outcome data, the sensitivity of the M-CHAT administered at Time 1 with telephone follow-up was between .81 and .91 (some possible misses could not be confirmed) and specificity was .98. Positive and negative predictive power were found to be .56 and .99, respectively. The M-CHAT thus appears to be an effective method of screening toddlers for ASDs.

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K.G. KELLY, E.B. FENNEL, K. RICKEL & N.K. DIXIT. Divergent Neurocognitive Patterns in Siblings with Myelomeningocele.

To use the case study format in order to contrast neuropsychological presentations of siblings with myelomeningocele (MM). Medical record review confirmed parallel presentations of nonhydrocephalic, low-level, MM with tethered cord in African American male siblings, ages 10 and 12 at the time of testing. Siblings were evaluated using a comprehensive neuropsychological test battery designed to assess a broad range of cognitive functions and behaviors. The 12-year-old's cognitive strengths and weaknesses were generally consistent with the nonverbal learning disability (NLD) pattern previously reported in approximately 50% of children with MM. A 21-point VIQ>PIQ split, relatively weak arithmetic skills (WRAT-3: Arithmetic = 81, Reading = 102), and mildly impaired Picture Learning (WRAML: Scaled Score = 6) versus average Story Memory (Scaled Score = 10) were identified. Conversely, the 10-year-old produced an 8-point PIQ>VIQ split and performed in the average range across all tested domains with the exception of mild impairments in the areas of Arithmetic (Standard Score = 74) and processing speed (Trail Making Test A = 8th percentile). In both

siblings, maternal responses on the BASC, CPRS-R:L, and BRIEF suggested problems in the areas of oppositionality/conduct, depression/anxiety, hyperactivity, inattention, and executive skills, and criteria for ADHD, Combined Type were met. Despite similar neural tube defects, genetics, and environments, the cognitive presentation of male siblings with MM was found to be markedly disparate. Commonalities were limited to conduct problems, hyperactivity, and inattentiveness, as well as weaknesses in arithmetic. These findings underscore the variable neurocognitive sequelae of MM.

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S. HEPWORTH, K. NASH & J.F. ROVET. Functional Dissociation of Individual Working Memory Components.

Working memory represents a cognitive system comprised of two distinct elements: a short-term storage component and a controlled attention component. To assess whether these components could be dissociated in pediatric populations with suspected working memory difficulties, we compared children with attention deficit hyperactivity disorder (ADHD) and congenital hypothyroidism (CH). Based on past research, we hypothesized ADHD would have difficulty with the controlled attention component and CH with storage. Studied were 20 ADHD, 26 CH, and 55 controls age 7 to 12 years. All children were assessed using n-Back (nB) and Sternberg Item Recognition (IR) tasks. Storage was manipulated by varying Load (1 versus 3 letters on nB; 3 versus 6 letters on IR) and controlled attention by varying backedness on nB (1-versus 2-back) and interference on IR (low versus high). Recorded were accuracy and reaction time (RT). Results showed no group effects or interactions on nB. However on IR, children with ADHD were outperformed by controls, especially on low interference and low load/high interference conditions, whereas CH were only affected in the high load/high interference condition. Females with CH showed greater effects of Load than males with CH. Different RT patterns suggest that ADHD were more susceptible to interference effects than CH. These results suggest functional independence of storage and controlled attention components for IR but not the nB task. Children with ADHD were affected in both storage and controlled attention components, whereas children with CH, especially females, were affected mainly on storage. Correspondence: Joanne F. Rovet, PhD, Psychology, The Hospital for Sick Children, 555 University Avenue, Toronto, ON M5G 1X8, Canada. E-mail: jrovet@sympatico.ca

S. CARCOM, Z. EVIATAR & L. ROTHCHILD. Developmental Right Hemisphere Syndrome and Hemispheric Asymmetry for Emotion Identification, Face Identification, and Lexical Decision.

We tested the hypothesis that children diagnosed with Developmental Right Hemisphere Syndrome (DRHS) have a global deficit in right hemisphere (RH) functioning. We used divided visual field paradigms to compare cerebral hemispheric involvement in an emotion identification task, a face identification task, and a language task. The hypothesis predicts a larger right visual field advantage in all of the tasks for the experimental group than for a control group, resulting from low RH performance levels. We compared the performance of 12 boys diagnosed with DRHS to that of 13 boys without a history of learning disabilities or behavioral problems. The groups were matched on age (between 9-12 years), intelligence and SES. All were right handed. The two faces tasks used identical stimuli and differed only in the instructions. The language task was a lexical decision task. The results revealed that the groups were not different in the lexical decision task, where both showed equivalent left hemisphere (LH) specialization, or in the face identification task, where both groups revealed equivalent hemispheric sensitivity. The groups did differ on the emotion identification task. Children with DRHS were less accurate than the controls at identifying angry faces, but were equally accurate with happy faces. We suggest that the

RH deficit in these children may be specific to emotion identification. In addition, in both face tasks, for both groups, we found an interaction between emotional valence and visual field, with higher sensitivity to angry faces in the LVF (RH) and higher sensitivity to happy faces in the RVF (LH), with the pattern stronger in the face identification than in the emotion identification. This finding supports the valence model of emotional processing (e.g., Davidson & Fox, 1982), which is discussed. Correspondence: *Zohar Eviatar, Ph.D., Psychology, University of Haifa, Mount Carmel, Haifa 31905, Israel. E-mail: zohare@research.haifa.ac.il*

G. VOELBEL, G. LOCASCIO, R.L. HENDREN & M.E. BATES. Neurocognitive Abilities and Caudate Nucleus Volumes: Is There a Relationship?

In individuals diagnosed with Autistic Disorder (AD), a prior study reported that the volume of the caudate nucleus (CN) was increased and was correlated with ritualistic/repetitive behaviors. The current study compared the CN volumes of youths diagnosed with AD, Asperger's Disorder (ASD), or Bipolar Disorder (BD) to those without psychiatric diagnosis (NC). The relationship between CN volume and neuropsychological performance was also examined. Participants were diagnosed with ASD (N=25, mean age=10.52, SD=1.93, males=96%), AD (N=10, mean age=10.20, SD=1.81, males=100%), BD (N=17, mean age=10.35, SD=1.66, males=76%), or were NC (N=20, mean age=10.65, SD=1.87, males=70%). A standard neuropsychological battery and magnetic resonance imaging of the brain were administered. Controlling for age, gender, and total brain volume, a significant increase in the CN volume was found in the ASD group. The results of the regression analyses examining the relationship between CN volumes and measures of executive function (EF) showed a significant inverse relationship between the right CN volume and Wisconsin Card Sorting Test perseveration errors, and between the left CN volume and semantic fluency. Relative to the NC group, larger left and right CN volumes were related to poorer sustained attention only in the BD group. These results support previous findings of increased CN volume in Autism Spectrum Disorders. Recently, studies have reported the basal ganglia's role in cognition. This study provides evidence that the volume of the CN is related to perseverative errors, verbal fluency, and sustained attention. The relationship between the CN volume and cognition are discussed.

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E. BRANDLING-BENNETT, D. WHITE & R. STEINER. Semantic Fluency in Children with Early-Treated Phenylketonuria.

Early-treated phenylketonuria (PKU) results in dopamine dysregulation, which appears to compromise frontally-subservd executive abilities. In our study, we examined frontally-mediated strategic processing in children with PKU by administering an animal fluency task. The CONTROL group comprised 22 typically developing children. The PKU group comprised 23 children. Age ranged from 6 to 17 years. Total number of animals produced was examined. To evaluate possible between-group differences in strategic processing, number of clusters, mean cluster size, and number of switches was examined. ANCOVA (controlling for age and IQ) revealed no significant between-group difference in total number of animals reported. In examining strategic processing, however, a significant difference ($p < .05$) in mean cluster size and number of switches was observed, with the PKU group producing smaller clusters and more switches than the CONTROL group. Further analyses showed that this difference did not exist between the groups in children younger than 11 years, but did exist in children 11 years or older. These findings are consistent with previous data from our laboratory suggesting an age-related emergence of executive deficits in children with PKU.

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P. MOES, G. SCHILMOELLER & K. SCHILMOELLER. Agenesis of the Corpus Callosum: Physical, Sensory and Motor Characteristics.

Agenesis of the Corpus Callosum is rare congenital disorder with varied etiology. The primary goals of the study were to provide: 1) a comprehensive profile of characteristics based on a much larger sample (N=720) than for any previous studies, 2) a profile of associated diagnostic markers to improve identification of individuals with ACC who have yet to be diagnosed, 3) an expected prognosis for families and professionals planning a course of treatment, 4) additional hints as to the role of the cerebral commissures in normal and disordered development, 5) an initial comparison of outcomes for individuals with complete or partial ACC. The present study surveyed over 700 families and individuals affected by ACC, along with comparison data from over 200 unaffected siblings. Attempts were made to isolate the characteristics of ACC apart from any concurrent neurological or unrelated behavioral disorder. Principle characteristics identified include: enlarged head size, small or atypical body size, delayed developmental milestones, sleep difficulties, reduced pain sensation, altered touch and cold perception, depth perception difficulties, motor difficulties for certain tasks, particularly for those tasks involving left-right coordination, and an increased proportion of left or mixed hand preference. Comparisons between partial and complete ACC did not yield striking differences. In contrast to our previous reports of this data, the addition of sibling comparison data and the isolation of individuals who are relatively free from concurrent neurological and unrelated behavioral conditions provides a clearer picture of the consistent characteristics associated with this condition.

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S. WARSCHAUSKY, P. DIXON & S. CUNNINGHAM. Neuropsychological Correlates of Social Adjustment in Children with Congenital Neurodevelopmental Conditions.

Recent research on the neuropsychological correlates of social problem-solving (SPS) in children with congenital neurodevelopmental conditions has shown that executive functions are associated with SPS (Warschawsky et al., 2003). The present study examines neuropsychological correlates of specific aspects of social adjustment including social contact and quality of friendships. The primary hypothesis was that executive functions would be key predictors of social adjustment. The samples included 69 children, ages 6-12, mean age 8.9 (SD = 2.0), 48% male, with Verbal IQ >70 and <120. The Developmental Condition (DC) group was comprised of 29 children including 18 diagnosed with cerebral palsy, 12 with other congenital conditions. The Typical Development (TD) group included 40 children with no history of neurodevelopmental conditions. There were no significant group differences in age, gender or ethnicity. The neuropsychological battery included WISC-III Vocabulary, TEA-Ch Creature Counting, Same and Opposite Worlds, CVLT-C, NEPSY Arrows and the Symbol Digit Modalities Test Oral trial. Social variables were assessed using the Social Network Inventory for Children-Child Version (Simkins, 2000), the Friendship Quality Questionnaire (Parker & Asher, 1993) and the Social Adjustment scale from the PIC-2. Controlling for Vocabulary, the DC group exhibited less social contact than the TD group. Hierarchical stepwise regression analyses indicated that controlling for intellect, executive functioning was a key predictor of friendship quality. Lower scores on executive functioning associated with higher amounts of conflict and less validation and caring in friendships of children in the DC group. Social intervention strategies with these populations may need to address underlying executive dysfunction.

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S.A. AHMAD, A. TAYLOR, J. OUT, C. SAUNDERS & J. STRANG. Intellectual Subtypes of Children and Adolescents with Mental Retardation.

The objective of current study was to identify subtypes of intellectual functioning in children and adolescents with mental retardation using cluster analytic methodology. Data from the neuropsychological evaluations of 169 children and adolescents referred to a regional children's mental health center in Southwestern Ontario were analyzed. Children and adolescents were between the ages of 6 and 16 years and had a Full Scale IQ of 75 or lower on the Wechsler Intelligence Scale for Children-Third Edition (WISC-III). Two separate cluster analyses were conducted. The first cluster analysis was conducted utilizing the participants' WISC-III index scores. The second cluster analysis was conducted utilizing the participants' WISC-III subtest scores. Additional neuropsychological data were used for the purpose of establishing external validity. The first cluster analysis, using the WISC-III index scores, yielded the following strength-based subtypes: language strengths, visual motor strengths, symbol processing strengths, and global deficits. The second cluster analysis, using WISC-III subtest scores, also yielded subtypes exhibiting language strengths, visual motor strengths, symbol processing strengths, and global deficits. Further statistical analyses demonstrated good reliability and external validity of the cluster solutions. Results indicated that distinct subtypes of intellectual functioning exist for children and adolescents with mental retardation. Subtypes identified were similar to those found in previous learning disability research. Research and clinical implications for understanding intellectual strengths and weakness patterns in children with mental retardation were discussed. Correspondence: *Saadia A. Ahmad, Ph. D., Windsor Regional Children, Ozad Institute, 3901 Connaught St., Windsor, ON N9C 4H4, Canada. E-mail: sahmad@mdirect.net*

Imaging Studies of Brain Function

F. IRANI SIVASEGARAN, L. FONTEYN & S. PLATEK. Preliminary Validation of fNIR using BOLD Response.

To investigate concordance between BOLD response in functional near infrared spectroscopy (fNIR) with functional magnetic resonance imaging (fMRI) as a validating comparison. Twenty-one healthy males and females between the ages of 18-25 volunteered for participation. In two experiments, subjects were asked to respond to faces (self, unknown, famous) or a computerized version of the Mind in the Eyes Test (Baron-Cohen et al., 2001). Data acquired using fNIR technology were later compared to preexisting fMRI data that employed the same experimental tasks. Consistent with our hypothesis and working model, fNIR revealed differential right frontal activation when subjects responded to their own face when contrasted with unknown and famous faces. Similarly, subjects showed medial frontal activation when solving the Mind in the Eyes Test. These data were shown to be consistent with our existing fMRI data (Platek et al., 2004; Cog. Br. Res.) These data suggest that the inexpensive, portable and minimally invasive fNIR device being developed at Drexel University measures approximately the same neurocognitive response (via BOLD) as fMRI.

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D.T. PULSIPHER, R.O. HOPKINS & L.K. WEAVER. Basal Ganglia Morphology following Carbon Monoxide (CO) Poisoning.

Carbon monoxide poisoning may result in diffuse neuropathological changes, including basal ganglia lesions. However, basal ganglia volumetric changes following CO poisoning have not been described. This study assessed basal ganglia volumes longitudinally following CO poisoning. 73 consecutive CO poisoned patients had MR scans on day 1, 2 weeks, and 6 months post-CO poisoning. Quantitative MR analysis of the caudate, putamen, globus pallidus (GP), and the total basal ganglia were carried out at all 3 scan times. The day 1 scans were used as baseline data. Atrophy was defined as >1 SD decline from the group mean of the baseline volumes for each structure. 73 patients (67% male) with a mean age of 35 ± 14 years, mean educational level 12.1 ± 2.8 years, and mean COHb $22\% \pm 11\%$. There were 21/73 (29%) patients with atrophy of one or more basal ganglia structures at 6 months compared to baseline scans. Putamen atrophy occurred in 15/73 (21%), caudate atrophy 13/73 (18%), GP atrophy 12/73 (16%), and 13/73 (18%) had total basal ganglia atrophy. 7 patients had atrophy in one structure, 9 in 2 structures, and 5 in all 3 structures. The mean decrease in basal ganglia volume from day 1 to 6 months was 0.31 ± 1.37 cm³ (not significant). Regression analysis showed that age, sex, loss of consciousness, and total intracranial volume were predictors of basal ganglia atrophy ($p = .0001$ to $.05$). CO poisoning may result basal ganglia atrophy 6 months following poisoning.

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S.K. NOONAN, F. HAIST, N. KEMMOTSU & R. MUELLER. A Frontoparietal System For Source Memory Identified By Functional Connectivity MRI.

Source memory refers to the recollection of original learning context in addition to the specific stimulus or event. Previous neuroimaging studies of source memory have identified activity in multiple brain regions, including prefrontal and parietal areas. We used functional connectivity MRI analysis (fcMRI) to examine interregional low-frequency temporal correlations in BOLD signals in an effort to identify the neural networks involved in source recollection. fMRI was performed in 10 healthy male volunteers during performance of a source memory task. Subjects determined whether test words had been presented visually or aurally during encoding, or were new (i.e., not previously presented). Visual and auditory presentation was used during testing and was analyzed separately using fcMRI. Left and right middle frontal regions (Brodmann area 9) showing robust activity during retrieval were used as seed volumes for fcMRI. Functional connectivity maps were calculated for each subject based on regional signal covariance with the average time course of the reference region. Fit coefficients were entered into one-sample t-tests for groupwise comparison. In both visual and auditory test conditions, functional connectivity with left and right area 9 was observed in bilateral superior and inferior parietal cortex and precuneus (areas 7 and 40). Homotopic interhemispheric connectivity was found between middle frontal regions in the auditory but not visual test modality. These findings suggest that source memory relies heavily on coordinated activity between dorsolateral prefrontal cortex, precuneus, and lateral parietal regions. Thus, these regions should be considered a coordinated system in source memory recollection.

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C. PRICE, I.M. SCHMALFUSS & C.L. SISTROM. Quantification of White Matter Alterations: A Reliability Analysis.

There is increasing interest in the clinical significance of white matter abnormalities (WMAs) as seen on Magnetic Resonance Imaging (MRI).

However, published studies vary in type of MRI sequence and WMA quantification method. To evaluate variability among study technique, we conducted a prospective reliability study on the most commonly used MRI sequences (T2 versus FLAIR) and WMA quantification protocols (Visual Rating and Pixel Threshold method). One hundred forty out of 3,382 MRI scans were selected using set inclusion (presence of WMAs, T2 and FLAIR images, adequate quality) and exclusion criteria (prior brain surgery, infarctions, tumor). The degree of WMAs was graded as mild, moderate, and severe. After removing header information, 15 scans (5 of each group) were selected, separated by sequence (FLAIR, T2) and randomized for scoring. Two readers independently rated each scan 3 times for FLAIR and 3 times for T2 using the Rotterdam Visual Rating Scale or Pixel Threshold method (NIH Image, Scion Software). Intraclass correlation coefficients identified high reliability using the Pixel Threshold method with both FLAIR ($r=.99$) and T2 sequences ($r=.96$). Reliability remained high regardless of sequence type (Pearson Product, $r=.96$). In contrast, the Visual Rating method had higher reliability for the FLAIR ($r=.93$) than T2 ratings ($r=.64$), with moderate reliability regardless of sequence type (Pearson Product, $r=.73$). The Pixel Threshold method applied to FLAIR images is the most reliable approach for the analysis of WMAs. Moreover, the Pixel Threshold method provided high reliability within and between the T2 and FLAIR sequences. Applying a Visual Rating technique to T2 images yielded the lowest reliability.

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B.J. NAGEL, I. MOADAB, A.D. SCHWEINSBURG, V.C. BARLETT, L. CALDWELL, A. PARK, C. BURKE, M. MELOY & S.F. TAPERT. The Role of Prefrontal White Matter Volume on fMRI Response to a Spatial Working Memory Task Across Adolescent Development.

The brain continues to develop throughout adolescence. One aspect of development involves increasing white matter volumes, particularly within the frontal lobes. Increases in white matter likely subserve the development of many cognitive functions, including working memory. The current study examined the role of prefrontal white matter volume on brain response to a functional magnetic resonance imaging (fMRI) task of spatial working memory (SWM). Participants were 54 right-handed 12- to 18-year-old adolescents. All teens were free from history of any psychiatric disorder, head injury, neurological problems, or learning disability. Each teen underwent structural neuroimaging and fMRI during a spatial working memory task. Regression analyses examined the relationship between prefrontal white matter volume and SWM fMRI response. Prefrontal white matter volume was not significantly associated with fMRI task performance. However, prefrontal white matter volume was positively linked with SWM neural response patterns. Specifically, teens with greater prefrontal white matter volumes demonstrated significantly greater brain activation ($p < .05$) during SWM in left inferior frontal regions (Broca's area) and right hippocampus and parahippocampal gyrus. In addition, teens with greater prefrontal white matter volumes evidenced less neural response in the right supplementary motor cortex and bilateral primary visual and association cortices during SWM. These results demonstrate that neuromaturation of prefrontal regions is associated with adolescent brain response patterns during SWM. These findings may suggest that maturing frontal white matter could underlie changes in the strategies employed and the neuroanatomical networks involved in SWM. Correspondence: Bonnie J. Nagel, Ph.D., Psychiatry, University of California San Diego, 3350 La Jolla Village Drive, 151-B, San Diego, CA 92161. E-mail: bnagel@ucsd.edu

M.E. ZIMMERMAN, A.M. BRICKMAN, R.H. PAUL, S.M. GRIEVE, D.F. TATE, R.A. COHEN & E. GORDON. Thalamic Volume and Neuropsychological Functioning in Healthy Adults.

Several converging lines of research have suggested that the thalamus plays a role in the cognitive functioning of healthy adults. In particular,

the thalamus has been shown to be involved in the cognitive processes of arousal, vigilance, attention, and executive functioning. The purpose of the current study was to further characterize these relationships using high-resolution magnetic resonance imaging methods and standardized comprehensive neuropsychological assessment in a large sample of neurologically healthy individuals. One-hundred sixty-four healthy adult participants (88 female and 76 male, aged 21 to 55) were selected from the Brain Resource International Database (BRID), an international collaborative effort comprised of 6 laboratories in English-speaking countries. High resolution MRI and a comprehensive, highly-standardized, computer-based neuropsychological assessment were administered to all participants. Voxel-based-morphometry analysis yielded gray matter volumes for caudate, putamen, and thalamus. Pearson correlation coefficients revealed multiple significant associations of small magnitude between thalamus gray matter volume and neuropsychological tests of attention, executive functioning, and semantic fluency ($r = 0.20$ to -0.17 , $p < 0.02$ to 0.05). However, there were a paucity of significant relationships between caudate and putamen gray matter volume and performance on tests of neuropsychological functioning. The findings from the current study suggest that fronto-thalamic circuitry may underlie executive functioning in healthy normal adults, whereas striatal structures may be involved to a lesser degree in these higher-order cognitive processes. Future studies investigating additional structures involved in fronto-thalamic circuitry may help further elucidate the relationship between neuroanatomic morphometry and cognitive functioning in this population.

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B. BERNAL & N. ALTMAN. Role of the Anterior Cingulate Cortex in Stroop Tasks.

Anterior cingulate cortex (ACC) activation found in Stroop tasks has been related to many different factors (1-5) that can be grouped into two main categories: inhibition and conflict. We present a functional MRI study to look at the role of ACC in two tasks. The color Stroop task (CS) has inhibition and conflict factors, while the Motor Inhibition Task (MIT) only exams inhibition. Twenty four healthy subjects were studied. In CS they named mentally the color of a word. The OFF condition consisted of congruent words (e.g.: the word "red" in red ink); while the ON condition consisted of incongruent color words. In the MIT they lifted the right index finger for a serial presentation of single letters on a screen, except for letter "X", presented pseudorandomly during the ON epochs. Individual and group analysis of the data was performed for clusters of activation ($p < 0.05$). Anatomical areas were obtained utilizing a 3D-brain digital atlas (6). There was marked intersubject variability in both tasks. Group analysis, showed bilateral activation in ACC in both tasks with clear left side predominance for the CS and right for the MIT. The Stroop task showed also activation of left inferior frontal gyrus, left posterior temporal, and left parietal lobe. The MIT showed additional activation of contralateral homologue areas. The ACC was activated in MIT, in spite of lacking the "conflict" factor, supporting the hypothesis that ACC is involved in inhibition. There was a task specific lateralization, left for verbal and right for non-verbal material.

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S.M. MEYER, L.R. KINGERY, J. YUN, B.N. AXELROD, G.D. PEARLSON & D.J. SCHRETLEN. A Voxel-Based Morphometric Investigation of Cognitive Estimation by Healthy Adults.

The Cognitive Estimation Test (CET) consists of 10 factual questions for which most persons do not know the correct answer. Thus, it requires both reasoning and self-monitoring of response plausibility. Because the CET is sensitive to frontal lobe brain lesions, it has been proposed as a

measure of “frontal-executive” functioning. The aim of this study was to assess the relationship between CET performance and neuroanatomic variability in normal adults using voxel-based morphometry (VBM), a semi-automated method of quantifying whole brain gray matter concentration at the individual voxel level. We report preliminary data from 39 healthy adults who were administered the CET and completed a brain MRI scan on a 1.5 Tesla scanner using identical pulse sequences and image acquisition parameters. MR image pre-processing and VBM analyses were conducted using Statistical Parametric Mapping (SPM2) software. At the voxel level, significant (uncorrected $p < .008$) correlations were found between CET performance and gray matter concentration in the right inferior frontal, precentral, and medial frontal gyri (Brodmann areas 6, 9, and 10) and left medial frontal gyrus (Brodmann area 10). Although we previously found that CET performance correlated more highly with IQ than with measures of “frontal-executive” functioning, these preliminary findings suggest that CET performance also depends on individual differences in gray matter concentration in cortical regions that are thought to subserve working memory and executive functioning.

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A. WABNITZ, B.W. JASPER, A.B. MOORE, B. CROSSON, K. MCGREGOR, K. COPINATH, M.E. GAIEFSKY, C.E. WIERENGA, K.K. PECK, R.W. BRIGGS, T.W. CONWAY, L.J. GONZALEZ ROTH & K.D. WHITE. fMRI Reveals Subcortical Activations Bridge The Stimulus-Response Interval During Word Generation By Nonfluent Aphasics.

fMRI separation of sequential cognitive processes during naming tasks cannot be done in normal controls. However, in some nonfluent aphasics, 4 or more fMRI brain images elapse between heard category (e.g., “birds”) and spoken exemplar (e.g., “eagle”). We analyzed patients’ images with deconvolutions time-locked to: (1) stimulus delivery, (2) the post-stimulus image, (3) the pre-response image, and (4) spoken response. Hypotheses: “Perception” areas show activity time-locked to (1), “production” time-locked to (4), and intermediate processes time-locked to (2) or (3). Three ischemic stroke patients with modest anomia participated. At trial onset, patients heard a single category and attempted to say aloud a single exemplar. Each fMRI run at 3T consisted of 9 trials separated by variable randomized inter-trial intervals with five runs in a session (event-related paradigm). Stimulus-locked activation was strong in R or bilateral posterior superior temporal cortices (“perception”), weak in R Broca’s homologue. Response-locked activation was modest in perception cortices, strong in SMA, R Broca’s homologue, modest in L Broca’s perilesionally (all “production”). Intermediate time-locking gave basal ganglia and thalamus activations as well as cortical ones. Stimulus delivery, as expected, evoked strong activation in perception cortices but also weak activity in Broca’s homologue. Response production, as expected, evoked strong activation in production cortices but perception cortices were also modestly active. Perception activation persisted over intermediate images, together with subcortical activations, which might reveal processes keeping perception “on-line” until response execution. Brain images in these slow responders (nonfluent aphasics) tease apart normally overlapping processes.

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L. CUTTING, A.M. CLEMENTS, J. SCHAFER, J.J. PEKAR, S.H. MOSTOFISKY & M.B. DENCKLA. fMRI of the Judgment of Line Orientation in Neurofibromatosis Type-1 (NF-1), RD, and Control Groups: Preliminary Findings.

Impaired visuospatial performance, indicated by the Judgment of Line Orientation (JLO), is a hallmark deficit in NF-1, a genetic disorder with

a high incidence of learning disabilities. This study used fMRI to investigate differences in the neural circuitry between children with NF-1, children with reading disabilities (RD), and controls while performing an analogue of the JLO task in the scanner. Participants included 18 children (10F): 6 controls, 6 RD, and 6 NF-1. Participants viewed a “fan” of eleven lines (two highlighted in yellow) at the bottom of the screen and were asked to compare the orientation of the highlighted lines to two yellow lines above the fan. Participants indicated via button press whether the yellow lines were the same or different in orientation. A visual discrimination control task was used in which participants indicated whether the top and bottom lines were the same or different color. Random effects analysis for each group showed significant activation in the right superior parietal, temporal, and prefrontal areas, and bilateral occipital lobe. Two-sample t-tests revealed statistically significant differences between RD and controls and NF-1 and controls, but not between RD and NF-1 groups. The RD group showed significantly greater activation than controls in the left parietal and right premotor areas, while children with NF-1 showed significantly greater activation than controls in the right basal ganglia (a typical location of T2-weighted hyperintensities found in NF-1) and inferior frontal gyrus. These results suggest that children with NF-1 and RD may utilize different neural mechanisms than controls to perform visuospatial tasks.

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P. PERSCHLER, S.M. RESNICK, M. CLARK, L. DENNERSTEIN, V. HENDERSON & P.M. MAKI. Brain Areas Subserving Figural Versus Verbal Encoding.

To better understand how the type of to-be-remembered information influences brain function, we compared patterns of brain activation during figural and verbal encoding tasks. Participants were 33 midlife women enrolled in the Melbourne Midlife Women’s Health Study (mean age = 60 yrs). Participants underwent fMRI scans during performance yes/no figural and verbal recognition memory tasks. Stimuli were abstract figures and words, and the design was event-related. We used SPM99 software to examine areas of differential activation during verbal and figural encoding (VE and FE). There was a trend toward better performance on figural (mean = 75%) compared to verbal (mean = 71%) recognition memory tests. Activations in left precuneus, left superior temporal gyrus, and right insula were greater during VE compared to FE. By contrast, activation in the right precuneus, left inferior frontal gyrus, left precuneus, right inferior frontal gyrus, and left parahippocampal gyrus was greater during FE compared to VE. There was no overlap between areas identified in this study and those reported in a PET study using similar tasks in 11 elderly participants (Beason-Held et al., 2004). However, our results are consistent with other findings including Grady et al. 1999 (FE > VE: right precuneus, left parahippocampal gyrus, VE > FE: superior temporal gyrus, insula), Cabeza and Nyberg 2000 (VE > FE: insula, FE > VE: area 19), and Fletcher et al. 2002 (VE > FE: left superior temporal gyrus, FE > VE: right inferior frontal gyrus, left parahippocampal gyrus). These findings point to brain regions that may underlie differential aspects of figural and verbal encoding.

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D. JOVANOVSKI, K. ZAKZANIS, Z. CAMPBELL, R. MRAZ & S. GRAHAM. The Neurological Correlates of a Novel, Ecologically-Valid Set Shifting Task.

The objective of the current study was to design an ecologically valid virtual reality task that is a “pure” measure of cognitive flexibility (i.e., set shifting) and to compare regions of activation during set shifting on

this novel “everyday” task (Office Courier Task; OCT) with the Wisconsin Card Sorting Test. 10 healthy right-handed participants (5 males) underwent fMRI scans coupled with virtual reality to examine neural correlates of pure set shifting using a paradigm purposely designed to minimize working memory functions. The OCT requires participants to deliver mail according to one of three different sorting strategies which repeat before unpredictably changing to a different strategy. Event-related fMRI was used to compare neural activation associated during switch trials in both the OCT and the WCST. With regard to set shifting, the largest activations on the WCST were observed in the right precentral gyrus, right inferior parietal lobule, and the left middle frontal gyrus; whereas, on the OCT, the largest activations were revealed within the right superior parietal lobule and left superior temporal gyrus. Only the right inferior frontal gyrus was activated in both tasks. The dorso-lateral prefrontal cortex was activated to a much greater degree during the WCST than during the OCT, while the inverse was found for the right superior and inferior parietal lobules as well as the superior temporal gyrus bilaterally. Different neuroanatomical regions appear to be associated with abstract vs. “everyday” set shifting ability although the right inferior frontal gyrus appears to be involved in both forms of cognitive switching.

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Symposium 8/10:30 a.m.–12:30 p.m.

Methodological Challenges in the Measurement of Social Cognition and Social Behavior

Chair: Seth Warschausky
Discussant: Keith Yeates

L. TURKSTRA. Methodological Challenges in the Measurement of Social Cognition and Social Behavior.

There is increasing recognition of the importance of social cognition and social behavior to the long-term success of children and adults with neuropsychological disorders. Social cognition is a hybrid field that evolved from a diverse group of disciplines, including anthropology, philosophy, communication studies, and developmental psychology. Social behavior is dynamic and complex. These characteristics are reflected in the tools used by researchers in this area. In this presentation, we discuss approaches to the measurement of social cognition and social behavior, the associated challenges, and creative solutions to capture this critical aspect of neuropsychological functioning.

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M. DENNIS. Social Cognition Involves Both Affect and Cognition.

Social cognition is neither disembodied nor cold. It involves the production and understanding of interpersonal exchanges that include the communication of feelings and affective evaluations. Studies of non-social decision-making have explored how hedonic contingencies affect gambling decisions, although the study of social cognition has been weighted in favor of affectively detached decision-making. Standard theory of mind tasks, for example, involve making non-affective deci-

sions about the location of an object. Some recent techniques for measuring social cognition have provided tools for the exploration of affect. One set of techniques measures the use and understanding of emotion: basic emotions (e.g., fear, anger); socially defined emotions (e.g., shame, embarrassment); and social display rules for expressing emotions (e.g., inhibiting inappropriate amusement). Another set measures rhetorical contexts having to do with such social-affective evaluations as praise and blame, including those involved in irony, sarcasm, and empathy.

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S. WARSCHAUSKY. Methodological Issues in the Assessment of Social Problem Solving.

With recognition of the significant social risks associated with neurodevelopmental disorders, pediatric neuropsychology investigators have begun to draw upon the extensive developmental psychology research on social problem-solving (SPS). This talk will include a review of recent evidence of specific social problem solving impairments associated with congenital and acquired neurodevelopmental conditions as illustrations of critical methodological issues. Discussion will focus on considerations in choice and modification of assessment techniques, including promising neuropsychological predictors, static versus real-time SPS stimuli, choice of protagonist, and the need for situation-specific assessments. Future directions for research will be suggested.

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L. TURKSTRA. Participatory Action Research as a Model for Generating Research Stimuli.

Adult recollections of adolescence differ substantially from the actual adolescent experience, particularly in the realm of social functioning. Social behaviors also evolve over time, so that adult researchers' views may not reflect current adolescent social norms. These factors suggest that adolescents may be the best source of stimulus material to study social function at this age. One method of involving adolescents in stimulus preparation is to use Participatory Action Research (PAR), an approach that was designed to engage the target population in development of ecologically valid measures. In the PAR framework, members of the target population are equal collaborators at each stage of the project, from conceptualization to implementation. This presentation will describe a PAR-based method for developing stimuli for the study of social cognition and communication in adolescents.

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Symposium 9/10:30 a.m.–12:30 p.m.

Measurement of Prospective Memory using the Memory for Intentions Screening Test

Chair: Sarah Raskin
Discussant: Elizabeth Glisky

S. RASKIN. Measurement of Prospective Memory using the Memory for Intentions Screening Test.

Prospective memory failures are increasingly being recognized as one primary impediment to daily functioning in a range of disorders. De-

spite this recognition, to date there has not been a systematic assessment tool to measure prospective memory functioning. The Memory for Intentions Screening Test (MIST) was designed to provide a brief measure of overall prospective memory functioning with individual scores for time cues compared to associative cues, short time delays compared to long time delays, and action responses compared to verbal responses. The abstracts that make up this symposium have used the MIST in a variety of populations for a variety of purposes. Mateer et al. examine prospective memory performance in young adults, young adults with brain injury, young-old adults and old-old adults in order to examine the effect of both age and brain injury on performance and to help identify cognitive domains underlying prospective memory performance. Carey et al. discuss prospective memory functioning in individuals with HIV-1 in order to better characterize the functioning in this population and to examine putative neuroanatomical substrates. Twamley et al. characterize prospective memory functioning in individuals with schizophrenia and schizoaffective disorder and compares prospective memory functioning to functioning on tests of memory and executive functions. Beauvais et al. also use the MIST with individuals with HIV+ but in order to examine the relationship between prospective memory functioning and the real-world problem of medication adherence.

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C.A. MATEER, I. FRIESEN & S. MISH. Remembering to remember: The impact of age, injury status, and other cognitive abilities on prospective memory.

Prospective memory (PM) functioning was examined in healthy young adults (n=20), young adults with brain injury (n=14), young-old adults (n=42), and old-old adults (n=38) using the Prospective Memory Test (PMT, a precursor to MIST; Raskin & Buckheit, 1998). Healthy young adults performed better than both the young-old and old-old adults, who did not differ from each other. The young adults with brain injury demonstrated significantly more PM difficulty than any other group. Performance on the PMT was better accounted for by measures of attention and executive functioning, than retrospective memory, consistent with the notion that PM relies heavily on executive brain systems. In all groups, PM performance was affected by the attentional demand of the distractor task, longer time delays, cue type, and response type. An error analysis indicated that Action Substitution errors (replacing the correct response with another response) were more frequent in both groups of older adults when compared to young adults, whereas Prospective Memory Failures (no response made at the target time) and Loss of Action Content (remembering that something was to be done, but not recalling the specific action) were particularly prevalent in the young adults with brain injury. The results of these studies will be discussed in terms of the effect of age on PM performance, the relationship of PM to retrospective memory, attention, and executive functioning, the task variables that impact PM performance, and implications for rehabilitation strategies to decrease PM errors.

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E.W. TWAMLEY, J.M. NARVAEZ & D.V. JESTE. Prospective Memory in Schizophrenia.

Objective: Although rarely assessed formally in neuropsychological evaluations, prospective memory ability has important ramifications for daily functioning. Furthermore, the relationships between prospective memory, other types of memory abilities, and other cognitive domains (e.g., attention, working memory, and executive functioning) are not well understood. Schizophrenia is a neurodevelopmental psychiatric disorder in which various aspects of neuropsychological functioning are impaired, but there is a high degree of heterogeneity within this patient group, making it an ideal disorder in which to examine

the construct of prospective memory. Method: Data were collected from 16 middle-aged outpatients with schizophrenia or schizoaffective disorder (mean age = 50, mean years of education = 13.5) who completed baseline evaluations as part of a randomized controlled trial of cognitive training. Prospective memory, attention, working memory, learning, recall, and executive functioning were measured, respectively, with the Memory for Intentions Screening Test summary score (MIST), WAIS-III Digit Span Forward and Letter-Number Sequencing, WMS-III Logical Memory I and Logical Memory II percent retained, and number of categories achieved on the Wisconsin Card Sorting Test. Results: The subjects were mildly impaired on the MIST, performing about .41 SD below normative expectation for their age group. Correlations between the MIST scores and scores in other domains were all below .50, and were not statistically significant. Conclusions: Prospective memory is impaired in schizophrenia and appears to be a unique domain of neuropsychological functioning. Future planned research will include larger sample sizes and analyses of the relationships between prospective memory and other neuropsychological domains.

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C.L. CAREY, S.P. WOODS, J.D. RIPPETH, R.K. HEATON & I. GRANT. Prospective Memory in HIV-1 Infection.

Cognitive deficits in HIV-1 infection are thought to primarily reflect neuropathophysiology within the fronto-striato-thalamo-cortical circuits. Prospective memory (ProM) is a cognitive function that is largely dependent on prefronto-striatal circuits; however, it has not previously been examined in individuals infected with HIV-1. A form of episodic memory, ProM involves the complex processes of forming, monitoring, and executing future intentions vis-a-vis ongoing distractions. The current study compared performance of 42 HIV-1-infected participants (HIV+) and 29 demographically comparable healthy controls (HC) on the Memory for Intentions Screening Test (MIST). Results showed that the HIV+ group demonstrated poorer overall ProM functioning relative to the HC sample (Cohen's $d = -0.92$). Analyses of the component processes of the MIST revealed that the HIV+ group exhibited deficits in both time- and event-based ProM, committed more 24-hour delay ProM failures, and demonstrated more ProM task substitution errors than HC. However, no group differences were observed on the recognition trial, indicating that HIV+ individuals were able to accurately retain and recognize the ProM intention when provided a structured format that minimized retrieval demands. Taken together, these findings indicate that HIV-1 infection is associated with ProM impairment that is driven by a breakdown in the strategic (i.e., executive) aspects of prospective retrieval, perhaps related to a disruption of prefronto-striatal circuits.

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J. BEAUVAIS, S. RASKIN, K. DIECKHAUS, L. MILLER & M.I. ROSEN. Prospective Memory and Adherence to Prescribed Medication.

The crucial importance of adherence to antiretroviral therapy for HIV+ individuals is well established, but patients commonly report having forgotten to take doses. Impairment in prospective memory, the ability to remember to do something in the future, may help explain forgotten doses. Despite the real-world importance of prospective memory, as of yet, there are no well validated tests available to measure it. The Memory for Intentions Screening Test (MIST) is a recently-developed test that involves asking individuals to remember to perform tasks while doing distractor tasks. As part of data

collection in a clinical trial, we are examining the relationship between prospective memory as assessed by the MIST and adherence to prescribed medication. Adherence is measured by self-report and by electronic pill caps that record bottle openings (MEMS caps). Data has been collected thus far from 60 participants infected with HIV. All have a history of substance abuse. We will describe the psychometric properties of the MIST in this population, and then present a multivariate analysis of the relationship between prospective memory and self-reported adherence, with appropriate covariates.

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Paper Session 10/10:30 a.m.–12:30 p.m.

Parkinson's Disease and Huntington's Disease

S.A. JOHNSON, J.D. LUTGRING, J.C. STOUT, C.A. ROSS, E.H. AYLWARD, D.R. LANGBEHN, J.S. PAULSEN & PREDICT-HD INVESTIGATORS OF THE HSC. Motor, cognitive, and psychomotor symptoms in individuals at-risk for Huntington's Disease.

Predict-HD is a prospective, longitudinal study investigating cognitive, motor, striatal, and psychiatric changes in presymptomatic Huntington's disease (HD). Baseline data for 400 participants (358 individuals with positive genetic testing for HD and 42 with negative results) were used to examine relationships between cognitive performance and distinct components (oculomotor, bradykinesia, dystonia, rigidity, chorea) of a standardized neurological exam. Bradykinesia and chorea were consistently associated with cognitive and psychomotor measures in individuals mutation positive for (but not diagnosed with) HD. In contrast, oculomotor symptoms were identified more often than chorea, but were related to few cognitive measures. Bradykinesia was significantly associated with performance on the Symbol-Digit Modalities Test, Stroop Interference, Trail Making A & B, WAIS-III Letter-Number Sequencing, and Verbal Fluency. Chorea was significantly associated with Verbal Fluency. A computerized version of Finger Tapping indicated that tapping speed was associated with bradykinesia and chorea. On the computerized Tone-Paced Tapping Task, the mean response rate was associated with bradykinesia, whereas variability in the rate of tapping was associated with chorea. Furthermore, performances on the Simple and Choice Response Tasks were associated with chorea, but not bradykinesia. Findings suggest that the early pathogenesis of HD may affect cortico-striatal circuits common to both specific motor and cognitive function. Alternatively, confounding of cognitive testing by motor impairment is possible. This highlights the importance of further clarifying the relationships between specific neurological symptoms and cognitive and psychomotor abilities in the earliest stages of HD.

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K. DUFF, V. VIJAY, C.T. HEY, A.F. CHISHOLM, L.J. BEGLINGER, J.C. STOUT, S. JOHNSON, J.S. PAULSEN & PREDICT-HD INVESTIGATORS OF THE HSC. Executive Dysfunction in Pre-Symptomatic Huntington's Disease.

Huntington's disease (HD) has been characterized by a number of cognitive sequelae, including executive dysfunction. Recently, Paulsen et al. (2001) reported that cognitive deficits, including executive dysfunction, were present before the onset of more manifest motor symptoms. This study will assess executive functioning in patients who are either gene-positive but pre-symptomatic for HD or gene-negative but "at-risk" for HD. Using a subset of the PREDICT-HD data, 45 gene-positive pre-

symptomatic patients were compared to 45 age-, gender-, and education-matched gene-negative "at-risk" patients on four tasks of executive functioning: Trail Making Test (TMT), Controlled Oral Word Association Test (COWAT), Stroop Color Word Test, and the Shifter task. Across all tasks, pre-symptomatic patients performed worse than controls. A MANOVA indicated significant differences between groups ($p = .01$), with largest differences on COWAT ($p = .002$) and TMT-B ($p = .05$). Trends were present for the other executive tasks. When depression was covaried, the group effects were attenuated (MANCOVA: $p = .04$; COWAT: $p = .005$; TMT-B: $p = .07$). In this sample of pre-symptomatic HD patients, many of whom are predicted to be more than 10 years from onset of motor symptoms, decrements in executive functioning were observed relative to well-matched controls. Although longitudinal evaluation of these patients as they approach manifest HD will be critical, findings suggest that neuropsychological measures may provide useful outcome measures of clinical trials in the pre-symptomatic epoch of this disease. Correspondence: *Kevin Duff, Ph.D., Psychiatry, University of Iowa, 1-308 MEB, Iowa City, IA 52242-1000. E-mail: kduff22624@aol.com*

K. HOTH, J.S. PAULSEN, L.J. BEGLINGER, E. AYLWARD, D. LANGBEHN, C. NEHL, J.C. STOUT & PREDICT-HD INVESTIGATORS OF THE HSC. Awareness of Executive Dysfunction in Presymptomatic Huntington's Disease is Associated with MRI and Psychiatric Measures.

It is well known that self-report of motor, cognitive, and psychiatric abnormalities is often inaccurate in persons with Huntington's disease (HD). Some authors suggest that unawareness of deficits may represent a disconnection of relevant feedback circuits in the brain secondary to the known frontal-striatal dysfunction in HD. The objective of the current study was to examine awareness of executive dysfunction among participants in the Predict-HD study. Participants were asked to complete a modified version of the Frontal Systems Behavior Scale ($n=353$). Discrepancies between patient and companion ratings of the frequency of patients' executive dysfunction were used to produce three groups: 1) companion ratings greater than patient ratings, 2) patient-companion agreement, and 3) patient ratings greater than companion ratings. Clinical characteristics, including neuropsychological test performance, depression, and striatal brain volume, were compared across the groups using analysis of variance. Overall, the groups differed on their neurological exam score ($F=4.192$, $p<.05$), striatal MRI volume ($F=3.47$, $p<.05$), Trail Making B performance ($F=5.83$, $p<.01$), and Beck Depression Inventory-II total score ($F=21.47$, $p<.01$). Specifically, participants with poorer awareness of deficits had smaller MRI volumes, more motor symptoms, and worse performance on Trail Making B than participants who agreed with their companions' ratings. Participants who overestimated their symptoms compared to their companions' ratings had the highest depression scores. Findings suggest that poorer self-awareness of executive dysfunction in persons at risk for HD may reflect both brain changes associated with impending disease as well as emotional responses to being at risk.

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D. ANAKI, P. DAVIDSON & M. MOSCOVITCH. Recognition Memory in Normal Aging and Parkinson's Disease: Differential Impairments for Low versus High Frequency Words.

Considerable debate exists regarding how normal aging and Parkinson's disease (PD) affect recognition memory. One factor influencing recognition is familiarity. For example, studies using low and high frequency (LF and HF) words have found a word-frequency mirror effect (ME): LF words lead to higher hit rates than HF words, whereas the opposite pattern is obtained for false alarms. Normal aging leads to subtle changes in the ME. However, the effects of PD on the ME are unknown. In the

present study we investigated whether qualitative differences would be found between normal aging and PD in the ME. Young adults, healthy old adults, and PD patients without dementia and depression studied a list of 48 words (half LF and half HF), followed by a recognition test. Normal aging led to a decrease in memory for the LF words, evidenced by lower hit and higher false alarm rates. Memory for the HF words declined little with age. In contrast, Parkinson's disease had little impact on memory for the LF words (compared to older controls), but did impair memory for the HF words. Normal aging and PD appear to have qualitatively different effects on the ME in recognition memory. These results can be explained by dual-process models of the ME, in which recollection and familiarity are proposed to play different roles in memory for LF and HF words. Specifically, normal aging disrupts recollection but leaves familiarity largely unaffected, whereas PD disrupts familiarity while relatively sparing recollection. This impairment of the PD group may be due to faulty encoding or retrieval.

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M.F. DULAY, H.S. LEVIN, A. MACIAS CHAMORRO, E.C. LAI, R.G. GROSSMAN, E.M. SOETY & M.K. YORK. Depression, Memory, and Executive Functions After Pallidotomy for Parkinson's Disease.

The purpose of this investigation was to evaluate the relationship between depression and neuropsychological test performance after unilateral pallidotomy for Parkinson's disease (PD). Depression is a common psychiatric disturbance found in a subgroup of individuals with PD, with prevalence rates ranging anywhere between 10 to 60%. Severity of depression has been found to be associated with severity of impairment on neuropsychological tests in PD, most consistently on measures of memory and executive functions. In the present study, 67 individuals with PD (38 left-sided surgery, 29 right-sided) were tested before and 3 months after surgery using the WMS-R Logical Memory (LM) subtest, CVLT, letter fluency, Stroop Color and Word Test, TMT part B and the BDI. Level of depression significantly improved after surgery: 21% were depressed after surgery compared with 33% before surgery (within subject $F[1,66]=8.28, p=0.005$). Significant correlations were found both pre- and post-surgery between depression and memory/executive functions. MANOVA indicated a significant interaction between side of surgery and level of depression post-surgery. Specifically, depressed individuals who underwent left-sided pallidotomy performed significantly poorer on the WMS-R LM (univariate $F[1,63]=4.29, p=.042$), Stroop ($p<.01$), and TMT part B ($p=.004$) compared with nondepressed left- or right-sided pallidotomy patients or depressed right-sided pallidotomy patients. Results are consonant with other studies that have found a significant impact of mood state on neurocognitive status in PD, and the results extend our knowledge of the relationship between depression and memory/executive functioning post-pallidotomy. Correspondence: *Mario F. Dulay, M.A., Neurosurgery and Psychiatry, Baylor College of Medicine, 6560 Fannin, Suite 944, Houston, TX 77030. E-mail: mariodulay@aol.com*

P.J. MOBERG, A. NEWBERG, K. CHOU, M. LLOYD, A. COLCHER, H. HURTIG, M.B. STERN, R.L. DOTY, D.P. MOZLEY, N. WINTERING, J.E. DUDA, D. WEINTRAUB & A. SIDEROWF. [99mTc]TRODAT-1 SPECT Imaging Correlates with Odor Identification Performance in Early Parkinson's Disease.

In vivo imaging of the dopamine transporter with [99mTc]TRODAT-1 (TRODAT) and olfactory testing have both been proposed as potential biomarkers in Parkinson's disease (PD). We sought to evaluate the relationship between TRODAT SPECT imaging, odor identification skills, and motor function in patients with early PD. Twenty-four patients with a clinical diagnosis of early-stage PD (mean Hoehn & Yahr stage 1.4)

underwent TRODAT imaging, UPDRS ratings off medication, and administration of the University of Pennsylvania Smell Identification Test (UPSIT). Brain images were obtained via a standardized processing protocol, and specific uptake ratios for striatal regions of interest were calculated. Correlations between the imaging indices, UPSIT scores, and UPDRS total and subscale motor scores were then calculated. UPSIT scores were highly correlated with TRODAT uptake in the striatum as a whole ($r=.67, p=0.008$). The putamen showed the strongest correlation with the UPSIT ($r=0.71; p=0.002$). The correlation between dopamine transport in the caudate and UPSIT was moderate ($r=0.45, p=0.05$), but was not significant after adjusting for multiple comparisons. Olfactory function is highly correlated with dopamine transporter imaging abnormalities in early PD. Further studies utilizing a multi-dimensional olfactory battery are warranted to determine if these relationships are unique to odor identification abilities, and whether changes over time in these two measures are also correlated.

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Paper Session 11/10:30 a.m.–12:30 p.m.

Developmental Neuropsychology: Normal and Low Birthweight Children

M. MAHONE, J. LARSON, S.H. MOSTOFSKY, M.C. GOLDBERG, L. CUTTING & M.B. DENCKLA. Gender Differences on Neuromotor Examination in Typically Developing Children.

Assessment of neuromotor function is critical to investigating the neurobiologic basis of neurodevelopmental disorders. Few studies, however, have contrasted performance of boys and girls on standardized neuromotor assessment. In the present study, integrity of the neuromotor system was assessed in 135 typically developing children (71 boys, 64 girls, ages 7-13), using the Physical and Neurological Examination for Subtle Signs (PANESS; Denckla, 1985). Gross and timed motor tasks were included. During gross motor tasks, observations were made for overflow and choreiform movements; during timed tasks, observations were made for overflow and dysrhythmia. Gross motor tasks included gaits on heels, toes, and sides of feet; tandem gait forward/backward; standing/hopping on one foot; standing heel-to-toe with eyes closed; standing with both feet together, arms outstretched with eyes closed. Appendicular coordination was assessed with finger-to-nose-to-finger maneuver. Timed tasks included a sequence of 20 toe taps, 10 toe-heel taps, 20 hand pats, and 20 finger taps, 10 hand pronate-supinate and tongue side-to-side; and 5 sequences of finger appositions—all performed bilaterally. Boys and girls did not differ in age; however, there were significant performance differences on gross motor tasks (total axial movements, bilateral overflow for gaits on toes, standing on left foot, left-sided dysmetria), and on timed tasks (left and right heel-toe taps, left side finger apposition). In all instances, girls were faster and more proficient than boys. Our results suggest that neuromotor development occurs earlier and more efficiently in girls than boys. Separate gender norms should be used in clinical assessment of neuromotor function.

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D.A. CHARAK, K.A. ESPY, G. TAYLOR, N. KLEIN & M. HACK. Growth Mixture Modeling of Academic Achievement for Children with Varying Birth Weight Risk.

Growth mixture modeling (GMM) was hypothesized to empirically identify subgroups of children from their academic achievement

growth trajectories. Children's birth weight status was expected to be a better predictor of longitudinal academic growth compared to children's SES status. 65 extremely low birth weight (ELBW; <750 g), 64 very low birth weight (VLBW; 750-1499 g), and 67 term children, N=196, were assessed at ages 7 and 10-16 years. Two separate GMMs were run for Woodcock-Johnson Broad Mathematics (BM) and Letter-Word Identification (LWI) w-scores measured at each age. Each GMM contained two growth subgroups that followed quadratic trajectories. The two BM model subgroups had different mean intercepts at age 13 (n=42; 477, $p<.01$) and (n=154; 518, $p<.01$) as did the the LWI model subgroups (n=33; 468, $p<.01$) and (n=163; 519, $p<.01$). Both BM subgroups had similar linear and deceleration of growth. Likewise, the two LWI subgroups had similar linear and deceleration of growth. Birth weight significantly predicted both BM subgroups and both LWI model subgroups. Prevalence of ELBWs was greater in both poorer performing subgroups: BM (n=26/42) and LWI (n=18/33); it was lowest in both higher performing subgroups: BM (n=39/154) and LWI (47/163). While SES was not a significant predictor of BM growth, it was for LWI. Both GMMs had a similar amount of both lower and higher SES children across each higher and lower performing achievement subgroup. GMM is a potent method to determine patterns of variability in heterogeneous samples. Higher and lower performing academic subgroups were derived empirically from this technique. Even over an extended age range, a biologically-based at-risk characteristic of children was a better predictor of academic achievement growth than was a socially-based at-risk indicator.

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S. WIEBE, D.A. CHARAK, J. MARTIN & K.A. ESPY. Individual Differences in Impulsivity and Cognitive Flexibility in Preschool Children, and Relations with General Executive Function.

The preschool years are an important phase in the development of executive function (EF). In recent years, a variety of tasks have been developed that index different aspects of EF (e.g., cognitive inhibition, working memory). However, the relations between these tasks and the structure of the general construct of EF are as yet poorly understood, particularly in preschool children. The present study focuses on two specific child characteristics, impulsivity and cognitive flexibility, and how they relate to EF more generally. A battery of EF tasks including a measure of impulsivity (latency to touch a prohibited gift), cognitive flexibility (spatial reversal; Kaufmann, Leckman, & Ort, 1989), and other tasks requiring working memory and cognitive inhibition, was administered to 242 preschool children (112 male, 130 female; mean age=4 years, range 2;4 - 6;0). Composite scores reflecting general EF were constructed based on confirmatory factor analysis; these did not include the impulsivity or cognitive flexibility measures (Espy et al., in preparation). These com-

posite scores were used as dependent measures in analyses of groups of children differing in impulsivity and cognitive flexibility. Individual differences in impulsivity were related to general EF, controlling for age: $F(1, 239) = 24.19, p < 0.0001$. Children who waited in the face of a delay had higher EF composite scores than did children who were unable to wait. In contrast, cognitive flexibility was not related to general EF, as children who could and could not shift set did not differ in their EF composite scores: $F(1, 239) = 0.12, p > 0.70$. These findings suggest that impulsivity may have a more fundamental relation to EF than does cognitive flexibility, at least in the preschool years.

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A.I. BUIZER, L.M. DE SONNEVILLE, M.M. VAN DEN HEUVEL - EIBRINK & A.J. VEERMAN. Behavioral and Academic Sequelae after Chemotherapy for Childhood Cancer.

Behavior and academic performance are reported in two groups of children after chemotherapy for non-CNS cancer: acute lymphoblastic leukemia (ALL) and Wilms (kidney) tumor (WT). Treatment for ALL includes CNS prophylaxis, currently existing exclusively of chemotherapy in Dutch protocols. WT patients are treated with non-CNS chemotherapy in addition to a nephrectomy. Parent- (Child Behaviour Checklist [CBCL]) and teacher- (Connors Teacher Rating Scale [CTRS] and School Achievement Level [SAL]) questionnaires were completed for 28 ALL patients, 36 WT patients, 37 siblings and 98 healthy schoolchildren (controls). Children were 4 to 18 years of age at evaluation and patients were at least one year after treatment. Mean age did not differ between groups. More ALL patients scored in the clinical range on the CBCL (17.9 %) compared to WT patients (5.6 %), siblings (5.4 %) and controls (4.1 %); odds ratio for ALL patients versus controls = 5.1 (95% CI 1.3-20.6, $p = 0.022$). Teachers reported more problem behavior on the CTRS in ALL patients compared to the other groups, but group differences were not significant ($p=0.10$). More ALL patients had repeated a grade compared to the other children (30.8% vs 9.4% of controls, odds ratio = 4.30, 95% CI 1.46-12.64, $p = 0.008$) and at primary school age their performance compared to classmates (SAL) was lower ($p < 0.001$). Parent- and teacher reports indicate that behavioral and academic sequelae are present after childhood ALL treated with chemotherapy only, while WT patients and siblings of cancer patients are rated similarly to healthy controls.

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FRIDAY AFTERNOON, FEBRUARY 4, 2005

Poster Session 8/1:00-3:00 p.m.

Aphasia/Stroke

T. KRETZMER, G.R. JEWELL, H.M. MURPHY, A. MEIDINGER, S. LIEM, A. WOODS, V. MARK, B. ANDERSON, A. CHATTERJEE & M. MENNEMEIER. Understanding Perceptual Deficits Following Right Hemisphere Injury.

Right hemisphere injury (RHI) alters perception of stimulus intensity. Stevens' (1970) Power Law holds that perceived intensity is a power

function of physical intensity. Depending on the sensory continuum, power functions yield a wide range of exponents. Stevens argued that the size of the exponent reveals the growth curve of the function. Exponents >1 have a positively accelerating curve while exponents <1 have a negatively accelerating curve. In most cases, RHI decreases the normal exponent's size, but only continua with exponents <1 have been tested. We know certain types of response bias (perseveration, categorization, & contextual effects) lower exponents following RHI; however, we can learn if RHI also alters the underlying growth curve of power functions by testing patients on continua with exponents >1 . RHI patients (N=15) were compared to age matched NC (N=49) on continua with exponents >1 . Subjects rated intensity using numbers between 10

and 99. All data were log-transformed and estimates were compared to objective measures of intensity using simple linear regression. Slopes and y-intercept values were compared between groups. Only 3 continuum produced exponents >1 in normal subjects (reflectance, temperature, salt), indicating that exponent size is not a fixed entity as Stevens surmised. RHI patients had decreased exponents relative to NC in all three continua - reflectance ($t(70)=2.82$, $p=.006$), left-handed temperature ($t(62)=3.06$, $p=.003$) and salt ($t(62)=4.2$, $p<.001$). Results indicate that response bias, rather than a change in the growth curve, alters power functions following RHI. Specifically, RHI patients appear to perseverate, categorize, and rely on stimulus context to compensate for perceptual deficits.

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L.J. ALTMANN, C.A. MORELLI, D.B. EFROS & D. MULLIN. Etiology of the Paraphasias of Older Adults in a Constrained Sentence Production Task.

Individuals with language pathologies often substitute related words for those they intend to include when speaking. These errors are also common in the responses of older adults in constrained sentence production tasks. Our objective was to determine if older adults' semantic substitutions and morphological alterations of stimulus words were related to individual differences in working memory (WM) or language ability. 48 healthy older adults (>60) completed a battery of 8 cognitive and linguistic tasks including the WAIS III vocabulary test, a word-reading task and the 2-back, a WM task activating frontal and parietal lobes. Participants also completed a sentence production task in which they produced sentences from 3 stimulus words, a transitive verb and 2 nouns differing in animacy. Dependent variables included the proportion of sentences produced in which stimulus nouns or verbs were replaced by semantic paraphasias (e.g., grown \rightarrow raised) or morphological alterations (e.g., scientist \rightarrow science, disgusted \rightarrow disgusting). These were analyzed using stepwise regressions in which age was allowed to enter first. 2-back accuracy accounted for 24% of variance in both noun and verb substitutions. Vocabulary scores contributed an additional 17% of the variance to paraphasias affecting nouns. Word-reading accounted for about 30% of the variance in both noun and verb morphological alterations. Further, age accounted for 10% of the variance in both types of verb substitutions. Less efficient fronto-parietal connections supporting WM, measured by 2-back accuracy, contribute strongly to inaccurate lexical selection. Moreover, increasing age may selectively impair verb access and use, without affecting nouns; whereas, differences in semantic ability may first affect noun use. Interestingly, these findings suggest that semantic paraphasias may be partially due to WM deficits. Thus, therapy targeting WM deficits may also increase the accuracy of lexical selection.

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L.J. ALTMANN, C.A. MORELLI, D.B. EFROS & D. MULLIN. Etiology of Grammatical Errors by Older Adults in a Constrained Sentence Production Task.

Aphasics often omit function words such as determiners and auxiliary verbs and have difficulty using verbs with noncanonical argument structures. These types of errors have also been elicited from older adults in constrained sentence production tasks. We hypothesized that grammatical errors may be heterogeneous in etiology. Thus, the objective of this study was to test whether different types of grammatical errors correlated with different cognitive and linguistic abilities. 48 healthy older adults (>60) completed a constrained sentence production task and a battery including: vocabulary tests (Shipley, WAIS-III), word reading, and 5 working memory tasks, including the 2-back. The sentence

production task required participants to use 3 stimulus words, a transitive verb and 2 nouns differing in animacy, in a sentence. Verbs included agent-theme verbs with regular morphology, noncanonical theme-experiencer verbs (e.g., bored) and irregular past participles (e.g., hidden). The proportion of sentences including omitted determiners, omitted auxiliary verbs and argument structure errors were compared to scores on linguistic and cognitive tasks. Omitted determiners were predicted by age and 2-back accuracy ($r^2 = .30$). Omitted auxiliary verbs were predicted by 2-back accuracy and vocabulary scores ($r^2 = .36$). Argument structure errors were predicted by vocabulary scores ($r^2 = .48$). These results suggest that determiner use relies strongly on working memory resources and may be vulnerable with increasing age. In contrast, using auxiliary verbs requires both working memory and semantic knowledge, but using argument structure correctly requires only semantic knowledge. These findings suggest that these three types of grammatical errors result from processing impairments in different cognitive and linguistic systems and, thus, may require different therapeutic approaches.

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K.B. WOMACK, D.L. KENDALL, J.C. ROSENBEEK, A.R. RIESTRA, H. QIN, K. REID & L.J. GONZALEZ ROTH. Effects of Age and Race on Aphasia.

Embolic stroke is associated with a greater likelihood of posterior rather than anterior localization, is more common with advancing age and is more frequent in Caucasians than in African-Americans (AA). This retrospective study looked at the incidence of stroke and aphasia type in individuals who were above the age of 45. We predicted that nonfluent aphasia will be more common in younger patients while fluent aphasias will be more common in older individuals and nonfluent aphasia will be more common in AA than Caucasian regardless of age. We conducted a retrospective analysis of a clinical database of 422 individuals with left hemisphere stroke. Individuals who were included in this study were over 45 years old, had an ischemic stroke, were less than 3 months post onset and had an abnormal Western Aphasia Battery Aphasia Quotient (WAB-AQ) (less than 94.3). Global aphasics were excluded. Individuals were divided into two age groups (young, 45-65 and old, 66+). Fluent or nonfluent was based on the fluency subtest score from the WAB (nonfluent ≤ 5 , fluent ≥ 6). 230 individuals met inclusion criteria (34 AA, 125 Caucasians, 5 females and 224 males). Mean WAB-AQ (Kertesz, 1982) was 61.46 (SD 24.16, range 8-93.8). Mean time post onset (months) was .57 (SD .57, range 0-2.93). Aphasia Type x Age: 216 individuals met inclusion criteria for this analysis ($n=86$ young and $n=130$ old). Fisher's Exact Test Results showed $p = .8885$ Aphasia Type x Race: 149 individuals met inclusion criteria for this analysis ($n=29$ African American and $n=120$ Caucasian). Fisher's Exact Test Results showed $p = .8341$ We failed to find an association between either age or race and aphasia type which is incongruous with previous reports. Perhaps low sample size, the predominance of males in our sample or the underlying associations upon which our hypotheses were based contributed to the lack of significance. This study should be replicated with more individuals and balanced for gender.

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G.A. MOLLET, R.P. WALTERS, D.W. HARRISON & P.S. FOSTER. Alexia without Agraphia: A Traditional vs. A Non-Traditional Case.

Alexia without agraphia is an acquired anatomical disconnection syndrome where the ability to write is intact, but the ability to read is lost.

The syndrome arises from a disconnection between the occipital regions of both cerebral hemispheres and the angular gyrus of the left cerebral hemisphere. The angular gyrus must be functionally intact but devoid of visual input from the occipital lobes for the disorder to appear. The present research establishes the existence of an atypical lesion within the visual projections producing alexia without agraphia but without the traditional cognitive deficits that occur with the classic syndrome. Two patients, who were referred for neuropsychological evaluation, completed a Neuropsychological Interview, a Neurobehavioral Status Exam for Syndrome Analysis, the Dynamometer Grip Strength Perserative and Fatigue Test, a Sensorimotor Screening, and a small battery of neuropsychological learning and memory measures. Patient 1, J.J., demonstrated alexia without agraphia concurrent with severe learning and memory deficits. He was diagnosed with a space occupying lesion in the posterior left hemisphere. Patient 2, G.L., demonstrated alexia without agraphia but performed at an average to high average level on tests of verbal learning and memory. It was concluded that the patient had a cut in the visual pathway to the left hemisphere causing a disconnection between the occipital lobe and the angular gyrus. The contrasting cases provide evidence for multiple pathologies for alexia without agraphia. The cases also demonstrate the utility of functional cerebral systems testing to diagnosis neurological damage.

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R.P. FUCETOLA, L.T. CONNOR, J. PERRY, P. LEO, F. TUCKER & M. CORBETTA. Language Competence, Semantics and Negative Mood Predict Functional Communication in Acquired Aphasia.

Aphasia due to stroke is associated with limitations in communication activities such as speaking on the telephone, reading a menu, understanding signage, and many other functional tasks. Whereas overall language competence (e.g., oral expression, auditory comprehension) is directly related to communication ability, the contribution of cognitive and psychosocial factors is less understood. In this study, patients with aphasia at various time points post-unilateral left hemisphere stroke ($n=57$; M age=57.6 years, 31 men, 26 women) were administered neurocognitive, aphasia diagnostic (BDAE), mood and functional communication assessments. Multiple regression analyses controlling for weeks post-stroke indicated that predictors of functional communication (Communication Activities of Daily Living-2nd Edition; CADL-2) were (1) overall language competence as measured by the aphasia exam, (2) semantic processing as measured by a semantic judgment task in the aphasia exam, (3) sadness/anger subscales of a nonverbal analog of mood measure, and (4) reading comprehension. The model accounted for 94% of the variance in CADL-2 score. Phonologic processing, verbal agility, written language, ideomotor praxis, fatigue, visual working memory, and other nonverbal cognitive functions were not significant predictors of functional communication. These findings suggest that interventions specifically aimed at semantic-level processing deficits, reading and negative mood states may be promising to improve functional communication in patients with aphasia.

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J.B. WILLIAMSON, D.L. NYENHUIS, L. PEDELTY, S. BYRD, M. JHAVERI & P.B. GORELICK. Lesion Location and Behavioral Disinhibition: Posterior Fossa Contributions to Quantifiable Behavioral Change.

Among the most common changes in neurobehavioral status in vascular cognitive impairment (VCI) are alterations in functions commonly discussed under the rubric of executive functions. Assessment of executive functions can be challenging and is currently an area of intensified focus in VCI. Executive dysfunction is often explained as a direct result of altered connectivity or lesion to the frontal lobes. Recently, the

contribution of cerebellar systems to executive processes including emotional disinhibition has received additional attention in both human and comparative neuroscience. The purpose of this epidemiological exploration is to examine the impact of lesion location and severity to behavioral change. 108 participants, 3-6 months after ischemic stroke, were examined using the informant version of the Frontal Systems Behavior Scale (FrSBe). Change scores were calculated from the premorbid estimate and post-stroke report for the Disinhibition, Apathy, and Executive subscales. Stroke locations were determined by a neuroradiology fellow/neuroradiologist team, and included 29 posterior-fossa lesions, 12 thalamic lesions, 55 subcortical lesions, and 38 cortical lesions. Lesion identification was completed with a high-resolution structural MR scan including coronal T1 and T2-weighted images of the entire brain. Regression analyses demonstrated a relationship between posterior fossa lesions and the FrsBe Disinhibition subscale score ($p = .014$). Results are discussed within the context of research examining cerebellar contributions to behavioral and executive control. Further neuroanatomical subregion analyses that specify cerebellum vs. brainstem infarcts are explored. Supported by NIA (R01 AG17934), PI: PBG (2000-2003) & DLN (2003-present)

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M.C. WILDE & G. VINE. The Predictive Validity of the RBANS and MMSE in Acute Stroke.

The ability of the Mini Mental Status Examination (MMSE) and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) to predict inpatient rehabilitation outcome after acute stroke was examined. It was hypothesized that the RBANS indices would have better predictive capacity than the MMSE. Ninety seven ischemic and hemorrhagic stroke patients undergoing inpatient rehabilitation served as subjects for this study. All patients were rated on the Functional Independence Measure (FIM®) within 48 hours of admission to rehabilitation and again at discharge. The MMSE and RBANS were administered at the beginning of their rehabilitation stay. Stepwise multiple regression analysis was used to analyze the data. The RBANS Visual Spatial/Constructional index significantly predicted the discharge FIM® Motor Subscale ($R^2 = .12$). The RBANS Delayed Memory Index significantly predicted the discharge FIM® Cognitive subscale ($R^2 = .10$). The analyses were repeated using FIM® Motor and Cognitive subscale change scores which were calculated by subtracting the admission from the discharge scores. The results disclosed that the RBANS Visual Spatial Constructional Index significantly predicted both the FIM® Motor and Cognitive change scores; ($R^2 = .076$ and $.12$ respectively). The relationships were modest and only the RBANS Visual Spatial/ Constructional and Delayed Memory Index scores predicted acute rehabilitation outcome. The MMSE or the other RBANS measures did not make significant contributions to outcome prediction. The potential importance of visual spatial and visual constructional skills as a moderator of rehabilitation outcome in stroke is also discussed.

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A.E. SPEIZER, R.M. LAZAR, R.S. MARSHALL, J. PILE-SPPELLMAN & G.L. BERNARDINI. Parallelism in Amusia and Aphasia in a Professional Conductor Following Left Parietal Hemorrhage.

Our goal was to determine whether degradation of elementary music skills parallels that of language in a professional musician with Wernicke's aphasia. The patient was a 36 year-old right handed male with aphasia after a left parietal intracerebral hemorrhage from an AVM. A conductor with a major orchestra, he was found to have a dense Wernicke's syndrome on the Boston Diagnostic Aphasia Examination. Lan-

guage was also assessed with matching-to-sample tasks using auditory and visual stimuli. In comparable tests of musical skills, he was assessed on symbolic matching tasks with auditory and visual music-related stimuli. He then underwent craniotomy for removal of the clot and the AVM, and was reassessed for language and music function. Before surgery, he could match simple language stimuli on the basis of common physical properties, demonstrating understanding of our matching paradigm. He had severe impairment in symbolic matching of printed words with pictures, and dictated words with pictures or printed words. Similarly, he was unable to match musical notation to locations on the piano, music selections to pictures of composers, or match dictated names of notes to either printed notes on staves or to corresponding piano keys. Following surgery, his language improved dramatically, along with a corresponding change in musical skills. The present study showed that loss of elemental musical skills parallels that of language in posterior aphasia. These findings suggest that music at a professional level and language are comprised of a symbolic representational system subserved by a common neuroanatomical substrate.

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J.D. JENKS KETTMANN, L.J. BEGLINGER & J.D. BAYLESS. Pre and Post Right MCA Stroke RBANS in a 22-year-old.

The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) is a relatively new, but widely used screening battery. There are no published studies using the RBANS pre and post-stroke. We present the case of a 22-year-old woman seen for an outpatient evaluation to assess neurocognitive functioning/IQ given a history of numerous psychiatric hospitalizations for self-injury, suicidal ideation, and mood lability. Three weeks later, the patient sustained a right embolic stroke (from a DVT) in the anterior branch of the middle cerebral artery. MRI revealed increased diffusion-weighted signal in the posterior right frontal lobe and T1 hyperintensity in the anterior insula suggesting hemorrhage. MRA showed complete right internal carotid occlusion. The patient was readministered the RBANS (alternate forms), as well as a full neuropsychological battery 3 weeks post-stroke. Sequelae included left hemiparesis and expressive aprosodia. The RBANS demonstrated sensitivity to post-stroke changes despite pre-stroke cognitive impairments and a complex psychiatric overlay. Subtest performance tapping cognitive domains unaffected by the stroke remained relatively unchanged. In contrast, the Visuospatial/Constructional index proved sensitive to the patient's right hemisphere dysfunction, as post-test scores significantly declined, with Line Orientation falling from normal to defective levels; these findings were associated with decline in standard neuropsychological measures (WAIS-III Block Design, Trails A/B and Rey Complex Figure drawing). Current findings demonstrate the sensitivity of the RBANS in an individual case with pre-stroke cognitive impairments and notable psychiatric complications.

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M.Z. CIAMPITTI, D.L. KENDALL, J.G. MERINO, H. QIN, K. REID, J. ROSENBEEK, K.B. WOMAK, A.R. RIESTRA, S. SILLIMAN & L.J. GONZALEZ-ROTHI. Changes in the Distribution of Aphasia Over Time After Stroke.

Kertesz (1979) reported the distribution of aphasia subtypes in a population of neurologically impaired patients using the Western Aphasia Battery (WAB). Because of potential selection biases, it is not known if this distribution is generally applicable to stroke patients. This study aimed to determine whether a series of stroke patients have the same distribution and the effect of time on this distribution. 222 right-handed patients with unilateral left hemisphere stroke consecutively referred to a Speech Pathology service were divided into "early" (0-6 weeks, n=154)

and "late" (>6 weeks, n=68) groups based upon time between onset of stroke and WAB administration. Subjects were categorized by aphasia subtypes and the distribution was calculated. We compared the proportion of patients within a given subtype using two-tailed hypothesis testing (z-scores). In the combined population, and in the "early" group, the distribution of subtypes was similar to that reported by Kertesz. However, the proportion of patients with Wernicke's aphasia was significantly lower in the "late" vs. the "early" group. The proportion of patients with Broca's and Global aphasias was higher in the "late" group compared with the "early" group. No significant difference was found between other subtypes. The distribution of aphasia subtypes mimics Kertesz's in the sub-acute period. However, in the later recovery group a different distribution was seen with fewer cases of Wernicke's aphasia and proportionately more cases of Global and Broca's aphasia. The change in distribution has prognostic implications and is consistent with the evolution of aphasia previously reported.

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V.J. HONN & R.F. WHITE. Neuropsychological Profiles of Individuals with Aphasia.

The purpose of the current study is to characterize the neuropsychological test performance of individuals with aphasia. Historically, research on persons with aphasia has reported minimal information regarding cognitive abilities outside the language domain. The current study includes 71 participants with mild to severe aphasia who were assessed through the Harold Goodglass Aphasia Research Center. Participants completed a standardized battery of neuropsychological tests which was developed to assess executive function, verbal and visuospatial ability, psychomotor function, memory, and mood among individuals with significant language deficits. As a group, participants demonstrated difficulties in the areas of sustained visual attention, visuospatial integration, delayed visual recall, delayed recognition, and fine motor dexterity when compared to norms for non-aphasic individuals. In contrast, participants tended to perform in the average range on measures of previously learned verbal information, non-verbal problem solving, immediate visual recall, and fine motor speed. Qualitative indicators of executive dysfunction, including perseveration, contamination, and loss of set were observed frequently in this sample. Participants tended to deny substantial mood disturbance on a nonverbal measure of current mood states. Across measures, clear variability was noted, suggesting that individuals with aphasia may present with a broad range of cognitive strengths and weaknesses. Sample cases will be presented to illustrate patterns of cognitive performance which may be noted among individuals with aphasia. These results indicate that valid, comprehensive neuropsychological assessment can be completed with most persons who have aphasia. Suggestions for modifying standard neuropsychological tests and preliminary normative data will be presented.

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M. GREENWALD, B.J. SMITH & S.M. BOWYER. Phonological Dyslexia Following Stroke Measured by MEG Utilizing MR-FOUSS.

Stroke survivors with phonological dyslexia have impaired phonological recoding of print to sound. Whole-word reading is relatively intact, though marked by visual and morphological errors. This syndrome is often associated with left MCA lesions affecting the angular and supra-marginal gyrus and the superior temporal lobe. It remains unclear how left frontal versus posterior brain regions, and the right hemisphere, contribute during the time course of visual word recognition and phonological recoding. Functional analyses of brain activation underlying this

disorder were conducted using MEG, which provides millisecond temporal resolution and millimeter spatial resolution. We determined the current density mapping response using MR-FOCUSS in a patient (MM) with phonological dyslexia resulting from left MCA lesion, and in 8 control subjects. MEG responses were recorded during a speeded visual matching task in which participants made same/different judgments and responded via button press. Matching of words versus nonwords versus false font strings was compared. Accurate performance in each condition required encoding of object or abstract letter identity ("what") and location within each string ("where"). Like the control subjects, MM demonstrated left frontal lobe activation (Broca's area) during word matching and not in nonword matching. Bilateral temporal lobe activation was observed at similar latencies in MM's word versus nonword matching. During word matching MM's inferior parietal region was significantly less active on the left than the right, but left supramarginal gyrus was strongly activated during nonword matching. Results support the utility of MEG for imaging regions of brain activation and re-activation during reading.

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M. GAIEFSKY, A.B. MOORE, K.M. MCGREGOR, K. WHITE, C.E. WIERENGA, K.K. PECK, K. GOPINATH, A. WABNITZ, A. RAYMER, L.J. GONZALEZ ROTH, R.W. BRIGGS & B. CROSSON. fMRI of Language Rehabilitation: Seeing versus Saying.

Nonfluent aphasics completed an object-naming task during fMRI. Study objectives sought to examine neural substrate changes associated with language treatment and to examine two types of deconvolution analyses. Two subjects were scanned prior to, and at completion of, an experimental word retrieval treatment program. Sixty items were administered in an event-related paradigm. Subjects viewed line drawings and named the objects aloud. Data were acquired with a 3T GE Signa scanner using a 1-shot spiral gradient echo sequence. Data were examined with deconvolution analyses that were time-locked to two image types: (1) image of stimulus delivery and (2) image of response production. Clusters of activity were isolated and quantified for pre- versus post-treatment activation for both types of deconvolution analyses. Observed neural changes correlated with changes in behavior. The subject with a more posterior lesion demonstrated greater frontal activity pre-treatment and greater right posterior activity post-treatment. For the subject with a more anterior lesion, the unaffected hemisphere was more engaged prior to treatment, with little contribution from the dominant hemisphere. Following treatment, both frontal and posterior neural activity was observed in the dominant hemisphere suggesting perilesional recovery. Results suggest that, for overt object naming, use of a response-based deconvolution may fail to reveal brain regions clearly active in stimulus-based deconvolution (e.g., medial and lateral frontal cortices). Examination of the hemodynamic response commencing with response production may fail to reveal all neural substrates across the object-naming process from stimulus encoding through response production. Future studies should further evaluate this methodological consideration.

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S.A. LEON, J.C. ROSENBEK, B. HIEBER, G.P. CRUCIAN, A.D. RODRIGUEZ, T.U. KETTERSON, M.Z. CIAMPITTI, K.M. HEILMAN & L.J. GONZALEZ ROTH. A Phase I Study of Interventions for Expressive Apraxia.

To replicate the design of previous studies by these authors investigating the effects of two treatments for expressive apraxia with a larger number of participants. The fourteen participants, five women and nine men, were all right handed, native English speakers. Thirteen participants had suffered a right hemisphere stroke and one had sustained a

traumatic brain injury. All had resulting expressive apraxia ranging from mild to severe. Trained raters determined presence of apraxia by judging participants performance on two emotional communication batteries. A single subject ABAC design, with replication across fourteen participants, was employed. Measures of sentence production using treated and non-treated emotions were completed during baseline and treatment phases. Sentences were scored for accuracy by a trained rater blind to time of testing and analyzed visually and statistically. Visual analysis judges determined that six of the fourteen participants showed treatment effects for both treatments and another six showed effects for at least one treatment. Two were judged to show no effect for either treatment. The results of statistical analyses ranged from a negative effect, -.22, to a substantial positive effect, 11.518. The statistical analysis results were consistent with the visual analyses. Due to a relative paucity of treatment studies investigating expressive apraxia, these data are among the first to suggest that apraxia is amenable to behavioral treatments. Future directions include refinement of the treatments and determination of who is most likely to respond to and benefit from the treatments. Maintenance of treatment effects also needs to be established.

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S. ZINN. Differential Impairment of Executive Functions in Cerebrovascular Disease.

The mechanisms of cerebrovascular disease can affect the executive functions in several ways. The ischemic death of neural tissue at diverse points in the arterial tree can affect various aspects of performance on neuropsychological tests assessing executive functions. Transient loss of blood supply from narrowed arteries can result in patchy white matter changes that may affect processing speed, efficiency or flexibility. Functionally, impairment of executive functions may reduce the capacity for self-care in cerebrovascular patients, so we sought to identify deficits that are correlates of cerebrovascular disease to help optimize treatment strategies. We studied the relationship between cerebrovascular disease symptoms and neuropsychological indices of executive functioning in patients presenting successively to acute care for evaluation of possible stroke. Of 45 patients enrolled, 30 were diagnosed with stroke and 15 with transient ischemic attack. Patients were rated for symptom severity using the NIH Stroke Scale and categorized for extent of white matter disease burden based on MRI. Neuropsychological test scores examined were: Digit Span Backwards (DSBack), Switching Trial of DKEFS Trailmaking subtest (Trails4), Switching Trial of DKEFS Design Fluency subtest (DFlu), Symbol Digit Modalities Test (SDMT), and WAIS-III Picture Arrangement (PicArr). Significant Pearson correlations with stroke severity were found for DFlu ($p=0.05$), PicArr ($p<0.01$), and SDMT ($p<0.05$). Neuropsychological indices not related to stroke severity were related to white matter disease: DSBack ($p=0.05$) and Trails4 ($p=0.001$). We conclude that aspects of executive functioning are differentially susceptible to the various ischemic mechanisms of cerebrovascular disease, and that patients without stroke may have executive dysfunction.

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K. GREENE & J. DONDEERS. Topographical Heading Disorientation: A Case Study.

We present an unusual case of a patient who suffered from large bilateral medial occipital lobe infarcts with resulting deficits in peripheral vision and topographical orientation. The patient is an 81-year-old man who was diagnosed with bilateral ischemic infarctions in the medial occipital lobes. He was referred for a neuropsychological evaluation approximately five months following the cerebrovascular accident due to ongoing difficulties with vision and orientation within the environment.

Considering the vastness of the patient's infarction and the neuroanatomical structures that it impacted, it would have been expected that the patient would have demonstrated striking cognitive impairments, including prosopagnosia, achromatopsia, and/or color agnosia. Unlike many previous case studies of occipital lobe insults, our patient exhibited intact memory, visual-object recognition, and visuospatial skills. However, he was unable to create a mental picture in his head of his environment, which interfered with his ability to navigate at home and in the community. This patient's clinical presentation is consistent with topographical heading disorientation as described by Aguirre and D'Esposito (1999). This case is significant in the fact that it demonstrates the importance of completing a thorough neuropsychological evaluation in order to define the presence or absence of cognitive impairments that can impact daily functioning.

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A.S. PRESTON, E.E. DIMOULAS, T.C. PICKETT, A.B. MOORE, E. KUX, K.S. FABRIZIO, B. STIDHAM & L.J. GONZALEZ ROTH. Effects of Stroke Education on Mood.

The association between stroke and depression has been established; less is known about effective psychological treatment delivered after stroke. We evaluated self-reported mood symptoms and presence of depression following an educational intervention focused on stroke sequelae without specific psychotherapeutic components. We hypothesized participants would exhibit decreases in depressive symptoms due to increased knowledge of stroke and stroke-related limitations, as well as management techniques for use in daily functioning. Five chronic stroke participants were assigned to a ten-week educational series as part of a larger pilot study. Participants were all diagnosed with major depression by a clinical psychologist. Educational modules were delivered in lecture format by health care professionals covering topics including: neuroanatomy, assistive devices, medication management, community support options, and emotional/sexual effects following stroke. To assess the effects of stroke education on self-reported mood, patients completed the Geriatric Depression Scale (GDS) at intake, during baseline, and after didactic presentations. GDS-reported symptoms of depression demonstrated small improvement in four participants, decreasing on average by 2.4 points (range: 0 - 7.2). Mild reductions in GDS-rated symptoms were observed over the course of this intervention. Stroke education may assist in alleviation of depression, although additional interventions may yield greater improvement in mood. Further, it is possible that GDS scores did not fully capture change in mood for these participants as reflected by study compliance, participation, and reported participant satisfaction following each lecture. These subjects will be reassessed at 1- and 3-months post intervention to allow assessment of long-term effects of the study.

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Pediatric Assessment

S.D. GREENAWAY, C.W. HUGHES, C.H. SILVER, G.J. EMSLIE, B.D. KENNARD & C.M. CULLUM. Executive Functioning and Motor Activity in Children with Major Depressive Disorder with and without Comorbid ADHD.

In clinical settings, depression and ADHD frequently co-occur, but research has typically not examined the relative impact of these comorbid diagnoses. This study compared children with MDD to those with MDD/ADHD on objective measures of attention and motor activity and

parent report of executive functioning. We hypothesized that children with MDD/ADHD would show greater impairments on all measures compared to children with MDD. Ninety-six children (ages 7 to 17) were classified as MDD or MDD/ADHD based on K-SADS-P/L structured diagnostic interviews followed by consensus diagnostic review. Attention was measured using a continuous performance task, motion was simultaneously monitored with a computerized infrared optical motion sensor, and executive functioning (EF) was assessed with the Children's Executive Functions Scale. The MDD/ADHD group displayed poorer performance than the MDD group on five out of six attention measures, two out of six motion measures, and four out of five subscales on the parent report of EF, as well the total score. Age differences were found, as well. Discriminant function analysis using measures of attention, motion, and EF correctly identified 43 out of 51 (84.3%) of the cases of the MDD group and 33 out of 44 (75%) of the cases of the MDD/ADHD group with a significant kappa ($p < .001$). Objective measures of attention and motion and a parent report of EF can be used to help differentiate children with MDD alone from those who have comorbid ADHD. This distinction is expected to have implications for prognosis and treatment.

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M. MAHONE & J.C. HOFFMAN. Behavior Ratings of Executive Function Among Preschoolers with ADHD.

The Behavior Rating Inventory of Executive Function-Preschool Version (BRIEF-P; Gioia et al., 2003) was developed to assess executive function (EF) behaviors in children ages 2 to 5 years. We compared parent ratings of 25 preschool children with ADHD to 25 age-, sex-, and SES-matched controls from the BRIEF-P standardization sample. Children with ADHD were rated significantly higher than controls ($p < .005$) on all five primary scales (Inhibit, Shift, Emotional Control, Working Memory, Plan/Organize), and on all four indexes (Inhibitory Self Control, Flexibility, Emerging Metacognition, General Executive Composite). The largest effect sizes were for the Working Memory ($d = 2.4$) and Plan/Organize ($d = 2.1$) scales. The five primary scales were significantly intercorrelated (all $p < .01$, mean correlation $r = .63$). Within the ADHD group, the General Executive Composite (GEC) was significantly correlated ($p < .01$) with the Conners' Parent Rating Scale Hyperactivity ($r = .65$), and ADHD Index ($r = .81$) scales, but only moderately correlated with an estimate of IQ ($r = .39$). The GEC was minimally correlated with performance-based measures of motor/executive control, including manual imitation ($r = -.13$), graphomotor control ($r = .10$), digit span ($r = -.01$), motor persistence ($r = .01$), and inhibition ($r = -.13$); and was moderately correlated with measures of selective ($r = -.35$) and sustained ($r = -.38$) attention. Similar to the original BRIEF, the BRIEF-P is sensitive to symptoms of ADHD, and appears to measure different elements of EF than those tapped by performance-based measures.

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A. MAERLENDER. Psychometric Tests and Central Auditory Processing Disorders (APD): A Pilot Study of Diagnostic Efficiency.

Objective: To determine functional use of psychometric tests in identification of APD's. Hypothesis 1: that psychometric tests would differentiate those with diagnosed APD's from those ruled-out. Hypothesis 2: that some set of psychometric tests could provide diagnostic efficiency independent of the auditory testing. 36 children, ages 7-14 were followed after APD testing with a battery of psychometric tests by doctoral level clinicians. A series of MANOVAs were conducted to determine tests that accounted for significant variance between the two groups (APD

diagnosis, $n=22$; noAPD diagnosis, $n=14$). Tests that accounted for significant variance ($p = .01$) were entered into a logistic regression. Sensitivity, specificity, positive predictive power (PPP) and negative predictive power (NPP) were calculated. Six tests accounted for significant variance between groups at the .01 level: Wechsler Intelligence Scale for Children, 3rd Ed. (WISC-III) Digit Span Forward, WISC-III Coding, WISC-IV Letter Span Nonrhyming, Comprehensive Test of Phonological Processing (CTOPP), Rapid Digit Naming, Clinical Evaluation of Language Fundamentals, 3rd Ed. (CELF-3), Recalling Sentences, and CELF-3 Concepts and Directions. Logistic regression identified the Digit Span Forward subtest (DF) as providing the most diagnostic utility, with CTOPP Rapid Digit Naming a strong contributor. In the final model, the sensitivity of DF was 85.7%; and the specificity was 71.4%. Positive predictive power (PPP) was 83% and negative predictive power was 77%. The overall accuracy rate was 80%. This study provided strong evidence that psychometric tests alone can differentiate referred children who are diagnosed APD from those who do not meet APD diagnostic criteria. Further, diagnostic efficiency for the DF score from the WISC-III was robust.

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I. BORODYCHUK & S. KISELEV. Age-related differences in neuropsychological profile in preschool children.

Goal was to reveal the age-related differences in neuropsychological profile in normally developing children at 5 and 6 years of age. We studied 24 children at 5 years of age and 25 children at 6 years of age. Child neuropsychological assessment developed in Moscow State University was used. This assessment allows evaluating the level of maturity of different functional components (neuropsychological factors), which was revealed in framework of Luria's approach. The assessment consists of 18 subtests. Factor Analysis (Principal factors - MINRES) of obtained primary results revealed 8 neuropsychological factors (executive, kinetic, kinaesthetic, visual preceptive, verbal, auditory, visuo-spatial factors, and factor of inter-hemisphere cooperation). The comparative analysis of obtained factors in children at 5 and 6 years of age was made. Children at 6 years of age showed more high level of maturity of executive factor, visual preceptive factor, and factor of inter-hemisphere cooperation in comparison with children at 5 years of age. The obtained results confirm the irregularity in development of different neuropsychological functions that are mediated by different brain regions. An important result of research was the statistical confirmation of relevance of "neuropsychological factor" as useful conception that was offered by A.Luria.

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Z.A. MELIKYAN. Visual Information Processing in 6-8-year-old Children with Functional Immaturity of Cerebral Regulatory Systems.

Functional immaturity of cerebral regulatory systems is one of the most common causes of cognitive disorders in children that leads to poor school performance. Previous EEG studies demonstrated that immaturity of cerebral regulatory systems in children may be due to immaturity of frontal-thalamic or nonspecific regulatory systems. Present study reveals differences in visual information processing between these two groups. 20 children with immaturity of frontal-thalamic system, age 6-8 y.o. (mean 7.9) were compared to 19 children with nonspecific regulatory system immaturity age 6-8 y.o. (mean 7.6). All the children were first or second-graders. EEG results revealed two groups of children with regulatory systems immaturity. The object perception task and visual association task (Luria's tests modified for children) were administered.

Different patterns of visual information processing in two groups of children were revealed. Children with frontal-thalamic system immaturity made significantly less object perception mistakes ($p < 0.04$). However, they made significantly more mistakes in finding precise names for correctly perceived images ($p < 0.05$). In visual association task, children with nonspecific regulatory systems immaturity had significantly lower productivity ($p < 0.03$), and significantly more of their drawings were unrecognizable by experts due to the lack of distinguishing features as compared to children with frontal-thalamic system immaturity ($p < 0.05$). This discrimination allows providing an individualized approach to cognitive assessment and rehabilitation for children with regulatory systems immaturity.

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T.D. WARNER, F.D. EYLER, M. BEHNKE, W. HOU & C.W. GERVAN. Normative Data for Low SES African American Children on Selected Halstead-Reitan Tests.

To remedy the lack of normative information for neuropsychological tests for ethnic minority children, the current study provides data for the Trail Making Test (TMT), Finger Tapping Test (FTT) and Grooved Pegboard Test (GPT) for a sample of African American children with average and below average IQ and compares these data to currently available norms. Right-handed African American children ($N = 87$), who were full-term and of average weight at birth, were assessed at ages 5 and 7. The mothers of the children were enrolled prospectively into a longitudinal study when they first entered prenatal care or presented for delivery at a tertiary care hospital. Mothers denied any illicit prenatal drug use, were 24 years old, had 11 years of education, and were low SES, on average. T-tests and $\alpha = .05$ criterion were used for comparisons. A Wechsler Full Scale IQ score of ≥ 85 was used to define average IQ. Compared to published norms, our sample had significantly lower mean FTT scores bilaterally at ages 5 and 7 and a significantly higher mean number of GPT drops bilaterally at age 7 regardless of IQ. Additionally, below-average IQ children took significantly longer to complete the GPT with the non-dominant hand and had a higher mean number of GPT drops with the dominant hand at age 5 and took significantly longer to complete the TMT Part A at age 7. A number of significant differences were found between the average performance of our sample and currently available norms, which are based on average IQ ethnic majority samples, suggesting that the latter may not be adequate to characterize the abilities of low SES African American children. Determining whether these discrepancies in motor speed and dexterity are due to cultural, SES or other factors awaits future research.

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K.R. WHITE WATERS, M. ROBERTS, S. EHLY & E. MAHONE. Evaluation of the Ecological Validity of Tests of Executive Functioning in Children: The Issue of Domain-Specific Content Skills.

The ecological validity of clinical tests of executive functioning (EF) is questionable and complicated by the fact that individual differences in basic content skills (e.g. language) can confound interpretation of scores as measures of 'pure' executive functioning. Therefore, clinicians often make intra-individual comparisons between tests of EF and domain-matched tests of content skills (Reader et al., 1994). The current study examined the ecological validity of the Controlled Oral Word Association Test (COWAT) and Rey Osterrieth Complex Figure Test (ROCF) as part of intra-individual comparisons to predict EF in daily life. Both clinical and nonclinical child samples were used for the COWAT ($n = 54$) and ROCF ($n = 45$). Parent ratings on the BRIEF were used as the criterion measure. Discrepancies between EF tests and domain-

matched content tests were used to predict BRIEF scores. Correlational and sensitivity analyses were conducted. Results did not support the ecological validity of the COWAT. ROCFT scores were found to be 100% sensitive to BRIEF impairment only when scores were both discrepant from content test scores AND in the impaired range. Unfortunately only a very small subsample of children ($n = 4$) met both criteria. Partial correlations between ROCFT and BRIEF scores, controlling for CBCL Anxious/Depressed scores, were significant. Extreme caution is warranted when using discrepancies between ROCFT or COWAT and respective content skill tests as measures of EF. The results suggest it is important to consider general 'nonexecutive' behavioral functioning when assessing EF.

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N.S. KOUSHIK, C.D. SAUNDERS & B.P. ROURKE. Patterns of WPPSI-R Subtest Performance in a Clinic-Referred Sample.

The study sought to examine patterns of performance on the Wechsler Preschool and Primary Scale of Intelligence- Revised (WPPSI-R). The sample consisted of 108 preschoolers between the ages of 3 and 7 years inclusive, referred to a day treatment program for a variety of psychological and psychosocial difficulties. All children had Full Scale IQ scores between 50 and 130. The sample was subjected to a two stage cluster analysis. In the first stage a hierarchical cluster analysis was conducted using Ward's minimum variance method of group Linkage. In the second stage a K-means relocation pass was conducted utilizing the mean centroids generated from the stage 1 solution as seeds for determining final cluster centers. The reliability of the derived solution was examined using an additional two-stage cluster analysis involving a hierarchical cluster analysis using Within-Groups Linkage followed by a K-means relocation pass. Five reliable subtypes were identified. Three of these were differentiated primarily by level of performance (low, average, and high). The other two were differentiated by pattern of performance: one characterized by nonverbal deficits and the other verbal deficits. The results of the study appear to be in accordance with previous research (e.g., Glutting & McDermott, 1990). A comparison of the results of the present investigation with previous research suggests subtypes that are relatively robust across samples and measures. Developmentally this suggests subtypes that are relatively stable across the age span and that continue to support subtypes discussed in the literature.

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A. LANSING, M.W. JACOBSON & D.C. DELIS. Gender Differences in Creative Relative to Verbal Intellectual Ability in School Aged Youth.

To assess potential gender differences in creative problem solving (executive functioning) relative to verbal intelligence (VIQ) in youth 8-19 years old. Recent data indicate a subset of youth demonstrate superior executive functioning compared to their performance on indicators of VIQ, which tap skills often assessed in standardized achievement tests. In contrast, executive function strengths likely support flexible and critical thinking skills that facilitate optimal achievement in a variety of functional domains (educational, occupational) and may be overlooked in early, formative academic settings. Participants were 470 youth (260 female, 210 male) who participated in the normative standardization process for the Delis-Kaplan Executive Function System (DKEFS) and Wechsler Abbreviated Scale of Intelligence (WASI). Gender comparisons were made between WASI VIQ performance relative to a DKEFS Executive Function Quotient (EFQ) comprised of scores tapping verbal (Category Fluency Switching Accuracy, Card Sort Recognition Description), visuospatial (Design Fluency Switching, Trails Number Letter Switch-

ing) and integrated verbal-visual processing (Color Word Inhibition Switching) executive skills. Subsets of girls (56/256, 22%) and boys (54/208, 26%) had significant discrepancies (≥ 1.5 S.D.) between EFQ and VIQ ($\chi^2=9.05$, $df=2$, $p=.01$). A larger subset of girls (11%) than boys (6%) demonstrated EFQ > VIQ scores, with boys (20%) more often demonstrating VIQ > EFQ scores than girls (11%). Comparisons of VIQ to the individual DKEFS scores comprising the EFQ yielded similar results. These data suggest 1) substantial subsets of boys and girls demonstrate superior EFQ relative to VIQ; 2) a greater proportion of girls demonstrate EFQ > VIQ, with the reverse pattern for boys and 3) reported verbal strengths in girls may be partly related to better developed verbal reasoning ability. These findings underscore the need to develop, support and assess EFQ skills in school aged youth.

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S. SIKLOS, K.A. KERNS, E. SHERMAN & U. MUELLER. A Rasch Analysis of the Behavior Rating Inventory for Executive Function (BRIEF).

The Behavior Rating Inventory for Executive Function (BRIEF) provides a standardized method to obtain information from parents regarding their children's executive function (EF) and consists of several scales purported to assess different aspects of EF. However, it is unclear whether the BRIEF is a unidimensional or multidimensional measure and responses to different items are given equal weight, although different items may be differentially informative about EF. In the present study, the Rasch model was used to (a) elucidate whether the BRIEF constitutes a unidimensional or multidimensional measure, and (b) to determine whether different items might be differentially informative about EF. The goals of the present study were to use Rasch analysis to create a shorter, more reliable parent report inventory of EF. Using principles of item response theory, responses to the BRIEF from 4 samples of children (20 with ADHD, 54 with epilepsy, 20 general clinic referrals, and 30 controls) were used to create a scale satisfying the Rasch measurement model. PCA showed that the BRIEF measures a unidimensional construct. Consequently, the Rasch model was applied and analysis revealed that 17% of items did not fit the model. The final BRIEF items retained fit the Rasch model with a Cronbach's alpha of .99. Analyses suggest that this revision of the BRIEF could make this instrument more reliable, efficient, useful, and valid for clinical applications. The fit of the four clinical samples will be discussed, as well as the characteristics of specific items on the BRIEF.

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P.S. FASTENAU & T.M. SASHER. Validity of the Extended Complex Figure Test (ECFT) for Use with Children.

Although the ECFT was designed with children in mind, no studies have examined the validity of this test in that age range. The Extended Complex Figure Test (ECFT; Fastenau, 1996, 2003) and Rey-Osterrieth Complex Figure Test (ROCFT; Osterrieth, 1944; Rey, 1941) were administered to 81 children ages 6 - 17 years (44% female, 8% ethnic minority, varied parental educational levels). ECFT scale and subscale scores showed good reliability, correlated highly with ROCFT scores ($r = .37 - .66$, $p \leq .001$) and showed expected quantitative relationships with age ($r = .36 - .72$, $p \leq .002$) and qualitative changes at transitional stages of childhood. There was no sex effect or interaction with age ($p > .10$). The ECFT showed good reliability, criterion-related validity, and construct validity for pediatric use.

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D. BODIN, J.T. BEETAR, K.O. YEATES, K. BOYER, A. COLVIN & S. MANGEOT. A Survey of Parent Satisfaction with Pediatric Neuropsychological Evaluations.

Few empirical studies have investigated parental perceptions of pediatric neuropsychological evaluations. The purpose of this study was to examine parent satisfaction, to evaluate the factor structure of a parent satisfaction measure, and to identify demographic and service-related variables that are related to parent satisfaction. Participants included parents of children who received outpatient neuropsychological evaluations during 2002 and 2003. Using a multiple wave method, 354 surveys were mailed. Sixteen addresses were incorrect, resulting in a total of 338 surveys successfully mailed. Of those, 97 were returned, for a return rate of 29%. Parents completed a 30 item questionnaire designed to elicit opinions regarding the quality of the services provided as well as the impact of the neuropsychological evaluation on their child. A review of individual items revealed overall positive ratings of parent satisfaction. A factor analysis resulted in a four-factor solution, with factors assessing General Satisfaction, Acceptance/Empathy, Provision of Help, and Facilities/Administrative Assistance. Ratings were higher on the General Satisfaction, Acceptance/Empathy, and Facilities/Administrative Assistance factors than on the Provision of Help factor. Evaluations completed by faculty received higher satisfaction ratings than those completed by trainees. Parental education was negatively correlated with satisfaction. No other variables were significantly related to satisfaction. The results suggest that parents are generally satisfied with pediatric neuropsychological evaluation services, although some parents indicated that the evaluations did not provide as much help as expected. More educated parents may have higher expectations, resulting in lower ratings of satisfaction. Future studies could assess satisfaction of referring physicians.

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Language: Fluency and Reading

M.J. MAGUIRE & C.O. DOVE. An ERP Study of Imageability and Grammatical Class Influences in Noun and Verb Processing.

Research indicates that nouns and verbs are processed differently. Bird, et al., (2003) and others (Gilette, et al., 1999) propose that semantic features, such as imageability, underlie these differences more so than grammatical class, yet little research has addressed these issues. Following work by Kellenbach (2002) with Dutch-speakers, using Event Related Potentials (ERPs) we tested the interaction of grammatical class and imageability subclasses. Fifteen adult participants heard and repeated 30 words (15 nouns, 15 verbs) across 3 semantic categories: abstract, action, and visual. Abstract included items that cannot be seen or manipulated (i.e., thoughts (n.), dreaming (v.)). Action included items that can be seen and have a manipulation feature, (i.e. hammer (n.), throwing (v.)). Visual included items that have a visual property but cannot be manipulated, (i.e. balcony (n.), dripping (v.)). Using a Principle Components Analysis (PCA) followed by ANOVAs and post-hoc analyses we found a main effect of semantic class, a main effect of grammatical class and no interaction between the two. Specially, in Factor 1 between 216ms and 536ms there was an interaction between syntactic category x hemisphere, $F(1,14) = 10.50$, $p = .01$, power = .92. Further, in Factors 2 (448 to 700 ms) and 3 (80 to 312 ms) the electrodes around the frontal lobes yielded significant differences between abstract and motor types ($p < .05$), but not between visual and either motor or abstract. These results indicate that information about semantic and grammatical class are processed early and possibly independently by English-speaking adults.

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B.R. WILLIAMS, S.G. SIPPEL, G.A. DAVIDSON & P.J. DONOVICK. Differences in Verbal Fluency Performance in Three Populations as a Function of IQ.

This study sought to identify factors contributing to differences in word production ability on the *Controlled Oral Word Association Test* (COWA-FAS) in three adult populations. Although referral questions for all groups were similar, the incarcerated group generated significantly fewer words on the COWA. Furthermore, the incarcerated group had a significantly lower IQ and education level compared to other groups. Thus, IQ and education were hypothesized to be important contributors to word production ability. Participants were referred for neuropsychology evaluation at a civilian community hospital ($n=120$), a private practice ($n=79$), and two mental health units associated with a state prison ($n=105$). Measures administered include the COWA, Wechsler Adult Intelligence Scale-III-R, and Kaufmann-Brief Intelligence Test. Analyses revealed that the hospital and private practice groups performed in the average IQ range and typically completed a high school education. It is of interest to note that the prison group differed significantly from the hospital and private practice groups in IQ score and education. Prisoners performed in the below average IQ range and typically completed less than 10 years of schooling. As expected, the hospital and private practice groups generated more words on the COWA than did the prison group. Despite differences between groups in IQ, education, and COWA scores, the number of words produced by each group increased as IQ and education increased. Findings provide support for the relationship of IQ and education to word production ability. Moreover, the results contribute to evidence of the interrelatedness of general intelligence and performance on neuropsychological measures.

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S.L. RIMRODT, A. LIGHTMAN, L. ROBERTS, M.B. DENCKLA & L. CUTTING. Are All Tests of Reading Comprehension the Same?

Reading disability is typically characterized by single word reading deficits (WRD) that result in reading comprehension deficits (RCD). However, RCD *without WRD* (RCD-only) has also been reported. WRD is generally identified by poor performance on standardized measures of real and/or nonword decoding accuracy, all of which use similar formats. In contrast, there are a variety of formats for measuring the more complex task of reading comprehension (RC). Some investigators rely on a single measure of reading comprehension, while others use a composite score of different measures. We considered that subjects could score quite differently on different measures of RC, which could allow category assignments to vary depending on the RC measurement chosen. To examine this issue, we compared RC test scores of 27 children between 7 and 14 years old who performed poorly (≤ 25 th-%ile) on at least one of three standardized measures of RC (WIAT, Gates-MacGinitie and Gray-Oral Reading Test comprehension subtests). Thirteen of the 27 children had WRD (defined as ≤ 25 th-%ile on word reading accuracy measures) and the other 14 were categorized as RCD-only based on demonstrating normal word reading accuracy (≥ 40 th-%ile). Comparison indicated very little agreement among RC measures, with the majority of subjects (17/27) scoring poorly on only one out of the three RC measures; this was particularly true for the RCD-only group. These results suggest that different RC measures may reveal different areas of deficit among poor readers, especially those with RCD-only. Therefore, the method of measuring RC is critical to consider when studying RC.

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S.L. RIMRODT, A. LIGHTMAN, J.R. ABEL, M.B. DENCKLA & L. CUTTING. Reading Comprehension in Spite of Normal Word Reading Accuracy: A Matter of Reading Speed?

Reading disability with poor comprehension due to single word reading accuracy deficits (WRD) has been well-studied; however, there has been less focus on poor reading comprehension associated with normal word reading accuracy (RCD-only). To explore potential deficits associated with RCD-only, we compared performance between WRD, RCD-only, and control groups on language and reading-related measures. We hypothesized that the reading comprehension deficits in RCD-only could stem from poor reading speed. Fifty-eight children ages 7 through 14 years were categorized into three groups based on reading scores. The groups consisted of 14 children with WRD (≤ 25 th-%ile on word reading accuracy), 14 children with RCD-only (≥ 40 th-%ile on word reading accuracy but ≤ 25 th-%ile on one-out-of-three measures of reading comprehension), and 30 controls (≥ 40 th-%ile on all reading tests). Participants were compared on measures of IQ, language, phonological awareness, Rapid Automatized Naming, and reading speed. Both WRD and RCD-only groups performed significantly lower than controls on language and phonological awareness measures. The RCD-only and control group performed comparably, but significantly better than the WRD group, on measures of Rapid Automatized Naming. Reading speed decreased progressively across groups, with controls scoring better than both the WRD and RCD-only groups (control vs. RCD-only and control vs. WRD, both $p=0.0001$) and the RCD-only group performing better than the WRD group (RCD-only vs. WRD, $p=0.02$). These findings support the conclusion that RCD-only is characterized in part by poor reading speed and raises the question of whether RCD-only represents a milder or residual form of WRD or word-level difficulties.

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Memory

N.W. PARK, D.A. GOLD & C.L. SHAPIRO. The Effects of Time on Dual-Task Performance of Retrieval from Long-Term Memory.

Although few studies have reported that performing a second task affects retrieval performance from memory, Barbuto and Park (2004) have recently shown that concurrent memory tasks performed at retrieval cause an overall decrement, even when the tasks do not compete for a common representational system. The present study determines if interference effects would be reduced when participants are given an unlimited amount of time for retrieval. Sixteen participants aged 20-29 ($M=22.30$, $SD=2.11$) years, screened for previous brain injury, neurological disorders, and English fluency, were tested individually. The study employed an experimental design having two within and one between-group factors. During the practice phase, participants performed each task used in the study (verbal matrix, spatial matrix). During the test phase of the experiment, each matrix task was presented in isolation (single-task condition), and concurrently (dual-task condition). The between-group condition, limited and unlimited time for retrieval, was randomly assigned to participants. The order of presentation of the verbal and spatial matrix and single and dual task was counterbalanced. A mixed ANOVA demonstrated significant effects of task (verbal vs. spatial), $F(1, 14) = 13.91$, $p < .01$, and load (single vs. dual task), $F(1, 14) = 22.66$, $p < .01$, collapsed across conditions. No other significant effects were found. Therefore, giving participants an unlimited amount of time to respond does not reduce the interference observed from single ($M=63.19\%$, $SD=16.32\%$) to dual ($M=46.81\%$, $SD=14.72\%$) tasks. This study determined if pressure for time was responsible for the decline in performance at retrieval under a dual task condition. The results show that even under unlimited time conditions, memory accuracy is significantly lower in the dual than the single-task condition. We are currently investigating the reason for the decrements in performance.

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E.S. STORY, S. KARANTZOULIS, B. YAU, J.A. MANGELS & J.B. RICH. Enactment and Divided Attention Effects on Free Recall and Recognition.

Recall and recognition are better following subject-performed (SPTs) than verbal (VTs) tasks, a phenomenon termed the SPT effect. SPTs also reduce semantic interference, most likely by binding the object and action components. If the SPT benefit generalizes to other forms of interference, then SPTs should reduce the interfering effect of divided compared to full attention. To test this hypothesis, we predicted that the magnitude of difference between full and divided attention at encoding would be smaller following SPT relative to VT encoding. Twenty-four undergraduates (M age = 21.4) were presented with 4 lists of 20 object-action commands in a 2 (task: SPT vs. VT) \times 2 (attention: full vs. divided) design. In the divided attention conditions, participants tapped their foot in response to high/low tones while verbalizing (VT) or enacting (SPT) object-action commands. Testing included free recall of object-action pairs, yes/no recognition of objects, and forced-choice recognition of actions. Both free recall and recognition performance showed an SPT effect and a divided attention disadvantage. The difference between attention conditions was smaller in the SPT relative to the VT condition for yes/no recognition, but not for free recall or forced-choice recognition, thereby providing partial support for our hypothesis. Results indicate that the extent to which SPTs reduce interference depends upon the nature of the interference (semantic vs. attentional) and the type of information retrieval (recall vs. recognition). These differences may help identify the mechanism underlying the SPT effect as well as situations where SPTs may be used for therapeutic interventions. Correspondence: Jill B. Rich, PhD, Psychology, York University, 4700 Keele Street, Toronto, ON M3J1P3, Canada. E-mail: jbr@yorku.ca

K. GSANGER, S. HOMACK & C. RICCIO. Spatial Span Components as Predictors of Attention Problems and Executive Functioning in Adults.

Neurocognitive deficits of Attention Deficit Hyperactivity Disorder (ADHD) in adults have been well-documented in the literature. Due to the association between ADHD with working memory deficits, the purpose of the current investigation was to determine the extent to which performance on the Spatial Span subtest of the Wechsler Memory Scale-Third Edition predicted attention problems and executive dysfunction in adults. Participants are 100 individuals ages 18 to 33 ($M = 21.92$; $SD = 3.49$) who participated in a comprehensive neuropsychological assessment in a university clinic setting. In addition to investigating correlations among the variables of interest, multiple regression analyses were conducted to determine the predictive quality of the Spatial Span components on one's performance on measures of executive functioning with working memory demands (i.e., Tower of London-Drexel Edition Total Moves, Wisconsin Card Sorting Test Categories Obtained, Wisconsin Card Sorting Test Trials to First Set, and Conners Adult ADHD Rating Scale Inattention/Memory subscale scores). Adults with ADHD did not differ significantly from controls in Spatial Span performance. Additionally, no direct effects were observed between spatial span tasks and other measures of working memory. Findings suggest that spatial working memory tasks do not predict attention problems or executive dysfunction in adults. Furthermore, no differences were observed when the tasks were broken into forward Spatial Span versus backward Spatial Span tasks and investigated discretely.

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S. HEPWORTH, N. KELLY & J.F. ROVET. The Development of Individual Components of Working Memory.

Working memory represents a cognitive system comprised of two dissociable elements: short-term storage and controlled attention. To assess whether these components develop at different rates in childhood, we examined 7 to 12 year old children on two computer-generated tests, which each evaluated the separate working memory components. 55 typically developing children in 7-8, 9-10, or 11-12 subgroups were assessed using n-Back (nB) and Sternberg Item Recognition (IR) tasks. Storage was manipulated by varying Load (nB:1 versus 3 letters; IR: 3 versus 6 letters). Controlled attention was manipulated by varying backedness on nB (1- versus 2-back) and interference on IR (low versus high). Recorded were accuracy and reaction time (RT). Results from the two tasks were highly correlated signifying they likely tap similar aspects of working memory. For both tasks, significant overall Age effects were observed. For nB, an Age by Back interaction ($p < .05$) reflected an increase in controlled attention but not storage between 7/8 and 9/10 years. For IR, different effects were seen for accuracy and RT. Results indicated a greater effect of load than interference on accuracy between 7/8 and 9/10 years and of interference than load on RT between 9/10 and 11/12 years. Different age-related improvements in controlled attention versus storage elements suggest distinct developmental trajectories for these two working memory components but the patterns differ for the two tasks. While these results support an interpretation that functionally dissociable working memory elements develop at different rates in childhood, they may be task specific.

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C. TANEJA, R.A. HANKS & B.P. ROURKE. Differentiating Between Subgroups of Stroke Using the Short Form of the California Verbal Learning Test-Second Edition.

The Short Form of the California Verbal Learning Test - Second Edition (CVLT-II SF) is widely used to assess aspects of verbal learning and memory. Published research on this neuropsychological screening tool is scarce; however. The objective of the current study is to examine the accuracy of the CVLT-II SF in distinguishing between subgroups with ischemic stroke. Archival data of 75 consecutive admissions for inpatient stroke rehabilitation were included in the study group. Participants were divided into three groups based on the neuroanatomical regions afflicted by the stroke: (1) left cortical, (2) right cortical, and (3) subcortical. A discriminant function analysis was performed using seven CVLT-II SF variables to predict membership in the three stroke groups. Predictors included measures of attention span, general verbal learning, delayed recall, recency effect, semantic clustering, recognition discriminability, and recall/recognition contrast. The discriminant function analysis significantly differentiated the left cortical, right cortical and subcortical stroke groups. A classification procedure correctly classified 85.7% of individuals with left cortical stroke, 75.0% of individuals with right cortical stroke, and 58.8% of individuals with subcortical stroke, yielding an overall classification rate of 70.7%. Individuals with left cortical stroke were well-differentiated from individuals with right cortical stroke and subcortical stroke on the CVLT-II SF, with the left cortical stroke group noted to perform significantly poorer than the other two groups on the CVLT-II SF. The utility, as well as the limitations, of using the CVLT-II SF to distinguish between subgroups with ischemic stroke is discussed.

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D.E. TRAHAN & C.E. ROSS. Revised Norms and Clinical Validation for the 6-trial Verbal Selective Reminding Test.

H.S. Levin and colleagues introduced Form I of the Verbal Selective Reminding Test (VSRT), a 12-trial task using 12 unrelated words. A 6-

trial version of the same test was introduced by Larrabee, Trahan, and Levin (2000). However, that study provided only initial normative data (means and standard deviations). Additionally, subsequent clinical validation studies for the 6-trial form have been conspicuously lacking. This study provided revised norms (including percentiles) and examined sensitivity and specificity in a large clinical sample. Participants included 302 normal adults (age range 18-91), 243 outpatients (age range 22-95), and 190 inpatients (age range 18-89). The patients included individuals with known neurological diagnoses, including traumatic brain injury, stroke, Alzheimer's Disease, brain neoplasms, and other conditions. All subjects, including the normal adults, were administered the VSRT along with a battery of other tests. Scores for normal adults were divided into 5 age groups: 18-29, 30-44, 45-59, 60-74, and 75+. The 5th percentile for each group was used as the cutoff score to define impaired performance. For the long-term storage index (LTS), sensitivity was 58% and specificity was 95%. For consistent long-term retrieval (CLTR), sensitivity was 47% and specificity was 94%. Total predictive power was 73% for LTS and 67% for CLTR. The 6-trial VSRT has advantages over the 12-trial version, which is more time-consuming and likely to cause fatigue and diminished motivation, especially in older subjects and more impaired patients. The 6-trial version does appear to be a valid measure of verbal learning ability for a broad range of neurologically impaired patients. The LTS index had a higher sensitivity rate and total predictive power than CLTR.

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N.S. FOLDI, M.E. KNUTELSKA, W. WINNICK, K.L. DAHLMAN & V. ANDREEVA-COOK. What Happened to their Middle Region? Serial Position Effects (SPE) in Late Life Depression, Alzheimer Disease, and Normal Elderly on the Rey Auditory Verbal Learning Test (RAVLT).

Learning characteristics of late life depression (LLD) have been demonstrated (Foldi et al., 2003) using *regional* serial position scores of the CVLT. LLD differed from normal elderly controls (NEC) and from patients with Alzheimer disease (AD) with a significant decrease of items recalled from the middle region. The current study predicted that middle region deficits in LLD would be validated in the semantically unrelated RAVLT. Three participating groups, LLD (N=24), AD (N=34) and NEC (N=22), were equivalent on demographics and IQ. The RAVLT was administered over five trials and short delay free recall (SDFR). Regional SPE scores (ratio of items recalled to items *presented* from each of the primacy, middle or recency regions) were recorded. NEC and LLD had similar U-shaped recall patterns, but LLD learned overall fewer items, $p = .001$, and were worse on middle region recall, $p < .01$. Decay from Trial 5 to SDFR, $p = .001$, from all regions was similar in LLD and NEC, and U-shaped patterns deteriorated with recency region items most vulnerable. AD showed relative reliance on the recency region during learning, $p < .001$, although they were able to demonstrate learning of these items with rehearsal, $p < .001$; over time they showed typical decay. The study provides a first validation that unique SPE regional profiles differentiate learning patterns in LLD and NEC, with middle region items most vulnerable. The recall pattern supports the notion that recency items reside in working memory, and decay over time in all groups. SPE regional measures are valid in non-semantically organized lists.

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A.M. POREH. Analysis of Mean Learning of Subjects on the Rey Auditory-Verbal Learning Test (AVLT).

The published normative data sets of the AVLT differ considerably and often do not take into consideration the effects of background variables

which fluctuate considerably. The present study set out to assess whether the mean change in performance over the five free recall trials of these groups might be described by a single equation. 12 normative data sets comprised of 56 age groups (1852 subjects) were analyzed using curve fitting statistical procedures. The resulting analysis shows that a logarithmic function $R(t) = R1 + S \ln(t)$, where $R1$ and S are functions of age, gender, and education significantly correlated with each of the normal age groups (mean $R^2 = 0.985$, $SD = 0.018$). The analyses also show that $R1$ changes significantly with age. It grows rapidly in the early years and reaches values of about 8 around the age of 16. It remains at this level up to the age of 30. Beyond this age, it decreases consistently with age to approximately 5 at the age of 85. In contrast, quite surprisingly, the mean value of the mean logarithmic slope coefficient, hardly varies with age. The present study shows that the main characteristics of the AVLT learning curve may be described parsimoniously using a single formula. This formula may be easily calculated and thus could be used in clinical and research settings. The study also raises several interesting theoretical questions that are related to the nature of the auditory-verbal learning process. For example, that normal development and aging significantly correlate with the immediate memory span but hardly affect the learning curve.

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B.A. PYYKKONEN, D. HAN & M. LACY. HVLt-R & BVMT-R: Correlation between Recognition Memory Scores.

Recognition memory performance is often used to differentiate cortical and subcortical dementias. The Hopkins Verbal Learning Test Revised and The Brief Visuospatial Memory Test Revised are widely used instruments in dementia evaluations. While immediate and delayed recall trial scores are highly correlated in normal controls, recognition memory is less strongly correlated (Benedict et al., 1996). Due to the important use of recognition scores for diagnoses purposes, we examined correlations between these recognition measures. This retrospective study analyzed the correlation between the HVLt-R and BVMT-R recognition scores using SPSS in a clinical population of 748 individuals. Delayed recognition scores of the HVLt-R and BVMT-R were significantly correlated: HVLt mean=5.26, $SD=3.88$; BVMT mean=3.04, $SD=2.17$; Pearson's $R = .52$, $p < .001$. Current findings indicate a significant correlation between the BVMT-R and HVLt-R recognition measures in a clinical population. The correlation is essentially equivalent to a previously established correlation found in normals. Nevertheless, the correlation is somewhat anemic in comparison to that seen between the BVMT-R and other memory measures (Benedict et al., 1996). While the HVLt-R discrimination index loads strongly on verbal learning and memory abilities, and is sensitive and specific in the diagnosis of dementia, the BVMT-R has not demonstrated significant memory factor loading nor diagnostic specificity (Benedict et al., 1996; Hogervorst, et al., 2002). Considering the BVMT-R recognition scores somewhat anemic correlation to the better established HVLt-R and the BVMT-R's nonsignificant loading on memory, results of the BVMT-R recognition scores should be interpreted cautiously.

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A.A. PICA, J.L. WOODARD & C.H. MORTON. The Impact of Executive Functioning and Information Processing Efficiency on Semantic Clustering During Immediate and Delayed Recall Trials of the HVLt-R.

The main objective of this study was to examine the influence of executive functioning and information processing efficiency on semantic clustering during immediate and delayed recall trials of the Hopkins Verbal Learning Test-Revised (HVLt-R). 73 male, high school football

players completed the HVLt-R, Controlled Oral Word Association (COWA), Digit Symbol Coding (DS), Symbol Search (SS), Brief Test of Attention, Dual Task measures, and the computer-based Automated Neuropsychological Assessment Metrics (ANAM) during a pre-season baseline assessment as part of a larger sports-related concussion study. Semantic clustering scores on the HVLt-R were adjusted to control for total number of words recalled. Semantic clustering during immediate recall trials significantly predicted the number of words recalled after 20-minutes. Semantic clustering on total immediate recall correlated significantly with phonemic fluency (COWA), a six-item memory search paradigm from ANAM, dual task measures, and a measure of speeded information processing and working memory (DS). Semantic clustering during delayed recall correlated significantly with phonemic fluency (COWA) and a measure of speeded information processing and working memory from ANAM. Measures of vigilance and reaction time did not correlate significantly with semantic clustering during either immediate or delayed recall. Semantic clustering is an efficient strategy for successful encoding, consolidation, and retrieval of verbal information. Results suggest that basic attentional processes such as vigilance and reaction time do not significantly contribute to the application of this strategy. However, executive functioning and information processing efficiency may play an important role in the ability to utilize semantic organization during verbal memory tasks.

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M.A. BROWN & D.M. TUCKER. Quantitatively Varying Stimuli in the Retrieval Practice Paradigm: Effect on Recall Practice and Inhibition.

The retrieval practice paradigm (RPP, Anderson, Bjork, & Bjork, 1994; Anderson & Spellman, 1995) utilizes selective retrieval practice of semantically organized word lists to compare recall of unpracticed words that are either associated by category or unassociated with words that undergo repeated retrieval practice. Since the RPP has been offered as a paradigm capable of capturing the effect of retrieval induced forgetting, some research has focused on determining the boundaries under which retrieval induced forgetting may be captured with this paradigm. Defining the conditions under which the RPP is capable of capturing retrieval induced forgetting is important in determining the utility of the RPP as a viable paradigm for investigating the role of forgetting processes in other psychological phenomena such as depression and anxiety. The current study was conducted with 126 undergraduate students from a major southern university. Participants received one of three variations of the retrieval practice paradigm in which the number of words per category were varied. This resulted in participants completing the RPP with 4 categories and either 6, 8, or 12 words per category. ANOVAs were conducted to investigate the effect of number of words per category on overall recall accuracy, retrieval practice accuracy, and inhibition. The results indicate that as the number of words per category in the RPP increases, both recall and retrieval practice performance decrease. The implications for measuring inhibition with the RPP and application of the RPP in future research are discussed.

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T.J. STORY, K.J. MILLER, A. LAUTZENHISER, L. ERCOLI, P. SID-DARTH & G.W. SMALL. A New Recognition Test for the WMS-III Verbal Paired Associates.

Recognition tests are often used in the assessment of verbal learning and memory to identify deficits in retrieval or stimulus discrimination (Lezak, 1995). Earlier research (Story et al., 2004), demonstrated that the WMS-III verbal paired associates test (VPA) lacks sensitivity in identifying

moderate levels of memory impairment. We present preliminary findings on a new recognition (NR) measure for the VPA test with greater sensitivity. Neuropsychological exams of 81 older patients ($M = 61.27$) were included in analyses. Participants with Mini-Mental Status Exam (MMSE) scores consistent with dementia (<25) were excluded to avoid atypical data distribution. Based on memory performance, participants were classified as normal (N), age associated memory decline (AAMD), age consistent memory decline (ACMD), late-life forgetfulness (LLF), and amnesic (A). No participants met amnesic classification in these analyses. Results of a one-way ANOVA revealed a significant omnibus effect ($F(3, 77) = 13.97$, $MSE = 70.35$, $p = .000$), indicating that group differences in NR recognition scores were present, but specifically between the LLF group and the less impaired groups. In addition, NR significantly predicted VPA delayed recall scores and MMSE scores ($R^2(2, 76) = .442$, $b_1 = .226$, $p = .017$; $b_2 = .546$, $p = .000$), but the MMSE effect disappeared when LLF was removed ($R^2(1, 68) = .069$, $b = .069$, $p = .573$). No other significant differences were found. These findings suggest greater discriminability of the NR over the original VPA recognition measure. Implications for research and clinical use will be discussed.

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L.B. STROBER, C. CHRISTODOULOU, W.F. SHERL, P. MELVILLE & L.B. KRUPP. Pollyannaism and its Effect on an Implicit Memory Task.

The Pollyanna principle suggests that healthy, non-depressed individuals show selectivity for learning pleasant words. Positive affect has been shown to assist in word fluency and facilitate memory which may heighten the tendency to recall positive information. Negative affect, on the other hand, has been shown to impair memory and information processing but may also aid in the organization and recall of negative material. This study sought to determine whether the Pollyanna tendency is enhanced by positive affect and/or counteracted by negative affect during an implicit memory task. Positive affect (PA) and negative affect (NA) of 34 healthy controls (mean age = 41.4, education = 14.5, Center for Epidemiological Studies - Depression [CES-D] = 6.8) was assessed by the PANAS-NOW during a testing session. Subjects were given an implicit memory task asking them to rate words as pleasant, unpleasant, or neutral and underwent a free recall paradigm. Individuals rated more words as positive than negative ($t(33) = 3.36$, $p = .002$). Additionally, PA (mean = 33.6) correlated with percentage of words rated as positive ($r = .40$, $p = .002$), and percentage of positively rated words recalled ($r = .38$, $p = .028$). No significant associations were found for NA and the propensity to rate or recall more negative material. Findings support the Pollyanna principle in implicit memory. Further, PA appears to enhance the phenomena. However, study findings for correlations involving NA may have been limited by restriction of range, arising from the fact that relatively few words were rated negatively.

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B.P. UZZELL. Procedural Memory at Work: Case Report.

1) To demonstrate procedural memory after brain injury can be accessed to complete job duties. 2) To show activation of processes involved in procedural memory are accessible. 3) To confirm that procedural memory does not depend on integrity of brain structures. Participant: Case study method was applied to 42 year old male police officer who had sustained a gunshot wound to the right hemisphere resulting in a right temporal epidural hematoma with underlying contusion and subarachnoid hemorrhage. Method: The Participant received 12 outpatient Neuropsychological Rehabilitation treatments with a modified priming technique designed to stimulate procedural memory. After a work return two years after injury the police officer was able to drive rapidly with precise accuracy to 12 different police dispatched locations visited prior to injury without conscious awareness of the geographic locations of dispatch destinations. 1) Procedural memory can be activated following Neuropsychological Rehabilitation treatments. 2) The findings illustrate the benefits of using procedural memory in every day life situations after brain injury. 3) Procedural memory does not depend on the integrity of brain structures. 4) Procedural memory does depend on the integrity of traces of processes that can be activated by a motor skill. 5) Overcoming damage to a brain area involved in spatial relationships and destinations in space can be achieved through procedural memory processes.

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P.S. FOSTER & D.W. HARRISON. The Design Learning Test: Support for Right Hemisphere Sensitivity.

The Design Learning Test (DLT) was developed as a visuospatial analog of the Rey Auditory Verbal Learning Test, and hence sensitive to right hemisphere functioning. Previous research has established a significant relationship in performance between these two tests. However, no research has been reported addressing whether the DLT is sensitive to right hemisphere functioning. The present investigation sought to determine whether performance on the DLT is sensitive to right hemisphere functioning by correlating performance on the DLT with performance on the Ruff Figural Fluency Test (RFFT), a test known to be sensitive to right hemisphere pathology. It was hypothesized that performance on the DLT would be positively correlated with the total number of unique designs generated on the RFFT and negatively correlated with the perseverative error ratio. A total of 28 right handed men with no history of significant head injury were administered the DLT and the RFFT. Consistent with the hypotheses forwarded, the total number of designs recalled across the five learning trials of the DLT was positively correlated with the total number of unique designs produced on the RFFT ($r = .284$, $p = .029$) and negatively correlated with the perseverative error ratio ($r = -.374$, $p = .006$). Thus, the present findings provide support for the contention that performance on the DLT is sensitive to right hemisphere functioning. However, additional data needs to be collected to determine whether performance on the DLT is sensitive to right temporal lobe pathology.

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L. FRAKEY, A. SHRIKISSOON, K.G. THOMAS, W.J. JACOBS & R.M. BAUER. The Role of the Hippocampus in Spatial Pattern Separation.

This study examined hippocampal contributions to pattern separation in short-term memory using a method adapted from animal research. Using short-term memory for spatial location information and controlling the amount of spatial similarity between distal cues, a rodent study found bilateral hippocampal lesions produced deficits in spatial pattern separation. The results showed lesioned animals were impaired on all but the lowest degree of spatial cue similarity. We adapted this paradigm to assess pattern separation in human participants who had undergone either language-dominant (LD) or language non-dominant (LND) anterior temporal lobectomy (ATL). Prominent theories of the lateralization of function would predict lesions to the LND hippocampus would produce greater deficits in spatial memory. LDATL, LNDATL, and matched Controls completed a computer-based delayed-match-to-sample task designed to assess recognition memory for spatial locations. Participants learned the spatial location of a target in a computer-generated environment, then had to return to that target in the face of two distractor targets with varying degrees of spatial proximity between distal cues. Controls showed greater accuracy than the LNDATL

participants at all spatial similarity levels. The LDATL participants were impaired on the two lowest spatial similarity levels as compared with Controls, but did not differ on the other levels. The LDATL and LNDATL groups were not significantly different. Hippocampal resection produces deficits in spatial pattern separation in humans regardless of hemisphere lesioned. The hippocampally lesioned humans never achieved the same level of accuracy of Controls even at the lowest degree of spatial similarity between distal cues. Correspondence: *Laura Frakey, MS, Brown University, 232 Lynch ST, Providence, RI 02908. E-mail: Laura_Frakey@brown.edu*

R. FAMA, A. PFEFFERBAUM & E.V. SULLIVAN. Differential Contributions of Explicit Memory Processes to Visuo-perceptual Learning in Alcoholics and Controls.

Alcoholics and controls have been shown to invoke different cognitive processes to perform tests at comparable levels. Previously, we observed that executive functional abilities predicted visuo-perceptual learning in alcoholics, whereas visuospatial abilities predicted such learning in controls. Although explicit memory contributed to perceptual learning in both groups, it remains unknown whether visual or verbal memory contributes differentially to visuo-perceptual learning in either group. We examined 51 alcoholics and 63 controls on the Golli Incomplete Pictures Test (initial, 1-hour, and 24-hour retests) assessing visuo-perceptual ability and learning, and Wechsler Memory Scale, assessing verbal and visual memory. Initial visuo-perceptual scores were not related to memory scores in either group. Multiple regression analyses indicated that visual memory predicted learning at 1 and 24 hours in controls, whereas verbal memory modestly predicted 1-hour learning in alcoholics. To ensure that lack of visual memory contribution to visuo-perceptual learning in alcoholics was not attributable to their visuospatial deficits, re-analysis was conducted with memory savings scores. Again, visual memory did not contribute to prediction of perceptual learning in the alcoholics. Verbal memory scores, however, significantly predicted learning at 1 and 24 hours. A similar pattern was observed for incidental recall of Golli stimuli: verbal memory predicted 24-hour recall in alcoholics; visual memory predicted 1-hour recall in controls. To the extent that declarative memory influences visuo-perceptual learning, different component memory processes contributed to learning in each group: whereas controls relied on visual memory, alcoholics relied on verbal memory. These results provide further support of alcoholics' abnormal cognitive strategy in perceptual learning. [Support: AA05965, AA101723, AA12388]

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M.J. MARQUINE & E.L. GLISKY. Self-Knowledge and the Self-Reference Effect in Memory-Impaired Patients.

Functional changes following brain damage can result in a loss of sense of self. Moreover, memory deficits might affect patients' ability to represent the self as a coherent entity through time. A few case studies have suggested, however, that although memory for the events in one's life (episodic self-knowledge) might be impaired, general knowledge about oneself (semantic self-knowledge) is usually intact. We were interested in exploring whether this preserved semantic self-knowledge might be used to improve performance in an episodic memory task. Studies have found that self-referential (SR) processing enhances memory in normal individuals. This has been called the self-reference effect (SRE). The main goal of the present study was to examine the SRE in memory-impaired individuals because of its potential practical applications in memory rehabilitation. Twelve memory-impaired individuals and 12 controls studied lists of personality trait adjectives under three encoding conditions: a) Shallow processing, "Is the word in upper case letters?" b) Deep processing, "Is the dictionary definition of the word positive?" and c) SR processing, "Does the word describe you?" Additionally, patients' self-knowledge was assessed using a

personality trait questionnaire. A mixed model ANOVA indicated that memory-impaired individuals showed a normal SRE. Preliminary correlational analyses suggested that the SRE was related to semantic self-knowledge but not to episodic memory. Engaging in SR processing promotes memory in patients with memory deficits. Hence, SR processing may be an effective strategy for memory rehabilitation. Moreover, findings were congruent with the idea that the SRE is dependent on an intact semantic self.

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E. SVOBODA, N.J. LOBAUGH, G. STAINSZ, S. KANAGASABAI, J. SKOCIC, G. TURNER, S.E. BLACK & B. LEVINE. Autonoetic Consciousness in Retrograde Amnesic Patient M.L.: Functional Neuroanatomy.

Functional and structural neuroimaging and behavioural methodologies were used to test hypotheses concerning inter-relationships of focal neuropathology and autonoetic (self-awareness) consciousness in isolated retrograde amnesic patient M.L. Patient M.L. (Levine et al., 1998) sustained right ventral frontal damage, putatively interrupting the frontal projections of the uncinate fasciculus, following severe traumatic brain injury. M.L. created a pool of audio recordings documenting unique episodes from his life over several months. He was scanned with fMRI while listening to the recordings and interviewed about these episodes. Diffusion tensor imaging (DTI) was used to assess the integrity of right frontotemporal connectivity in M.L. Relative to controls, M.L. showed markedly reduced recollection of episodic details for his prospectively collected events. He was specifically impaired for details reflecting episodic re-experiencing (emotion, perception). Qualitative ratings of recollected events using a modified remember/know technique showed that M.L. was most severely impaired for emotional re-experiencing, followed by reduced ability in re-experiencing visual and event details. Functional neuroimaging data indicated an altered pattern of activation in comparison to controls while listening to these recordings. DTI data were consistent with the previously hypothesized frontotemporal disconnection syndrome. M.L.'s deficit in autonoetic consciousness was documented for anterograde memories. Semantic processing was preserved. This deficit is likely related to traumatic fronto-temporal disconnection.

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R.F. ZEC & N.R. BURKETT. A Case Demonstrating a Dramatic Dissociation between Yes-No Recognition Memory for Words versus Pictures in a Patient with Severe Global Amnesia.

We tested the hypothesis that yes-no picture recognition memory is more resistant to medial temporal lobe damage than yes-no word recognition memory in a global amnesic patient. Yes-no and forced-choice verbal and visual recognition memory was studied in a 66-year-old man (20 years education) with severe anterograde amnesia 5 months after a series of strokes. CT/MRI indicated multifocal ischemic infarcts predominantly in left temporo-parietal and occipital areas. The patient's WMS-III index scores were AI=71, VD=78, ARD=75, VI=68, IM=63, AD=67, GM=69, and WM=85. On two alternate forms of the CVLT-II, the patient recalled no words on short- and long-delay free and cued recall and was at chance on delayed yes-no word recognition, but was 94% and 100% accurate on two delayed forced-choice word recognition trials. He recalled no words after delays on the RAVLT or ADAS word lists and was near chance on ADAS delayed yes-no word recognition. However, he displayed perfect scores on short- and long-delay yes-no recognition for 15 target objects and 15 distractors. The patient was 93% accurate on yes-no picture recognition for 100 target magazine pictures and 100 distractors, and 96% accurate when 200 target pictures and 200 distractors were used. The patient was perfect on TOMM Trial

2 (forced-choice picture recognition). These findings demonstrate that in a patient with severe global amnesia, yes-no object/picture recognition memory can be nearly perfectly preserved in the context of chance yes-no word recognition and that forced-choice word recognition can be perfectly preserved in the context of chance yes-no word recognition.

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L. NG & N.W. PARK. The Relationship Between Verbal Description and Action Production of Novel Naturalistic Actions.

The objective was to examine the memory representation of novel naturalistic actions (NNA; i.e., unfamiliar goal-directed activities that require the production of several actions in a particular order to achieve a specific goal) through verbal description and action production. Twelve undergraduates viewed the performance of an NNA while generating a verbal description of the actions that were being performed. Subsequently, they physically reproduced the actions they had observed. This same procedure was repeated using a second NNA. Using the Action Coding System (Schwartz et al., 1991), actions of each NNA were divided hierarchically into A1 or A2 actions. A1s are divided into crux and non-crux actions, where the crux actions are more essential to the completion of a sub-goal (i.e., A2). A1s are grouped into A2s, and every A2 has at least one crux action. Further, several A2s are grouped together in order to complete the task. Results show that more crux than non-crux actions were physically performed than verbally recalled, and that significantly more crux than non-crux actions were verbally described ($t(23) = 23.57, p < .001$). Furthermore, the degree of association was higher for crux actions ($\phi = .406, p < .0001$) than non-crux actions ($\phi = .152, p < .0001$). The different pattern of results for verbal description and physical performance suggests that different cognitive processes mediate these two modes of retrieval. Specifically, crux actions are consciously accessible as evidenced by a higher proportion reported in verbal description whereas non-crux actions are mediated by conscious and unconscious processes.

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Y. GOVEROVER, E.G. HILLARY, J.C. ARANGO, N.D. CHIARAVALLOTI & J. DELUCA. Employing Spaced Learning Trials to Improve Functional Task Performance in Persons with Multiple Sclerosis.

The present study examined the utility of using spaced learning trials (when trials are distributed over time), vs. massed learning trials (consecutive learning trials) in the acquisition of everyday functional tasks. It was hypothesized that participants will recall tasks presented in the spaced condition better than tasks presented in the massed condition. In a within subjects' design, participants with Multiple Sclerosis (MS) completed two route learning tasks and two paragraph reading tasks. One task in each area was presented in the "spaced" condition, in which the stimuli were presented to the participants three times with a five-minute break between each trial, and the second task in each area was presented in the "massed" condition, in which the stimuli were presented three consecutive times to the participants. The dependent variables consisted of recall and recognition of the stimuli (paragraphs and routes) 1 minute and 30 minutes following initial learning. Finally, a single Transfer Trial was conducted for the route learning tasks in which participants were asked to recall the route again, but two distinct features about the map were altered: the map color and the location of the route on the map. Results showed that for Paragraph Learning, the spaced condition enhanced memory recall for this task

relative to the massed condition. However, this effect was not demonstrated in the route-learning task. The spacing effect can be beneficial to enhance recall and performance of activities of daily living for individuals with MS. However, it will be important during future investigations to better characterize the factors that maximize its effect.

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Invited Symposium/1:15–3:15 p.m.

A Lifespan Perspective of Sex Hormones and Cognition

Chair: Pauline Maki
Discussant: Susan Resnick

P. MAKI. Lifespan Perspective of Sex Hormones and Cognition.

The effects of the sex steroid hormones - estrogen, progesterone, and testosterone - on cognitive abilities have been examined across the lifespan. In utero, these hormones have been shown to exert organizational effects on brain, behavior and cognition. A model for these effects is congenital adrenal hyperplasia, a condition of increased androgen exposure in utero. Girls with this condition are similar to boys in play behaviors and patterns of cognitive strengths. Sex hormones also exert activational effects on cognition in premenopausal women. These effects are evident in studies comparing sexually dimorphic abilities across the menstrual cycle. In general, these studies show that performance on tests that favor women is enhanced when estrogen levels are high. Circulating ovarian hormone levels fluctuate during the perimenopausal period and then plateau to low levels during the postmenopausal period. Although the perimenopausal stage per se has little immediate effect on cognitive abilities, menopausal symptoms are related to decreases in cognitive function. The effects of hormone therapy on cognition may depend on timing of initiation of therapy. Postmenopausal women who initiated hormone therapy during the perimenopause show enhanced hippocampal function and verbal memory compared to never users. Large-scale, randomized clinical trial data suggest that hormone therapy may have competing risks and benefits on cognition in postmenopausal women. These areas of research point to the complexity of sex hormone effects on cognition and their changing mechanisms of action across the lifespan.

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S. BERENBAUM. Prenatal Androgen Effects on Social and Cognitive Development.

Sex hormones that are present during prenatal development affect social behavior and cognitive abilities across the life-span, although the association between prenatal hormone exposure and later behavior is complex. Much of the evidence about the human behavioral effects of prenatal hormones comes from individuals with endocrine disorders, especially from females with congenital adrenal hyperplasia (CAH), who are exposed to moderately elevated androgens during the prenatal period, but this evidence is increasingly being confirmed in typical populations. Females with CAH are behaviorally masculinized in several ways. Compared to their unaffected sisters, they play more with boys' toys (e.g., vehicles, Lincoln logs) in childhood, have more male-typical hobbies (e.g., electronics, sports) in adolescence and adulthood, and are more interested in male-typical occupations (e.g., engineer) at all ages; they also have higher spatial ability (e.g., rotation, targeting, geography)

in childhood, adolescence, and adulthood. These effects do not appear to result from estrogen aromatized from androgen, because women with excess estrogen exposure alone are not masculinized in activities or cognition. Ongoing studies are now focused on the mechanisms whereby hormones influence behavior. For example, what are the neural substrates underlying androgen effects on spatial ability? what basic behavioral mechanisms cause someone who is exposed to high prenatal levels of androgen to play with toy trucks? Important questions also concern joint effects of prenatal hormones and experience: hormones likely affect behavior by altering a person's selection and interpretation of the social environment, particularly those aspects related to sex.

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E. HAMPSON. Estrogen-Related Effects on Cognitive Function in the Premenopausal Woman.

Studies of pre-, peri-, and post-menopausal women have suggested that estrogen may have a variety of modulatory effects on cognitive function. In older women, studies have focused on estrogen's role in memory, especially episodic memory. In contrast, the focus in studies of young women has been on functions that are sexually differentiated and the possibility that circulating estrogen, through its central effects in the nervous system, might contribute dynamically to the feminization of these brain processes. This presentation will review some of the evidence that estrogen can modulate performance on tests of spatial reasoning and expressive language tasks. Temporary elevation in estrogen concentrations associated with the menstrual cycle may have favourable effects on memory function in young women just as it does in older women, though evidence is still equivocal. There is empirical support for the idea that the modulatory effects of estrogen selectively affect functions that exhibit sex differences and thus may contribute to the sex differences found on these tasks. The hypothesis that estrogen can affect cognitive and simple motor functions during the reproductive portion of the lifespan is supported by animal and human studies, and by studies using a variety of experimental methodologies including mapping of cognitive function across the menstrual cycle, during oral contraceptive use, pregnancy, and in transsexual men who are genetically male but who elect to take estrogen supplementation to promote the development of female secondary sex characteristics.

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P. MAKI. Effects of Ovarian Hormones on Cognition in the Perimenopausal Woman.

The effects of the sex steroid hormones - estrogen, progesterone, and testosterone - on cognitive abilities have been examined across the lifespan. In utero, these hormones have been shown to exert organizational effects on brain, behavior and cognition. A model for these effects is congenital adrenal hyperplasia, a condition of increased androgen exposure in utero. Girls with this condition are similar to boys in play behaviors and patterns of cognitive strengths. Sex hormones also exert activational effects on cognition in premenopausal women. These effects are evident in studies comparing sexually dimorphic abilities across the menstrual cycle. In general, these studies show that performance on tests that favor women is enhanced when estrogen levels are high. Circulating ovarian hormone levels fluctuate during the perimenopausal period and then plateau to low levels during the postmenopausal period. Although the menopausal transition has little immediate effect on cognitive abilities, menopausal symptoms are related to decreases in cognitive function. The effects of hormone therapy on cognition may depend on timing of initiation of therapy. Postmenopausal women who initiated hor-

mone therapy during the perimenopause show enhanced hippocampal function and verbal memory compared to never users. Large-scale, randomized clinical trial data suggest that hormone therapy may have competing risks and benefits on cognition in postmenopausal women. These areas of research point to the complexity of sex hormone effects on cognition and their changing mechanisms of action across the lifespan.

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S.M. RESNICK. Hormone Therapy and Cognitive Function in Postmenopausal Women.

Studies of estrogen-containing hormone therapy and cognition in postmenopausal women have yielded inconsistent findings. A number of small randomized trials of younger women following surgical menopause and larger observational studies of older postmenopausal women, including the Baltimore Longitudinal Study of Aging (BLSA), suggested benefits of hormone therapy on some cognitive functions, particularly verbal memory. In contrast, a large trial of combination conjugated equine estrogens (CEE) and medroxyprogesterone acetate (MPA) in older women with cardiovascular disease did not support these findings, and data from the Women's Health Initiative Memory Study (WHIMS) suggested small detrimental effects of combination CEE + MPA and CEE alone on changes in a global measure of cognitive function. In an ancillary study to WHIMS, we investigated the effects of hormone therapy on annual rates of change in specific cognitive functions and affect in 2302 older postmenopausal women without dementia. Results of the WHISCA CEE + MPA subtrial indicated that the intervention had different effects on different aspects of cognitive function and were evident only after an average of 4-5 years of treatment. These findings indicate that hormone therapy differentially affects specific cognitive functions and suggest that hormone therapy may have competing risks and benefits on cognition. Neuroimaging evaluations will help distinguish potential risks, such as increases in vascular events or inflammation, from potential benefits, such as decreased brain atrophy or amyloid deposition.

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Symposium 11/1:15-3:15 p.m.

Cognitive and Neuroimaging Links Between Late-Life Depression and Future Dementia

Chair: Meryl Butters
Discussant: Martha Storandt

M.A. BUTTERS. Cognitive and Neuroimaging Links between Late-Life Depression and Future Dementia .

The relationship between late-life depression (LLD) and dementia is very complicated. LLD patients are at risk for: 1) cognitive impairment during the depressed state, 2) cognitive impairment during a euthymic state following successful treatment, and 3) developing progressive dementia. They exhibit structural changes compared to non-depressed subjects, including abnormalities of the caudate nucleus

and putamen, decreased volume of orbitofrontal cortex, and greater burden of white matter hyperintensities, especially in the deep frontal lobe. Moreover, an inverse relationship exists between the time since the first depressive episode and hippocampal volume. Finally, just as increasing age increases the risk of Alzheimer's Disease (AD), history of depression is an independent risk factor for dementia. The relationship between LLD, cognitive impairment and dementia is difficult to reconcile, but suggests that cognitively impaired, non-demented LLD patients have both cerebrovascular burden, and elevated risk for developing AD. This symposium highlights ongoing research focusing on the interface between LLD and dementia. Meryl Butters begins with an overview of the current state of the field. The speakers will present findings on: the relationship between memory and brain metabolites (V. Elderkin-Thompson), the role of working memory capacity as a potential marker of later decay (N. Foldi), the rate of change in general cognitive functioning in remitted depressed patients over 5-years (R. Bhalla), and the relationship between neuropsychological functioning during the depressed state and future cognitive diagnosis (G. Potter). Our discussant, Martha Storandt, will place this evolving work in the context of Mild Cognitive Impairment and other pre-clinical dementia syndromes.

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V. ELDERKIN-THOMPSON, M.A. THOMAS, J.J. DUNKIN & A. KUMAR. Cognitive Performance of Minor and Major Depressed Patients on the CVLT and its Relationship to Brain Metabolites.

Objective: Metabolites are critical for amino acid, lipid and energy metabolism in the brain. Two metabolites, choline (Ch) and myo-Inositol (mI), have been reported as elevated and one, N-acetylaspartate (NAA), is unchanged among geriatric depressed patients. We investigated the association between the metabolites and cognition. Methods: Healthy controls (N=74) and high functioning, unmedicated late-onset major (N= 21) and minor (N=13) depressed volunteers (MMSE=29) completed neuropsychological testing. A subset of major depressed patients also completed two-dimensional magnetic resonance spectroscopy (2D MRS). 2D MRS estimates the relative concentrations of myo-Inositol (mI), N-acetylaspartate (NAA), creatine (Cr), and choline groups (Ch). Results: On a composite scale comprised of five recall scores from the California Verbal Learning Test (CVLT), both minor and major depressed patients differed from controls ($p=.002$). Analyses of the individual tests in the scale showed that depressed volunteers differed from controls strongly in the initial recall tests of the CVLT (trial 1 ($p=.008$), trials 1-5 ($p=.03$), list B ($p=.000$)) but the difference between groups in the final long-delay recall and recognition tests were not significant. Semantic organization of depressed volunteers also differed from controls. The most sensitive biochemical measure, Ch/Cr, explained 66% of the variance for CVLT trials 1-5 and for semantic organization, 56% for CVLT List B, but only 7% for the long-delayed recall. NAA and mI also showed a decreasing relationship with CVLT performance over the recall tasks. Conclusion: These data are consistent with the literature indicating that late-onset of depression is associated with frontostriatal dysfunction rather than loss of medial temporal processing. Future research needs to address whether this type of dysfunction improves if the mood disorder remits and if it is a long-term risk for the development of dementia.

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N.S. FOLDI, R.K. BHALLA, A.M. BRICKMAN, M.A. BUTTERS, A.E. BEGLEY & B.A. SCHODERBEK. Role of Working Memory in High and Low Functioning Patients with Late Life Depression: Using Serial Position Profiles to Differentiate Patterns of Learning and Storage. Objective: Recall profiles differ in Late Life Depression (LLD) and normal age-matched controls (NC), but characteristics why they differ needs

to be further explored. A previous study showed that item recall of a word list (CVLT) scored for serial position differentiated profiles in LLD and NC. The current study examines serial position pattern in LLD patients referred for primary complaints of depression, not for complaints of memory. Methods: 109 patients diagnosed with LLD and 45 age-matched controls are compared on CVLT serial position regional scores. LLD patients did not meet criteria for dementia, but were further subdivided into low-LLD and high-LLD functioning, if they fell below or above the cutoff of -1 SD of the mean Mattis-DRS performance of the controls. Results: For each of the 5 trials, all groups demonstrate an inverted U-shaped serial position profile, with recall from primacy and recency regions better than from the middle region, $F(2,304)=77.79, p<.001$. The low-LLD group recalled significantly fewer items than either controls or high-LLD, $F(2,151)=10.26, p<.001$, and a greater decline than the high-LLD on recall of Short and Long Delay from Trial 5, $F(4,302) = 2.89, p<.023$. Conclusions: Both NC and LLD lose recency region items over time, implicating that these items are only stored in working memory and thus vulnerable for later recall. However, the disproportionate decay of recency items in low-LLD suggests that these patients are further compromised. We discuss the role of working memory capacity in LLD as a sensitive marker of later decay in cognitive function.

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R.K. BHALLA, M.A. BUTTERS, A.E. BEGLEY, B.A. SCHODERBEK, M.D. ZMUDA, R.D. NEBES & J.T. BECKER. The Five-Year Course of Cognitive Functioning in Late-Life Depression.

Objective: Cognitive impairment both during and following an episode of late-life depression (LLD) is highly prevalent, substantial, and poorly understood. Moreover, there is a substantial risk of developing a progressive dementia following a depressive episode. The purpose of this study was to examine the long-term cognitive course of LLD patients following remission of depression. Methods: We compared the rate of cognitive change in 100 initially non-demented LLD subjects age 60+, meeting DSM-IV criteria for current episode of unipolar major depression (non-psychotic) and 40 non-demented, non-depressed, age- and education-equated elderly controls. Neuropsychological performance was compared from the time subjects achieved remission of their depressive episode up to a period of five years following remission. Results: A Kaplan-Meier survival analysis revealed that remitted LLD patients were more likely to achieve a designation of "impairment" at a quicker rate than control subjects (Log-rank = 8.98, $df=1, p=0.0027$). Impairment was defined as performance at least two SDs below the control subjects' mean on the Dementia Rating Scale (≤ 134). Over five years, 7/40 (17.5%) of control subjects scored in the impaired range compared to 39/100 (39%) of remitted LLD patients. Conclusions: As a group, remitted elderly depressed subjects were more likely to decline cognitively at a faster rate than age- and education-equated controls, despite no longer being depressed. This suggests that cognitive impairment may be less dependent on mood state and more reflect permanent trait deficits that include underlying degenerative brain changes. Further long-term follow-up is necessary to elucidate pathways linking LLD to Mild Cognitive Impairment and dementia subtypes.

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G.G. POTTER, R.H. WAGNER, K.A. WELSH-BOHMER & D.C. STEFFENS. Relationship of Neuropsychological and Clinical Definitions of Dementia in the Context of Late-Life Depression.

Objective: Research suggests the emergence of depression later in life may be a prodrome for dementia, but considerable heterogeneity exists among this population. Methods: In the current study, 184 de-

pressed individuals aged 60 and older were enrolled in a longitudinal treatment study of late-life depression. Baseline neuropsychological test performance was converted to an algorithm to diagnose dementia based on DSM-IV cognitive criteria, and was compared with a comprehensive clinical diagnosis of dementia as participants were followed over time. Results: We found that approximately 20% of depressed individuals were diagnosed as demented by neuropsychological algorithm at baseline assessment, and that 28% of these individuals were later diagnosed as demented based on clinical diagnosis. In contrast, only 5% of individuals who were non-demented by neuropsychological algorithm were later diagnosed as clinically demented. Individuals with neuropsychologically defined dementia at baseline who later converted to clinically diagnosed dementia differed from non-converted individuals by greater age, later age of onset of depression, higher cumulative medical burden, and more extensive periventricular pathology on MRI. Conclusions: The current findings suggest that the absence of neuropsychological impairment among depressed elders is protective for dementia, whereas early neuropsychological impairment is more likely to progress to dementia among individuals with later onset of depression, poorer health, and more extensive vascular involvement.

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Paper Session 12/1:15–3:15 p.m.

Adult TBI: Cognitive Studies

J.A. TESTA, J.F. MALEC, A.M. MOESSNER & A.W. BROWN. Neurobehavioral problems and family functioning after traumatic brain injury.

To examine the relationship between family functioning and neurobehavioral problems after traumatic brain injury (TBI) or orthopedic injuries (OI). Design: Longitudinal analyses of data from an inception cohort including mild TBI, moderate/severe TBI, and OI patients. 75 moderate/severe TBI patients, 47 mild TBI patients, and 44 OI patients at discharge; 49 moderate/severe TBI patients, 24 mild TBI patients, and 33 OI patients at one-year follow-up. Outcome Measures: Measures of family functioning (FAD) and neurobehavioral functioning (NFI) at hospital discharge and one-year follow-up. At discharge, moderate/severe TBI patients had higher symptoms of depression, memory/attention problems, and motor impairments compared to OI patients and greater communication difficulties than OI or mild TBI patients. Both moderate/severe and mild TBI patients reported more somatic problems compared to OI patients. At follow-up, moderate/severe TBI patients continued to have more neurobehavioral problems in the areas of memory/attention, depression and communication. Approximately 1/3 of each group had unhealthy family functioning at each assessment period. Few patients reported both impaired family functioning and clinical depression. Distressed family functioning strongly correlated with increased rates of neurobehavioral symptoms. Family dysfunction at follow-up was best predicted by family dysfunction at discharge and depression or memory/attention deficits at follow-up. Neurobehavioral problems in communication and memory/attention were more severe and of longer duration for moderate/severe TBI patients. There was a significant relationship between family distress and neurobehavioral problems, particularly depression. Those patients at greatest risk for distress at follow-up were those with family dysfunction at discharge and continued neurobehavioral problems.

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C.M. O'TOOLE, H.A. PATTERSON, F. GAU, C. O'CONNOR, S.E. BLACK & B. LEVINE. Psychosocial Outcome at 1-year Following Traumatic Brain Injury: Relationship to Quantitative MRI.

There is marked variability in outcomes following traumatic brain injury. The contribution of brain damage to this variability has been difficult to determine due to the lack of specificity of brain imaging findings. In this study, MRI data from a large sample of chronic-phase TBI patients was subjected to quantitative regional analysis. These data were then related to psychosocial outcome. Seventy-one patients spanning the full range of TBI severity were recruited from consecutive admissions to a level I trauma center. They were scanned with high resolution MRI and administered a comprehensive battery of psychosocial outcome measures. Following segmentation into separate tissue compartments, regional measures of atrophy were derived from the MRI scans and correlated with outcome data. Lesion effects were also examined. Demographically-matched controls were also tested on behavioral measures (but not MRI). Significant correlations were restricted to white matter. Left ventral frontal volume was related negative affect on the Dysexecutive Questionnaire and self-reported occupational difficulties. Right dorsal frontal volume was related to significant other endorsement physical dependency on the Head Injury Family Interview Checklist. Right temporal volume was related to self-reported changes in intimate relationships. Patients with prefrontal lesions were rated as more impaired than non-lesion patients (with similar TBI severity) on more measures of affect, insight, behavior and social isolation. This is the first study to examine high quality brain imaging in relation to psychosocial outcomes in the chronic phase of TBI. Both volume loss and lesion in the frontal and temporal regions are related to psychosocial changes. Ventral frontal regions are particularly vulnerable to head injury and related to specific changes in behavior. These findings highlight the role of frontal and temporal white matter pathology in TBI outcome.

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D.J. TODD & J. FREELAND. Seasonal Affective Disorder Following Brain Injury.

Seasonal affective disorder (SAD) is a well established construct in the general population (Lam and Levitan, 2000) but only a single case study has examined SAD following brain injury (Hunt and Silverstone, 1990). Because psychomotor agitation and irritability are prominent features in SAD, the present study retrospectively examined weekly irritability data, as measured by graded frequency recordings of frustration or aggression, in clients from two neurorehabilitation units situated in Northern England. Out of a study population of twenty-seven inpatients with neurological injuries who had remained within the neurological rehabilitation units for longer than twelve months and had on average at least two incidents of verbal or physical aggression per week during their residency, six index cases were selected based upon a visual analysis of the irritability data (graphs.) The data was grouped by season and an Analysis of Covariance with the dependent variable being irritability and the covariant being a weighted measure of antidepressant medication. The effect of season on irritability was found to be significant [$F(3,24) = 8.513, p < 0.01$]. These results indicate a relatively high prevalence (22%) of SAD among this sample with chronic neurological impairments. This prevalence is markedly higher than the average prevalence of SAD in normal populations as suggested by Magnusson (2000). The findings of the current study would suggest that SAD deserves greater attention from clinicians and researchers in brain injury with particular emphasis on irritability as a factor with changes often occurring during equinoxal periods.

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R.D. VANDERPLOEG, G. CURTISS & H.G. BELANGER. Adverse Long-term Neuropsychological Outcomes Following Mild Traumatic Brain Injury.

Studies of non-referred individuals with MTBI that include carefully matched control groups are lacking, but necessary to draw conclusions regarding natural recovery from MTBI. We examined the neuropsychological outcomes of MTBI an average of eight years post-injury in a non-referred community-dwelling sample of male veterans. This was a cross-sectional cohort study derived from the Vietnam Experience Study. Three groups matched on premorbid cognitive ability and demographic characteristics were examined, those who: (1) had not been injured in a MVA nor had a HI (Normal Control; $n = 3214$), (2) had been injured in a MVA but did not have a HI (MVA Control; $n = 539$), and (3) had a HI with altered consciousness (MTBI; $n = 254$). A MANOVA found no group differences on a standard neuropsychological test battery of 15 measures. Across measures, the average neuropsychological effect size of MTBI compared to either control group was -0.03 . Subtle aspects of attention and working memory also were examined by comparing groups on PASAT continuation rate and CVLT proactive interference (PI). The MTBI group evidenced attention problems in their lower rate of continuation to completion on the PASAT and in excessive PI. Unique to the MTBI group, PASAT continuation problems were associated with left-sided visual imperceptions and excessive PI was associated with impaired tandem gait. These results show that MTBI can have significant adverse long-term neuropsychological outcomes on subtle aspects of complex attention and working memory, and that these deficits are independently related to neurological symptoms. Correspondence: Rodney D. Vanderploeg, Ph.D., Psychology, Tampa VAMC, Psychology Service (116B), James A. Haley Veterans Hospital, Tampa, FL 33612. E-mail: Rodney.Vanderploeg@med.va.gov

J.L. PONSFORD. Effects of age on long-term outcome following traumatic brain injury.

Age has been identified in both animal and human studies as a factor which has a significant influence on outcome following traumatic brain injury (TBI). However, this operates in a complex fashion. The influence of age is potentially modified by environmental and developmental factors. This paper will examine the impact of age on outcome two years following moderate to severe TBI. A cohort of 808 patients with moderate to severe TBI, aged 15-80, who had undergone rehabilitation were followed up 2 years post-injury. They completed measures including a Structured Outcome Questionnaire covering independence in ADL, vocational and relationship status and changes in cognitive, behavioral and emotional function, the Craig Handicap Assessment and Reporting Technique (CHART) and the Glasgow Outcome Scale-Extended version (GOS-E). Univariate comparisons indicated that those who were older (age ≥ 45) showed significantly worse outcomes in the domains of mobility, independence in ADL and employment, and lower scores on the GOS-E and all CHART subscales than those aged <45 years. These differences were also evident in another cohort of 170 TBI patients followed up at 10 years post-injury, but younger patients were more likely to report being affected from a cognitive, psychosocial and emotional point of view. Results suggest that whilst older individuals have worse functional outcomes, the psychosocial impact of TBI is greater in those who are younger. Rehabilitation programs need to adapt to the differing needs of their clients across the lifespan. The impact of the ageing process on head-injured individuals has yet to be documented. Correspondence: Jennie L. Ponsford, PhD, Department of Psychology, Monash University, Wellington Road, Clayton (Melbourne), VIC 3800, Australia. E-mail: jennie.ponsford@med.monash.edu.au

J.L. PONSFORD, D. RUDZSKI & K. NG. The influence of ApoE polymorphism on cognition and outcome following traumatic brain injury.

The apolipoprotein E (ApoE) gene has increasingly interested researchers investigating patterns of recovery from traumatic brain injury (TBI),

with early trends suggesting it influences both cognition and outcome. The majority of research has focused on the effect of the $\epsilon 4$ allele. The present study aimed to further explore the influence of ApoE polymorphism on cognition and outcome following TBI. One hundred and twenty patients with moderate-severe TBI were assessed at 3, 6 and 12 months post-injury and compared with 84 controls of similar gender, age and education, assessed at similar intervals, on measures of memory (RAVLT, WMS-III), executive function (COWAT, Trail Making Test, BADS Zoo Map), speed and attention (SDMT), and functional outcome (GOS-E and MPAI). It was expected that carriers of the $\epsilon 4$ allele would perform worse and recover more slowly than $\epsilon 4$ non-carriers, and carriers of the $\epsilon 2$ allele would perform better and recover more quickly than $\epsilon 2$ non-carriers. Apart from isolated non-significant trends, there was no significant evidence of poorer cognitive performance or functional outcome, or slower improvement, in either TBI or control participants possessing the $\epsilon 4$ allele relative to non-carriers. Similarly, those possessing the $\epsilon 2$ allele did not perform stronger, exhibit better outcome, or improve at a faster rate. These results suggested that ApoE, and the $\epsilon 4$ allele in particular, may have less effect on cognition and outcome following TBI than first thought.

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Paper Session 13/1:15–3:15 p.m.

Normal and Abnormal Executive Function Across the Lifespan

H.M. CONKLIN, M. LUCIANA, C. HOOPER & R. YARGER. Working Memory Performance in Typically Developing Children, Adolescents and Young Adults: An Upward Extension of and Methodological Expansion upon Past Investigations.

We previously demonstrated that protracted frontal lobe development could be captured in the performance of children ages 9 through 17 on working memory (WM) measures; however, it was unclear whether adult levels of performance had been attained by age 17. Consequently, this study sought to examine the WM performance of young adults, in comparison to children and adolescents, and to investigate the relationships among WM performance, pubertal status and personality traits. A comprehensive WM battery (Wechsler digit and spatial span tasks; a letter span task; computerized spatial, verbal and object self-ordered pointing tasks; a computerized spatial delayed response task; and a computerized n-back task) was administered to typically developing children, adolescents and young adults ($N=153$; ages 9-25; 67 males, 86 females). Findings indicate that young adults (ages 18-25) continue to show the same pattern of improved WM performance on most tasks; however, their performance was not generally statistically different than 16 and 17 year olds. There was a measurable contribution of pubertal status (Self-rated Tanner Stages and Petersen Puberty Questionnaire) to WM performance above and beyond age. WM performance was not systematically related to assessed personality traits (Eysenck Personality Questionnaire). The factor structure underlying WM tasks, as determined by Principal Components Analysis, added support for process-specific WM models. Current findings have important implications for understanding the typical developmental trajectory of frontally-mediated behavior. Researchers may also begin to understand when and how development gets derailed in disorders with suspected frontal lobe involvement by investigating the performance of relevant clinical populations on similar WM measures.

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D. WABER, E.B. GERBER, V. TURCIOS & E.R. WAGNER. Neuropsychological Correlates of Performance on High-Stakes Testing in Children from Disadvantaged Urban Schools: Which Child Left Behind?

Children's ability to succeed on federally mandated high-stakes testing can have a profound impact on their lives. We examined children's neuropsychological functions in relation to their performance on these high-stakes tests. Ninety-one fifth graders from two urban schools completed a brief battery of neuropsychological tests of motor function, executive function, processing speed and working memory. Teachers completed behavioral rating scales (BRIEF, BASC). Hierarchical regression analysis was applied to evaluate the association of neuropsychological test performance and behavioral ratings with state-mandated achievement test scores obtained in the fourth grade. The children as a group exhibited an increased prevalence of problems in executive functions and slow motor speed (both $p < .01$), but processing speed and working memory were within the range of normal expectation. The model, with age and sex forced in first, accounted for 49% of the variance in English scores and 41% of the variance in Mathematics. The neurobehavioral variables accounted for 35% of the variance in English scores and 32% in Mathematics scores. Neurodevelopmental factors, heretofore unrecognized, may be highly relevant considerations in children's performance on high-stakes tests and possibly in the well-documented bias of these tests against poor children. Cognitive self-regulation appears to be a particularly potent factor. Children's academic success may be a function of how they learn, as much or more than what they learn. Educational approaches that emphasize curriculum can fall short, especially for disadvantaged children, if they do not address this key consideration as well.

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A.E. COUDRIAAN, J. OOSTERLAAN, E. DE BEURS & W. VAN DEN BRINK. Executive Dysfunctions in Impulsive and Addictive Disorders: Performance Profiles of Pathological Gamblers, Alcohol Dependent Patients, Tourette Syndrome Patients, and Healthy Controls.

In this study a comparison is made of executive functioning in pathological gambling (PG), alcohol dependency (AD), Tourette Syndrome (TS) and a normal control (NC) group. Characteristics and specificity of executive function deficits in PG can thus be investigated. Furthermore, the role of comorbid psychopathology on executive functions is assessed. The four groups (PG: $n=49$; AD: $n=48$; TS: $n=46$; NC: $n=50$) were tested on a wide range of executive function (EF) tasks: [1] inhibition measured through a Stop Signal paradigm (Logan et al. 1997), [2] time estimation and reproduction (Barkley et al. 2001), [3] cognitive flexibility (Wisconsin Card Sorting Test; Heaton 1981, Fluency task) [4] working memory (Self Ordered Pointing Task; Petrides and Milner, 1982) [6] planning (Tower of London; Krikorian et al 1994) and [7] decision making (Iowa Gambling Task; Bechara et al 1994). Response speed, short term memory and sorting skills tasks were administered to control for cognitive skills prerequisite for the EF tasks. No differences were observed in basic cognitive functions. Pathological gamblers scored deficiently on inhibition, time estimation, cognitive flexibility, planning and decision making, compared to the normal control group. The AD group scored quite similar to the PG group, performing deficiently in terms of inhibition, cognitive flexibility, planning and decision making. In contrast, the TS group showed deficiencies in inhibition only. In general, the executive deficits in the PG, AD and TS group were not asso-

ciated with co-morbid Major Depressive Disorder, Attention Deficit Hyperactivity Disorder, or Antisocial Personality Disorder. At a neuropsychological level, PG resembles addiction rather than impulse control disorder. The consequences of these findings for the treatment and future classification of PG are discussed.

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E.C. RECKNOR, N.L. DENBURG, S.L. DOLAN, A.R. KAUP, H.J. FRIEDRICHSEN, D. TRANEL & A. BECHARA. Education Facilitates Iowa Gambling Task Performance.

The Iowa Gambling Task (IGT) is a test of reasoning and decision-making in which participants choose between decks of cards with varying amounts of reward and punishment. The focus of the study was to investigate the influence of education on IGT performance. Prior research by Evans and colleagues reported a paradoxical effect of education on the IGT, with less-educated individuals outperforming more highly educated participants. We examined the IGT performance of 148 healthy participants aged 26-85 (57% female). The sample was divided into groups: Low Education (<16 years of education, $n=55$) and High Education (≥ 16 years, $n=93$). IGT performance was separated into five blocks, each containing 20 card selections. A repeated-measures ANOVA revealed a main effect of block ($p < 0.001$), as well as an interaction between block and education ($p < 0.05$). This interaction reflects the fact that the higher educated individuals showed more improvement than the less educated as the task progressed. Although both groups performed similarly in the beginning of the task, there was a divergence in performance toward the latter part as the High Education group began to select more advantageous cards than the Low Education. We conclude that there is a facilitative effect of education on IGT performance. The current findings stand in direct contradiction to the results reported by Evans et al. Our study provided a much wider sampling of key demographics (our participants were of both genders, had a wide range of educational backgrounds, and covered an extensive age range), and this could explain the discrepancy between the studies.

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A.M. BRICKMAN, M.E. ZIMMERMAN, R.H. PAUL, S.M. GRIEVE, D.F. TATE, R.A. COHEN & E. GORDON. Frontal Lobe White Matter and Executive Functioning Changes across the Adult Lifespan.

There has been an increased focus on the examination of brain morphology in healthy individuals across the adult lifespan. Studies have shown dramatic age-associated changes in brain volume and normal age-associated cognitive decline, particularly in frontal lobe white matter and executive functioning, respectively. The current study utilized MRI and neuropsychological assessment to examine these relationships, as well as to determine whether age-associated changes in executive functioning are mediated by changes in frontal lobe white matter volume. The study made use of data acquired from an international collaboration composed of 6 laboratories in English-speaking countries. One hundred ninety-nine neurologically healthy adults (mean age=40.46 SD=15.29) received MRI and a comprehensive neuropsychological assessment. MR images were normalized and segmented by tissue type using a region-of-interest voxel-based-morphometry approach. Subjects were divided into Young ($n=77$) and Older ($n=40$) groups. A mixed design ANOVA revealed that older participants had significantly less overall white matter than younger participants. Differences in frontal lobe white matter volume were of largest magnitude, followed by temporal lobe; parietal and occipital lobe white matter differences did not reach statistical significance. Age was significantly associated with worsening performance on neuropsychological tests of executive functioning and memory. Partial correlations controlling for frontal lobe white matter

volume revealed that the associations between age and neuropsychological test performance remained significant, but were of decreased magnitude. The results confirm age-associated decline in frontal white matter volume and executive functioning and suggest that the latter is partially mediated by the former. Future research should focus on other factors that might mediate the negative relationship between age and neuropsychological functioning.

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C. WIERENGA, W. PERLSTEIN, M. BENJAMIN, C. LEONARD, L. GONZALEZ ROTH, T. CONWAY, M. CATO, K. GOPINATH, R. BRIGGS & B. CROSSON. Age-Related Changes in Word Retrieval: Frontal-Executive vs. Temporal-Semantic Substrates.

Older adults frequently complain of word-finding difficulties. This study tested two competing hypotheses to determine whether age-related changes in word retrieval result from changes in frontal lobe systems for retrieving lexical and semantic information or in the inferior temporal lobe systems for semantic storage. We also investigated the role of category (living, nonliving) and visual attribute (global form, local detail) in semantic representation in the fusiform gyrus. Forty healthy adults (20 younger, 20 older) named aloud pictures of animals, tools, and vehicles during fMRI. Results show that older adults activate a larger frontal network (right BA 45, right IFG, bilateral rostral cingulate zone/SMA) with decreased lateralization during word retrieval. Lack of an age-associated difference in the inferior temporal cortex indicates that semantic storage systems are similar in older and younger adults. Categories are processed in the lateral and medial regions of the fusiform gyrus according to whether they are living (animals) or nonliving (tools, vehicles), respectively. In contrast, visual attributes of global form (animals) are processed more by the right fusiform gyrus and local details (tools) are processed more by the left fusiform gyrus. When both global and local attributes are relevant to processing (vehicles), cortex in both left and right fusiform gyri is active. Taken together, these findings suggest that a deterioration of executive rather than storage functions underlies age-related changes in word retrieval and support the role of visual attribute and category in semantic representation.

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Poster Session 9/3:15–5:15 p.m.

Cognitive Intervention/Rehabilitation

J. WEIS, M. OLIVEIRA & M. LACY. Psychiatric History in Memory Training Program Volunteers.

Approximately 10% of older adults have one or more psychiatric disorders (Burke & Wengel, 2003). In the present study, we hypothesize that community dwelling adults volunteering for a memory training program will report much higher rates of psychiatric disturbance, despite intact cognition. Participants completed a personal history questionnaire, along with the Memory Functioning Questionnaire, developed specifically to subjectively assess the everyday memory functioning of older adults. In addition, they completed a battery of tests focused on assessing memory functioning. Study volunteers consisted of 33 subjectively healthy individuals with a mean age of 67 and mean education of 16.14 years. Thirty-one percent reported a history of depression, while twenty-eight percent reported generalized anxiety and fifteen percent reported experiencing panic attacks. Additionally, forty-three

percent of subjects reported being prescribed antidepressant or anti-anxiety medications. Self report of memory functioning indicated severe perceived impairment (MFQ General Frequency of Forgetting factor Z score = -3.0). In contrast, across memory tests (WMS-3; HVLIT), participants performed in the average to high average range. As seen in other studies, little correlation was seen between objective and subjective memory performance. Despite no objective impairment, these patients volunteered to complete testing and participate in an 8 week training course. Psychiatric disturbance is much higher in this population and may contribute to decision making regarding participation. Clinical and ethical implications for such programs in the context of prior literature is presented.

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T. HERLANDS, J. CHOI & A. MEDALIA. A Randomized Comparison of the Efficacy of Cognitive Remediation and Wait List Control for Psychiatric Outpatients.

The objective of this study was to compare the relative efficacy of cognitive remediation in improving cognitive outcome in outpatients with schizophrenia spectrum disorders (SSD) or affective spectrum disorders (ASD). It was hypothesized that (a) both diagnostic groups would show a positive response to cognitive remediation compared to a treatment control condition, and (b) ASD participants would show greater gains on neuropsychological measures since they tend to possess greater cognitive reserve than SSD participants. Study used a test retest, treatment controlled design with treatment consisting of 18 one-hour sessions of cognitive remediation over a period of 9 weeks (N=60). The Neuropsychological Educational Approach to Cognitive Remediation (NEAR) was utilized since it efficiently employs computer-based cognitive training that targets neuropsychological deficits as well as motivation and learning style. Uni-variate 2 x 3 mixed-design, one-way ANOVAs with time as a within-subject factor, and group type as a between-subject factor was used to analyze the data on the first 30 subjects enrolled in the protocol. Cohen's d Effect Sizes were calculated for significant findings to gauge treatment effect. The preliminary results give support for the first, but not the second hypothesis. Regardless of diagnosis, patients receiving cognitive remediation made more improvements on tests of executive functioning (WCST, Trailmaking Test B) compared to the control group (Effect Sizes ranged from 0.42 - 1.88). Interestingly, baseline scores showed the ASD and SSD group functioning at relatively the same cognitive level prior to treatment. In addition, the SSD group made greater gains on many of the cognitive measures than the ASD group. The preliminary results demonstrate the effectiveness of NEAR in treating executive deficits in patients with a range of psychiatric disorders.

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R.A. LILLIE, C.A. MATEER & D. LINDSAY. Cognitive Outcomes Following Memory Retraining.

Attempts at the rehabilitation of memory disturbances have followed two general approaches, compensatory models and remediation of underlying deficits. While compensatory strategies have found clinical utility, the remediation of underlying cognitive processes has shown mixed results. One explanation offered for the limited success of remediation attempts relates to the lack of well-specified models of normal memory function (Glisky, 2002). We report results of a new memory-training program based on a well-established model of memory processing (Jacoby, 1991). As part of this framework, memory output is thought to occur via two independent processing streams, one related to conscious recollection and the other related to more implicit feelings of familiarity. While this training paradigm has shown to be successful at improving memory performance in a group of aging adults (Jennings & Ja-

coby, 2001), the generalizability of results to other measures of memory is unknown. For the current project, 10 adults with TBI and memory difficulties completed 7 days of memory retraining. To assess generalizability, participants additionally completed a series of cognitive and neuropsychological tests pre- and post-training focused on domains of memory and attention. As the training task focuses on list-learning, we anticipated change on measures of memory similar to the training task. There was considerable variability between the subjects, with some, but not all demonstrating significant improvements on the task. Generalizability issues and implications for functional memory change will be discussed in the context of variability in outcomes on cognitive testing. Correspondence: Rema A. Lillie, BA, Psychology; University of Victoria, Psychology; University of Victoria, PO Box 3050 STN CSC, Victoria, BC V8W3P5, Canada. E-mail: rlillie@uwic.ca

S. BORGARO & J. BAKER. Reliability Studies for the BNI Affect Test. Disturbances in affect are often clinically observed in patients after brain injury, particularly during the early stages of recovery. The purpose of this study is to present initial test-retest and inter-rater reliability results on a new measure of affect for use with patients after brain injury. The BNI Affect Test is a new measure of affect standardized on 200 normal controls. It consists of 40 photographed pictures displayed across four different subtests: Facial Perception, Facial Matching, Interpersonal Perception, and Facial Discrimination. Twenty neurologic inpatients were retested with the BNI Affect Test within 3 days of their initial testing to establish test-retest reliability. A separate sample of 15 controls recruited from the general population were tested using the BNI Affect Test to establish inter-rater reliability by a second rater. Test-retest reliability coefficient for the Total BNI Affect Test score was $[r(18) = .985, p < .001]$. Inter-rater reliability coefficients were also calculated for each of the four subtests of the BNI Affect Test and all were significant at $p < .001$. Inter-rater reliability coefficient was significant at $p < .001$ for the Total BNI Affect Test score and each of the four subtests. These initial reliability studies on the BNI Affect Test support the test-retest and inter-rater reliability of this new test of affect. This test may provide clinically useful qualitative and quantitative information about a patient's emotional state during early recovery. Further studies documenting its clinical utility and psychometric properties with brain injured patients are currently in progress.

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A. ALDERSON & S. MACCIOCCHI. Family Needs during Inpatient and Outpatient TBI Rehabilitation .

The present prospective study identified and compared the needs of caregivers during inpatient and outpatient stages of TBI rehabilitation. These self-reported needs were also compared to multidisciplinary staff perceptions of anticipated caregiver needs. The Family Needs Questionnaire (FNQ; Kreutzer & Marwitz, 1989) was administered to a total of 50 caregivers of individuals completing inpatient and outpatient rehabilitation therapies for moderate to severe traumatic brain injuries. Caregivers completed the questionnaire at the initiation and completion of both inpatient and outpatient therapies. A total of 30 multidisciplinary staff also completed the same questionnaire, responding to items as they anticipated caregivers would respond. Subscale scores from the FNQ were compared between staff and caregivers using t-scores, revealing significant differences in expectations and actual needs caregiver needs. Staff significantly overestimated the actual needs of caregivers at both the inpatient and outpatient levels, with a tendency to generalize their needs across the board. Caregiver needs were significantly different at inpatient and outpatient levels. Factor analysis of individual FNQ items revealed a subset of caregivers at greater risk for adjustment difficulties. Utilization of early caregiver needs analysis may assist with devel-

opment of appropriate treatment and training strategies, as well as identifying those caregivers most at risk for adjustment difficulties. The results from this study suggest that rehabilitation staff often overgeneralize the needs of caregivers, which may contribute to the high level of rehabilitation staff turnover and dissatisfaction. More specific information about caregiver needs may be beneficial for patient, staff, and caregivers - additional investigations are planned to determine the relationship between appropriately met family needs and patient outcomes. Correspondence: Amy Alderson, PhD, ABI, Shepherd Center, 2020 Peachtree Road, Atlanta, GA 30309. E-mail: amy_alderson@shepherd.org

D.I. SITZER, R.L. SKEEL, G.F. RONAN & D.M. DUSH. Predictors, Obstacles, and Facilitators of Treatment Adherence.

Adherence to behavioral regimens such as medication, dietary, and exercise regimens, is central to effective healthcare. Yet, treatment non-adherence rates can range upward of 73%. Cognitive abilities such as memory and problem-solving have been linked to medication non-adherence. The current study evaluated the predictive utility of measures of these cognitive abilities for adherence to novel behavioral regimens, and identified behavioral and environmental factors that both inhibit and facilitate adherence. Forty-nine college undergraduates completed measures of their memory, intellectual, and abstraction and problem-solving abilities. Participants' adherence to four novel behavioral regimens was monitored during the following two weeks, after which they described their actual adherence strategies and obstacles they encountered. Participants' strategies for adherence most typically included integrating tasks into their daily routine (10-62%), and using written reminders (20-50%). Participants who integrated tasks into their daily routine demonstrated higher rates of adherence than those who did not use an integration strategy (e.g. e-mail task: $t_{11} = 2.89, p < .05$). Participants who used written reminders also demonstrated higher rates of task adherence (e.g. 3x5 card delivery task: $t_{30} = 3.48, p < .01$). The most common obstacles to adherence were forgetfulness (46%), being out of town (17%), and oversleeping (13%). No relationship was identified between cognitive abilities and observed adherence. These findings may aid in the development of cognitive training programs aimed at increasing treatment adherence through teaching participants to integrate new regimens into their daily routines, use written reminders, and problem-solve strategies for overcoming obstacles such as forgetting and being out of town.

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Cognitive Neuroscience

R. ROSENBAUM, B. LEVINE & D. STUSS. Autonoetic Consciousness is not Necessary for Theory of Mind.

Autonoetic consciousness and theory of mind both involve the ability to represent unobservable mental states, whether one's own during autobiographical remembering or that of others when inferring the source of a belief or action. It has been suggested that these two uniquely human abilities are closely connected, but the evidence supporting this claim is correlational at best. Here, we investigate the possibility that autonoetic consciousness is a critical component of theory of mind. Theory of mind was examined in two cases, K.C. and M.L., who have an extremely impoverished sense of subjective re-experiencing as indicated by complete retrograde amnesia for autobiographical episodes. An extensive battery of tests that measures theory of mind in a variety of ways was administered to assess the extent to which the patients can reason about other people's thoughts and feelings without the benefit of autonoetic consciousness. The patients performed well on social perception

and social reasoning tests known to be sensitive to theory of mind impairment. Specifically, the patients showed clear appreciation of false beliefs, faux pas, subtle hints, deception, sarcasm, empathy, and cognitive-affective states from eye gaze. Our findings cast doubt on the possibility that theory of mind depends on autonoetic consciousness, suggesting that current conceptions of 'mentalizing' are in need of refinement.

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L.M. LEIDIG, M. KIM, G.P. CRUCIAN & A.M. BARRETT. Spatial Bias in Korean Subjects: Influence of Early Reading Direction.

Further comparing spatial bias between subjects who learned to read right-to-left, top-to-bottom (RLV's), and who learned left-to-right, horizontally (LRH's), including both implicit and explicit, and horizontal and radial, visual-spatial assessment. 52 Korean RLVs (mean age 67.58, SD 5.82) and 52 Korean LRHs (mean age 34.96, SD 2.97) performed spatial-syntactic (drawings depicting four sentences, e.g. "A mother combs her child's hair"), and visual-spatial tasks (10 line bisections, tree/house/person drawing to examine implicit bias in horizontal/radial displacement of their drawings from page center). RLVs demonstrated rightward spatial-syntactic bias ($P = 0.002$) absent in LRH's (Mann-Whitney U group comparison, $P = 0.007$). Although line bisection performance was comparable, RLV's actually demonstrated more implicit visual-spatial bias (mean = -12.01 mm leftward, SD 14.43; LRH: mean = -5.84 mm leftward, SD 6.05; $P = .005$). Both groups demonstrated a far radial implicit bias (RLV: mean = 14.22 mm far, SD 31.16, $t = 3.29$, $P = .002$; LRH: mean = 18.50 mm far, SD 21.26, $t = 6.26$, $P = .000$). In this larger Korean subject group, RLV rightward spatial syntactic and leftward implicit visual-spatial bias exceeded that in LRHs. This further supports a greater effect of learned reading direction on spatial-syntactic bias than visual-spatial bias. RLVs were older than LRHs in this experiment, thus studies examining these tasks across age groups are also needed.

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H.M. GENOVA, N.D. CHIARAVALLI, F.G. HILLARY, A.J. KALNIN & J. DELUCA. Examining the Effects of Lesion Load on BOLD Activation in Multiple Sclerosis.

Although the application of functional Magnetic Resonance Imaging (fMRI) to study cognitive functioning in Multiple Sclerosis (MS) has recently become more widespread, the effects of lesion load (LL) on cortical activation remain elusive. This study examined the relationship between LL and BOLD activation in individuals with MS. Participants included 10 subjects with clinically definite MS. During fMRI, subjects performed a working memory task, a modified version of the Paced Auditory Serial Addition Test (mPASAT). Gross LL was quantified via visual inspection of participants' T2-weighted and FLAIR images by a board-certified neuroradiologist. Correlational analyses were performed to examine the relationship between LL in specific brain regions and activation levels in contralateral and ipsilateral regions. We examined four regions: the left and right frontal and parietal lobes. The results indicated that right frontal lesions were associated with decreased activation in right frontal cingulate gyrus, but no relationship was noted between right frontal LL and left frontal activation. Left frontal LL was inversely correlated with activation in the left frontal lobe, including the superior frontal gyrus, frontal cingulate gyrus, and dorsal prefrontal cortex. Left and right parietal lesions did not correlate with either right or left parietal activation. Our findings indicate that LL in MS, specifically

in the frontal lobes, may be correlated with decreases in activation of ipsilateral brain regions on fMRI tasks. Therefore, LL, and other measures of pathology should be considered when studying cognitive functioning in MS using fMRI. This research was conducted at the UMDNJ-Graduate School of Biomedical Sciences.

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R.E. JUNG, A.S. LEVINE, R.A. YEO, R.J. HAIER, W.R. SIBBITT & W.M. BROOKS. Biochemical Markers of Individual Differences in Cognitive Functioning.

Proton Magnetic Resonance Spectroscopy (^1H -MRS) is a powerful tool to assess individual differences in neurochemistry *in vivo*. Various researchers have linked N-acetylaspartate (NAA), a marker of neuronal function and viability, to cognition in both disease and health (Ross & Sachdev, 2004). Here we examine the regional specificity of white matter neurometabolism underlying individual differences in normal brain functioning. In a sample comprised of 27 healthy young subjects, we obtained ^1H -MRS measures from three white matter voxels including bilateral frontal and left occipito-parietal regions. We also obtained measures of intellectual (Wechsler Adult Intelligence Scale-III) and broad neuropsychological functioning described previously (Jung et al., 1999a; 1999b). Spectra were processed automatically with LCModel, and corrected for percent tissue within each voxel. We found strong relationships between NAA within the occipito-parietal white matter and both intellectual [$F_{(25,1)} = 8.65$, $p = .007$; $r^2 = .26$] and broad neuropsychological functioning [$F_{(25,1)} = 9.96$, $p = .004$; $r^2 = .28$]. More specifically, a model that included lower frontal NAA and higher occipito-parietal NAA predicted better performance on measures sensitive to working memory [$F_{(24,2)} = 5.8$, $p = .009$; $r^2 = .33$]. These results replicate our earlier findings (Jung et al., 1999a; 1999b) within a new study sample. Moreover, they highlight the "neural efficiency" hypothesis (Haier et al., 1992) that suggests optimal brain organization underlying individual differences in cognitive processes. 1. A. J. Ross, P. S. Sachdev, *Brain Res Brain Res Rev* 44, 83 (2004). 2. R. E. Jung et al., *Proc R Soc Lond B Biol Sci* 266, 1375 (1999a). 3. R. E. Jung et al., *Neuroreport* 10, 3327 (1999b). 4. R. J. Haier et al., *Brain Res* 570, 134 (1992).

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A.S. LEVINE & R.E. JUNG. Cognitive Spectroscopy: A Window to Neuropsychological Functioning.

Cognitive spectroscopy is a neuroimaging modality that combines measures of regional brain chemistry with measures of neuropsychological functioning (Ross and Sachdev, 2004). Among the neurometabolites most commonly assessed are: 1) N-acetylaspartate (NAA), a marker of neuronal density and function, 2) choline (Cho), a marker of cell membrane synthesis and repair, and 3) creatine (Cre), a marker of tissue energetics. As age is a strong predictor of cognitive functioning across the lifespan, we aimed to determine whether age was a moderating variable in the relationships observed between spectroscopic and neuropsychological measures in normal control subjects. A PUBMED literature review was performed using the terms "cognitive," "spectroscopy," "intelligence," and "neuropsychological" for years 1990 to present. Only studies in which relationships were reported for normal control subjects were included for the purpose of this analysis. We obtained the average correlation coefficient between neuropsychological and spectroscopic measures across the age range described in each study. The average correlation across age in normal subjects ($r = .42$) would suggest a moderate effect size. Significant correlation coefficients were found across the lifespan (age range = 6-85), the results forming an inverted U, with highest correlations obtained during the 4th decade. The quadratic re-

relationship between age and average cognitive-spectroscopy measure was highly significant ($r^2 = .76$). This review would suggest that age is a potential moderating variable in research designed to elucidate cognitive and brain biochemistry relationships, with the pattern conforming well to developmental myelination processes.

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T. KONDO, S. AOYAMA, R. FUKUMOTO, Y. SAITO & T. TOSHIMA. Cue Availability Alters Odor Intensity Processing in Orbitofrontal Cortex: A Near-Infrared Spectroscopy Study.

Olfactory processing is known to be effected not only by attributes of stimulus itself, but also subjects' internal expectations concerned with the stimulus. In this study, we investigate whether near-infrared spectroscopy (NIRS) can measure the hemodynamic changes in orbitofrontal cortex (OFC) which reflects the effects of these factors on olfactory processing. Thirteen healthy subjects participated in this study. We manipulated the olfactory stimulus intensity (the concentration of γ -undecalactone; STRONG, WEAK and CONTROL condition) as the attributes of stimulus, and the availability of preceding cue (starting verbal signals; WITH CUE and WITHOUT CUE condition) for the onset of the stimuli as the modifier of expectations for stimulus (both were the within-subject independent variables). In each condition, we measured participants' hemodynamic changes in OFC which were evoked by exposition of the olfactory stimuli. In the WITH CUE condition, activations in STRONG condition and baseline (activation at rest) were not different. However, activations in the WEAK and CONTROL condition decreased from baseline. On the other hand, in the WITHOUT CUE condition, activation in the STRONG condition increased, and activation phase in the WEAK condition declined from that in STRONG condition. Activations in the CONTROL condition and baseline were not different. As a function of the stimulus intensity, OFC activation linearly increased, however, when preceding cues were available, OFC activation linearly decreased from baseline. This confirmed that NIRS could measure the hemodynamics in OFC which were evoked by olfactory stimulus. Further, we discuss this alternation of the activation patterns by the preceding cues, in terms of 1) blood stealing from OFC by deep structures (i.e., cingulate gyrus and amygdala which involved in expectations but NIRS can't measure such a deep place) and 2) perceptual attenuation of expected stimuli which was due to the presence of the preceding cue.

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Cross-cultural Issues in Neuropsychology

G.J. REY, R. RIVAS-VAZQUEZ, R. MENDOZA, G. GARAYCOA & E. CARRAZANA. A Spanish Verbal Learning Test: Normative and Clinical Data.

The objectives of this investigation are: a. Develop normative data for the MAMI List Learning test (MAMI LL). b. Assess the clinical utility of the instrument in the assessment of dementia groups. The MAMI LL consists of 14 high frequency Spanish words, 5 learning trials, an interference list, immediate and delayed recall, and delayed recognition. Normative data was collected on 120 Spanish dominant Hispanics. Regression analysis was used to assess the contribution of demographic variables on test performance. The clinical groups consisted of 20 patients with Alzheimer's disease (AD) and 20 with a vascular dementia (VD). They were compared to 20 matched normal controls. ANOVA procedures were utilized to contrast their performance. Results revealed that, for the normative group, only age

contributed significantly to performance on all measures ($p < 0.0001$). Controls performed significantly better than the AD and VD groups ($p < 0.05$). The AD and VD groups did not differ on the learning trials but the VD group performed significantly better on immediate and delayed recall ($p < 0.05$). The MAMI LL subtest was standardized with 120 normal controls from South Florida yielding normative data for this population. The negative contribution of education could be, at least in part, related to the use of very high frequency words. However, our normative sample had a relatively high educational level (mean=13.8, range=2 to 27 years) and assessment of lower education groups is indicated. Our data revealed clinical specificity and utility in the assessment of dementia groups. AD and VD groups demonstrate similar deficiencies in the initial learning trials but the AD group exhibited accelerated forgetting rates. Larger normative studies are needed to develop well standardized norms that could be used nationally in the assessment of Hispanics residing in the US.

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G.J. REY, C. MENDEZ, R. RIVAS-VAZQUEZ & I. BELLO. Neuro-Psychiatric Symptomatology and Caregiver Distress in Alzheimer's Disease: A comparison of Hispanic and Angloaxon Groups.

The objectives of this investigation were to: a) Determine the nature and severity of neuro-psychiatric symptoms in Hispanic vs. Non-Hispanic Angloaxon patients with Alzheimer's disease. b) Assess differences in caregiver distress between these groups. Subjects consisted of 19 Hispanic (H) and 26 Non-Hispanic Angloaxon (NH) patients with probable Alzheimer's disease. None of the subjects were institutionalized and all had a reliable caregiver. Subjects with other neurological disorders and/or unstable medical conditions were excluded from the investigation. All subjects were administered the Folstein MMSE (Folstein et al., 1976) and the caregivers were interviewed with the Neuropsychiatric Inventory (NPI) (Cummings et al., 1994). For both groups a majority of the caregiver's were female but a higher percentage of caregivers for the H group were offsprings of the patient. Subject groups were contrasted with multiple t-test comparisons. A stringent significant level of $p < 0.005$ was utilized to correct for multiple non-orthogonal comparisons. Results revealed that as a group the NH group was significantly more demented than the H group ($p < 0.001$). On the NPI significantly higher levels of severity were found for the Hispanic group in: 1. agitation frequency, severity, and distress. 2. Delusion frequency and severity. 3. irritability frequency and severity. For the latter 2 domains caregiver distress approximated significance. Based on caregiver's report, Hispanic patients with Alzheimer's disease experience more severe neuro-psychiatric symptoms leading to higher levels of caregiver's distress when compared to Non-Hispanic Angloaxon patients, independent of dementia severity. While these findings may reflect cultural and psychosocial differences, prior investigations have revealed that differences in utilization of medical resources may also be contributory.

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J. WONG, G. MURCIA & J. RAZANI. The Performance of Bilinguals and the Effects of Acculturation on Attention and Information Processing Tests.

There is sparse information regarding how bilingual, non-Anglo American individuals perform on neuropsychological tests and factors that may affect their test performance. The purpose of the present study was to examine the performance of bilinguals on tests of attention and

information processing speed. We examined the performance of 50 fluent English-speaking bilingual participants from Hispanic/Latino, Middle Eastern and Asian descent to that of 37 monolingual English-speaking Anglo-Americans on tests of attention and information processing speed. The neuropsychological tests administered were Trail Making Test (TMT) Parts A and B and the WAIS-III Digit Symbol and Digit Span subtests. Participants were between the ages of 25 to 70 years of age. The bilingual participants were also administered an acculturation measure. The results revealed that the Anglo-Americans outperformed the bilinguals on TMT Part B ($p < .05$) and Digits Span ($p < .01$). The groups did not differ on TMT Part A or Digit Symbol. For the bilingual group, Pearson r bivariate correlations determined a statistically significant relationship between acculturation level and TMT Part B and Digit Span, and a weak but nearly significant relationship with TMT part A. These findings suggest that tests of information processing, particularly those that require verbal skills, may be more demanding for bilingual individuals and that performance on these tests is related to the degree of acculturation to the Anglo-American culture.

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P.A. SUAREZ, M. CHERNER, D. LAZZARETTO, M. RIVERA MINDT, L. ARTIOLA, I. GRANT, R. HEATON & HNRC GROUP. Demographically Corrected Norms for the Brief Visuospatial Memory Test-Revised Attenuate Education Related Performance Differences among HIV+ Spanish Speakers.

We compared rates of impaired performance on a test of visual learning based on published age-corrected norms vs. norms that account for test language, age, education, and gender. Age, education, and gender corrected norms were generated for the Brief Visuospatial Memory Test-Revised (BVMTR), form 1, based on the performance of 131 neurologically normal native Spanish speakers of Mexican descent from the border regions of Arizona and California. The normative sample ranged in age from 20 to 55 years and in education from 0 to 20 years, with equal proportions of men and women. Demographically corrected T-scores based on our normative sample were then computed for the raw BVMTR total learning scores of 60 HIV+ monolingual Spanish speakers and compared to the T-scores that would be obtained with the published norms, which are based on a primarily Caucasian, English speaking sample, and correct only for effects of age. Among HIV+ individuals with 9 or fewer years of education, the proportion determined to be impaired (T-score < 40) went from 77% with the published norms to 32% with the new norms, while among those with 10 or more years, the proportion impaired decreased from 47% to 42%, suggesting a high risk of misclassification for those with lower education. As has been reported for other instruments, these results clearly illustrate that in order to avoid diagnostic errors, culturally and linguistically appropriate norms must be applied that at minimum correct not only for age but also for level of education.

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L. PICKETT, J.A. LUCAS, G.E. SMITH, F.B. WILLIS, T.J. FERMAN, N.R. GRAFF-RADFORD & R.J. IVNIK. Demographic and Medical Factors Influencing the Performance of Older African Americans on the Mattis Dementia Rating Scale.

To examine the influence of demographic and medical factors on Mattis Dementia Rating Scale (DRS) performance in older African Americans. Participants included 248 cognitively normal self-identified African American elders recruited as part of Mayo's Older African American Normative Studies (MOAANS). The DRS was administered as part of a comprehensive battery, which also included the Reading subtest of the Wide Range Achievement Test (WRAT-3) and the short form of the African American Acculturation Scale (AAAS-33). The AAAS-33 is a

self-report measure of the degree to which an individual adheres to "traditional" African American values, beliefs, and cultural practices. Standard regression analysis was performed between DRS total scores and demographic variables (age, years of education, sex), reading ability, acculturation score, and health status (presence/absence of diabetes/hypertension). Age, education, sex, and reading level each contributed significantly to the prediction of DRS Total Score. Level of acculturation, diabetes, and hypertension, however, did not contribute to the model. A step-wise regression indicated that reading ability contributed significant unique variance to DRS Total Score beyond that accounted for by years of education. Among normal older African Americans, presence of diabetes or hypertension was unrelated to general cognitive status as measured by the DRS. Level of "acculturation" also failed to predict DRS performance. Reading ability appears to share the strongest association with DRS Total scores, beyond years of education. Results support recent studies suggesting the importance of understanding quality of education as a predictor of cognitive test performance in older African Americans.

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O. PEDRAZA, F.B. WILLIS, T.J. FERMAN, N.R. GRAFF-RADFORD, T. STEWART, J. GRAFF-RADFORD & J.A. LUCAS. Item Analysis of the Boston Naming Test in Caucasian and African American Elders.

The Boston Naming Test (BNT) is frequently used in the clinical evaluation of dementia and other neurological conditions where impairment in semantic knowledge and confrontation naming ability is suspected. Prior research has suggested that differences across demographic variables can account for some of the variance in BNT scores. However, little is known about the cross-cultural item equivalence of the BNT in normal Caucasian and African American elders. The aim of this study was to evaluate the cross-sample equivalence of BNT items, and to identify specific items that may demonstrate potential cultural bias. Participants included 120 Caucasian and 120 self-identified African American elders recruited as part of Mayo's ongoing studies of normal aging. Participants were matched on age ($M = 70.3$, $SD = 6.6$), years of education ($M = 13.8$, $SD = 2.7$), and WAIS-R Vocabulary raw score ($M = 42.5$, $SD = 8.0$). Internal consistency (Cronbach's alpha) was good within the Caucasian (.82) and African American (.90) samples. Chi-square analyses were evaluated at $p \leq .001$ to minimize Type I errors. Results showed that African American elders committed significantly more errors on "igloo," "cactus," "hammock," "pelican," "tripod," "sphinx," and "palette." The item "sphinx" was particularly problematic (72.5% correct in Caucasian vs. 41.7% in African American elders). The findings of substantial cross-sample differences in BNT item responses between normal Caucasian and African American elders call into question the cultural equivalence of the BNT and suggest that caution is warranted when interpreting errors on these items.

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M.C. WILDE. Racial Discrepancies on the Repeatable Battery for the Assessment of Neuropsychological Status in a Mixed Clinical Sample.

A recent paper demonstrated that cognitively normal older African Americans score lower on the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) than their Caucasian counterparts (Patton et al., 2003). The present study attempted to extend these findings to a clinical sample. It was hypothesized that African American patients would show lower scores on the RBANS than Caucasians. The performances of 175 Caucasian and 175 African Amer-

ican patients who were equated for age, education, and time post-illness onset were compared on the six RBANS index scores. The mean age, education and time post-illness onset were 58.68 years ($SD = 13.96$), 12.13 years ($SD = 2.09$) and 9.99 days ($SD = 7.43$), respectively. There were 167 males and 183 females in the sample. The performances of the two groups on each of the six index scores were analyzed using t tests for independent samples. The findings disclosed significant differences between the two groups across all measures with African Americans scoring significantly lower than Caucasians. The differences were both statistically and clinically significant with effect sizes ranging from $d = .54$ for the Immediate Memory and Visual Spatial/Constructional Index scores to $d = .75$ for the Total Index score. These findings extend previous research on the impact of race on RBANS performance and suggest that clinicians should exercise extreme caution when using the standard published test norms for the RBANS. The use of norms for African Americans is supported.

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M. MARES, M.O. PONTON & L. HERRERA. Demographic Predictors of Verbal Learning and Memory Indices on the World Health Organization-University of California at Los Angeles Auditory Verbal Learning Test in a Hispanic Sample.

There is a paucity of neuropsychological information about U. S. Hispanics. The effects of age, education and gender were assessed on 15 indices of verbal learning and memory from the WHO-UCLA AVLT - Spanish Version. Six research hypotheses were formulated: an inverse relationship between age and most indices; a direct relationship between education and most indices; no relationship between gender and the 15 indices; age as the most important predictor; presence of 'age x education' interactions; and an effect of education on semantic clustering performance. This study represents secondary research and focuses on the WHO-UCLA AVLT-SV. The original study (standardization of the NeSBHIS) utilized a non-experimental, cross-sectional design, and constituted quantitative, empirical research. The sample consisted of 300 Hispanic participants. Binary logistic regression analyses were run on the first five hypotheses. Alpha level was .01. Power analyses were performed at .05 and .01 alpha levels. Hypothesis 6 was tested by performing a Kruskal-Wallis test and a Mann-Whitney test. Results mostly supported the lack of a relationship between gender and the 15 indices; partially supported the effects of increasing age and level of formal education; failed to support age as being the most important predictor, and the impact of education on semantic clustering performance. One interaction was found. Of all three predictors, education was the most important; however, this study had a number of limitations and its results are preliminary in nature. Unexpected findings were obtained. Formal education was found to be unrelated to using semantic clustering as a learning strategy.

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M.A. SEDO, A. VERDEJO & M. PEREZ-GARCIA. Drug Use Related Deficits in Response Inhibition Skills: A Comparison of the Stroop Test and the Five Digit Test in a Large Sample of Substance Abusers.

The aim of this study was to examine the performance of substance abusers in two different measures aimed to tap selective attention and response inhibition skills: the Interference score of the Stroop test (Stroop) and the 5 Digit Test (5DT). The 5DT is a non-academic loaded alternative to the Stroop divided in four parts: parts 1 and 2 are related to automatic processes of reading and naming, while parts 3 and 4 are sensitive to executive processes of response inhibition and set-shifting. :

Ninety-seven (88 males) abusers of different substances were consecutively recruited as they joined inpatient addiction treatment. We administered the Stroop and the 5DT to all participants. The Interview for Research on Addictive Behaviors (IRAB) was also administered to obtain standardized indexes of severity of abuse of the different drugs: a composite score including (1) average dosing (per episode) x (2) frequency (per month) x (3) chronicity (years). Partial correlation analyses were used to examine the relationship between Stroop-Interference and 5DT controlling for age, education and premorbid IQ, and multiple regression analyses were used to examine the influence of severity of drug abuse on neuropsychological test performance. The Stroop-Interference test was significantly correlated with 5DT parts 3 ($r=0.361$, $n=97$, $p<.01$) and 4 ($r=0.351$, $n=97$, $p<.01$) after controlling for age, education and IQ. Regression analyses showed that the standardized indexes of severity of drug abuse significantly predicted performance on 5DT parts 3 ($R^2=.159$, $F=3.16$, $p<.05$) and 4 ($R^2=.101$, $F=2.37$, $p<.05$), but not performance on parts 1 and 2, nor the Stroop-Interference. Parts 3 and 4 of the 5DT are useful instruments for the detection of the subtle executive functioning deficits often exhibited by substance abusers. Correspondence: Manuel A. Sedo, Ph.D., Test Development, MultiLingual Testing, Manuel A. Sedo, 9 Ingleside Rd., Natick, MA 01760. E-mail: manuel@sedo.net

Electrophysiology/Event-Related Potentials

D.M. STROTHER, D.S. HARGROVE, B.L. ROPER & J.B. GREEN. Cortical Reorganization and its Relationship to Real and Imagined Movement.

After spinal cord injury (SCI) the location of the motor potential may shift posteriorly to the somatosensory cortex. This study sought to determine the relationship of executed movement and motor imagery following SCI. Specifically, does motor imagery undergo reorganization in a manner consistent with executed movement? Sixteen participants, including 6 controls and 10 paraplegics, completed high-resolution electroencephalography (Hr-EEG) during upper and lower extremity movements and motor imagery. EEG data was co-registered with MRI. Through dipole source analysis localization of electrical activity along three dimensions in space was calculated. Results indicate that motor ability is closely related to the ability to imagine oneself move. Controls and paraplegics did not differ in the location of activation for motor imagery, with imagery being associated with activity posterior to the vertex, suggesting somatosensory involvement. Within the control group, motor imagery was posterior to the location of activation for executed movement. In contrast motor imagery for paraplegics was generally associated with activation in a similar location to that of executed movement. Research has indicated that the posterior shift of motor potentials might reflect some preservation of somatosensory pathways. The current findings suggest that motor imagery involves somatosensory activation. Thus, following SCI, reorganization of activity during executed movements might shift to an area closely associated with that of motor imagery, primarily the somatosensory cortex.

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E. RATAJCZAK, D.L. MOLFESE, S. KEY & K. PEACH. Rule Inter-nalization and Learning in Young Adults Using ERP Measurements.

This study assessed the process of learning and rule transfer in young adults using event-related potentials (ERPs). Differences in brain activity were elicited by visual stimuli before and after learning a new rule in 30 college students (18-25 yrs.). The task involved learning the association between visual stimuli and spoken names across three phases:

(1) pre-test, (2) training on a subset of the stimuli, and (3) post-test that included learned combinations, new combinations of learned items, and novel items. Behaviorally accuracy increased from pre-test (32%) to post-test for learned items (88%) and for rule transfer stimuli (81%). Principal Components Analysis (PCA) with subsequent ANOVAs identified two portions of the ERPs that changed as a function of learning. Factor 2 (accounting for 20.55% of total variability from 160 to 508ms) characterized an interaction between learning and electrode sites, $F(12,336) = 2.771$, $p < .03$. Post-hoc analyses identified numerous differences. For example, learned and transfer items elicited larger amplitudes over both frontal brain regions. Factor 4 (14.63% of the variability between 380 and 668ms), indicated that learned items elicited larger amplitudes over right hemisphere sites while novel and transfer items evoked larger left hemisphere responses, $F(3,84) = 3.002$, $p < .035$. Rule transfer items elicited larger amplitudes compared to novel stimuli over the left frontal region. These findings indicate that transfer items are processed differently from both novel and learned items. Overall, these results suggest that ERPs are a reliable indicator of learning and can be used to track the generalization of learned rules to new situations.

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P.S. FOSTER, R. WALTERS & D.W. HARRISON. Individual Alpha Variability: Variation in Frequency and Amplitude of the Dominant Rhythm.

Many normal biological functions are characterized as consisting of oscillations or variability. Interestingly, no research has been reported that sought to investigate the variability that may exist within the dominant electroencephalographic rhythm, i.e. alpha (8 to 13 Hz). The present investigation sought to determine whether, and if so to what extent, variability exists in the frequency and amplitude of the ongoing alpha rhythm recorded in neurologically intact individuals. Variability in alpha was assessed by calculating epoch-to-epoch variations (mean successive squared differences) in peak frequency (Hz) and amplitude (microvolts) in a sample of 10 men. Given that it was hypothesized that healthy electrophysiological functioning would be characterized by variability in frequency and amplitude, these analyses were also applied to the case of an individual with a right frontotemporal gunshot wound. It was hypothesized that the dysfunctional or damaged area would possess decreased variability in frequency and amplitude, relative to the intact area. The findings indicated that peak frequency varied from epoch to epoch by an average of 1.653 Hz ($SD = .400$) and peak amplitude by an average of 2.056 mv ($SD = 1.050$). Further, the individual with the gunshot wound was noted to possess decreased variability in both frequency and amplitude at the right frontotemporal electrode sites, relative to the homologous electrode sites. Thus, the present investigation demonstrates that both frequency and amplitude of the alpha rhythm varies from one epoch to another in neurologically intact individuals and that these measures of Individual Alpha Variability may be sensitive to neurological dysfunction.

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P.S. FOSTER & D.W. HARRISON. Frontal Lobe Inhibition of the Temporal Lobes: Cardiovascular Correlates.

A relationship between asymmetry of cerebral activity along a lateral dimension and baseline cardiovascular functioning has been reported in the literature. However, the precise nature and strength of a relationship between asymmetry of cerebral activity along an anterior-posterior dimension and baseline cardiovascular functioning has not been investigated. The present investigation used quantitative electroencephalography (QEEG) to examine this relationship by correlating baseline cardiovascular activity with electrophysiologic deviation scores de-

rived from subtracting the magnitude of each temporal lobe electrode site from the magnitude of each ipsilateral frontal lobe electrode. Given the lateralization of the sympathetic and parasympathetic nervous systems to the right and left hemispheres, respectively, and that the frontal lobes are inhibitory and the temporal lobes excitatory, baseline cardiovascular activity was hypothesized to correlate positively with right hemisphere and negatively with left hemisphere low (31 to 21 Hz) and high (21 to 32 Hz) beta magnitude deviation scores. Ten right handed men were asked to quietly relax while QEEG and cardiovascular activity were measured. The results indicated significant positive correlations between resting systolic blood pressure and magnitude of F4-T6 low beta asymmetry ($r = .565$) and diastolic blood pressure and magnitude of F2-T6 low beta asymmetry ($r = .658$) as well as negative correlations between resting heart rate and magnitude of F3-T3 ($r = -.652$) and F7-T3 ($r = -.589$) low beta asymmetry. A similar pattern of correlations was also found for high beta correlations. Thus, the results support frontal lobe inhibition of posterior cerebral systems involved in regulating cardiovascular functioning.

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N.L. PRATT, S. KELLY & D. LARTAUD. Mood Affects the Processing in the Brain of Affective Language.

This study examines how specific mood states alter brain processing of affective language and the different time-dependent changes that occur with the processing of positive or negative words. Researchers recorded ERPs from 15 college undergraduates while they read positive and negative words (e.g., PANIC, JOY). Prior to this, we induced positive and negative moods by telling participants that their brainwaves either: were among the best that the professor had ever seen or a bit unusual and asked if they were feeling well or tired. The design was a 2x2 within subjects study with two word conditions for each mood condition. Consistent with previous studies, a difference between positive and negative words occurred around 200-300 ms and had a negativity peak that is similar to the N400 semantic component. There was also a main ERP effect of mood in the bi-lateral frontal sites from 160 to 260 ms and also at 256 to 660 ms, with positive mood ERPs having greater amplitude than negative mood ERPs. Finally, there was a significant mood by word interaction for positive words in positive mood in the early portion of the brainwave (120 to 168 ms). The results suggest that mood influences neural processing of affective language. One interpretation is that when the brain processes affective words, it re-activates neural circuits involved in subjectively experiencing the emotion that those words connote. In this way, the processes of language within our brain is partly rooted in our own experience of emotion.

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Learning Disabilities/ADHD

G. PAILOPOULOS & K. KARAMPATZIAKIS. Retention of Symbol Sequences by Children with Learning Disabilities: An investigation of memory for letter, number, and symbol sequences amongst dyslexic children and children with additional learning disabilities in Greece.

Studies of the dyslexics have provided some evidence to suggest that dyslexia may be explained as a combination of low-level auditory and visual impairments, and it seems unlikely that working memory deficits are a major cause of reading comprehension difficulties. Since no studies so far reported have examined how dyslexic children handle sequencing in the oral and visual channels, the purpose of the present study was to investigate whether dyslexics show an impaired ability in

the retention of sequences with visual versus oral presentation of the material. Twenty Greek dyslexic children (M age = 10 years) compared to age-matched normal readers and children with additional learning disabilities. Sequences of letters, numbers, and symbols in random order were presented to the participants and they were asked to reproduce the sequence forward and backward. The items were first presented visually and then orally. It was observed that older children were better than younger ($p = .004$), the means of visual presentation were better than oral and repeat was much better than backward. The mean scores for visual and oral repeat were similar. Group of the participants was significant ($p = .001$). The results data suggest that normal readers are better than dyslexics but dyslexics are better than children with additional learning disabilities. According to the results, it was not concluded that dyslexics have predominantly visual or mainly auditory difficulties, probably have both visual and auditory problems.

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Z.A. MELIKYAN. Two Types of Visual Information Processing in 5-9-year-old Learning Disabled Children.

To provide an effective individualized remediation and teaching for learning disabled (LD) children it is important to diagnose different approaches of visual information processing utilized by these children. This study demonstrates two types of visual information processing associated with functional deficit of primary left versus primary right cerebral hemisphere in LD children. 51 LD children, age 5-9 y.o. (mean 7.9) were compared to 50 controls, age 5-8 y.o. (mean 6.11). LD children attended special schools. Neurological and psychological assessment revealed minimal brain damage and delay in cognitive development in all LD children. Children from the control group attended regular schools and demonstrated no neurological, cognitive, or behavioral disorders. Both groups underwent modified Luria's neuropsychological assessment battery for children, followed by the Embedded Figures Test (EFT). EEG was recorded during visual-spatial task performance. Neuropsychological assessment revealed two subgroups with prevalence of functional deficit of the right versus left hemisphere in both LD and control groups. Differences in functional brain organization between two subgroups were confirmed by EEG registration during visual-spatial task. Also, the subgroups demonstrated different variants of visual information analysis in EFT. Children with functional right hemisphere deficit were significantly more successful in this test in terms of accuracy and completion time than children with functional left hemisphere deficit ($p < 0.05$). Present findings for the first time demonstrate different variants in visual information analysis in EFT performance in normal children and those with mild cognitive impairment.

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L.A. HOROWITZ, K. WESTLUND & T. LJUNGBERG. Aggression and Withdrawal Related Behavior in Conflict Resolution Progression in Preschool Boys with Language Impairment in Comparison to Preschool Boys with Typical Language Development.

Behavioral processes that guide peer conflict resolution are investigated in children with typically developing language (TL) and children with language impairment (LI). Two degrees of withdrawal and aggressive behavior in conflict resolution are examined, particularly relating to reconciliation, i.e. friendly contact between former opponents shortly following conflict termination. Unstructured play of 11 LI boys (4-7 years old), at a specialized language preschool, and 20 TL boys (4-6 years old), at mainstream preschools are video filmed. Conflicts are identified and coded according to a validated coding system, and conflict behaviors are described and compared statistically between and within the groups. TL boys exhibited aggression more often than LI boys, partic-

ularly when opponents socially interacted in the pre-conflict period and when in the role of conflict victim. TL boys exhibited aggression in the post-conflict period that was more reciprocal in nature and TL boys tended to reconcile conflicts with aggression more often than LI boys, especially when aggression was expressed exclusively verbally. LI boys exhibited the most extreme withdrawal form, - leaving the conflict scene, more often than TL boys, distinctively in conflicts without social interaction between opponents prior to conflict and when in the victim role. Conflicts without an opponent leaving the conflict scene are reconciled nearly two-fold when an opponent had left the room; contributing substantially to LI boys overall lower reconciliation rates. In addition to traditional psycholinguistic remediation, intervention programs should address behavior regulation and encouragement of finding pathways to reciprocal interaction in conflict situations through both affiliative and non-affiliative behaviors.

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M.Y. KIBBY, J.M. KROESE, H. KREBBS, C.E. HILL & G.W. HYND. The Pars Triangularis in Developmental Dyslexia.

The pars triangularis may be involved with expressive language functioning and phonological processing, and it has been implicated in language impairment. Our study sought to determine if morphological differences occur in this region between those with and without dyslexia. Participants included 28 children without dyslexia and 27 children with dyslexia between the ages of 8-12 years. Participants underwent a comprehensive neuropsychological evaluation including the WISC-III, CELF-R, RAN, and CTOPP Experimental version, along with a MRI scan. Groups were similar in FSIQ, PIQ, gender, age, and overall brain size. They differed in VIQ, with controls' VIQ being higher. Pars triangularis length was measured using Scion Image. Its structure was classified according to the Cunningham and Eberstaller system. Using MANCOVA to control for VIQ differences, results indicated that children with and without dyslexia were comparable in pars triangularis morphology (size and structural variation). In contrast, relationships between size of the pars and cognitive functioning differed between groups. Using Pearson correlations, left anterior ascending ramus (LAA) length was positively correlated with phonological processing ability in those without dyslexia. In those with dyslexia, LAA length was negatively correlated with verbal comprehension and positively correlated with naming speed. In addition, left anterior horizontal ramus length was negatively correlated with verbal comprehension, receptive language, and expressive language. Our results are consistent with Pugh's model suggesting individuals with dyslexia may use their left anterior region to compensate for a dysfunctional posterior region.

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A.S. DAVIS, M.J. TINCUP, R.C. D'AMATO & J.J. HALL. Evaluating the Effects of Computer-Based Phonological Processing Intervention for Children with Reading Disabilities.

Recent neuropsychological research in reading has demonstrated the importance of working with young learners in the area of phonological coding. Children who have difficulty retrieving phonological codes from long-term memory usually have a difficult time reading. Research has indicated that phonological processing skills can be improved through intervention. However, little is known at present about the effects of utilizing computer-based interventions to train phonological-processing skills in children. Sixteen children ranging in age from 6 to 12 years who were identified as having a learning disability in the area of reading were randomly assigned to a treatment or a control group. Both groups were evaluated using a neuropsychological battery to assess their level of

phonological processing and reading achievement. The treatment group received half-hour sessions of computer-based phonological training 4 times per week for 4 weeks. At the end of the intervention period, both treatment and control participants were re-administered all the neuropsychological measures. A nonparametric Mann-Whitney U test indicated that the treatment group participants showed significant improvement in the area of basic reading skills (Mann-Whitney $U = 9.00$, $p < .05$), although the improvement in phonological processing and lexical memory tasks did not markedly differ between groups. The participants in the treatment group were able to improve their reading ability at a significantly higher rate than did the control group, although phonological skills improved at a statistically similar rate. Possible reasons for this finding will be discussed in relation to computerized intervention methods for reading and neuropsychological aspects of phonological processing.

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E. JANSIEWICZ, R. MORRIS, J. HARRISON, R. CARTER, I. NGAI & M. ISRAELIAN. Language Preference in Bilingual Children with Reading Disabilities.

To assess language preference in bilingual (Spanish-English) children with reading disabilities. Language preference was assessed in 225 bilingual (Spanish-English) Latino children ages 7-11 (mean age = 9.2 years) with poor English reading scores (Basic or Broad Reading Score on Woodcock-Johnson III $< 30\%$). Parents of the children completed a language preference questionnaire assessing language use in different social situations (at home, in school, etc.) and contexts (when watching or listening to media, etc.) (adapted from Ledesma & Morris, in press). An exploratory principal components factor analysis with varimax rotation was completed on variables from the checklist, yielding three factors. The first factor (Media/Friends) included the language preference used for watching and listening to media and talking with friends. The second factor (Adult Family) included the preferences for talking with their mother, father, and grandparents. The third factor (Outside Community and Reading) included the preferences for talking with other relatives, clergy, teachers, coaches, and reading books, comics, and magazines. Together, these three factors accounted for 67% of the variance in parent-reported child language preference. An analysis of the factor scores showed that English was most often used when watching/listening to media or talking with friends; that Spanish was most often used when talking with adult relatives; and that English and Spanish were used with equal frequency when talking with external family members, community members, and when reading. In the sample of bilingual children in this study, English and Spanish were used with equal frequency while reading. This finding suggests the assessment of bilingual children's reading abilities in their native language as well as in English.

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P.A. O'CONNELL & A.R. IMHOFF. Developmental Gerstmann's Syndrome: Case Report of an Adult Seeking Academic Accommodations for Learning Disabilities.

Gerstmann's syndrome, characterized by finger agnosia, dyscalculia, dysgraphia, and right-left confusion, has been reported in adults following neurological damage to the dominant parietal lobe. This cluster of symptoms also has been described in children who have no apparent brain injury and has been called developmental Gerstmann's syndrome (DGS). Reports of children with DGS often note constructional apraxia as a fifth symptom. These children also frequently exhibit difficulties with attention and hyperactivity. We report the case of a 36-year-old right-handed male who sought a neuropsychological evaluation as he

returned to college. IQ testing revealed average to above average verbal abilities with below average perceptual skills and processing speed. Cognitive strengths included receptive language abilities and verbal memory. Weaknesses were noted on rapid naming, executive function, and complex visual-spatial and visual-constructional tasks. Handwriting samples were notable for dysgraphia. Finger agnosia was present and the client had difficulty consistently identifying right and left on another person. Academic achievement in algebra was below average. He reported a history of longstanding academic and social difficulties, with years of academic remediation and psychiatric treatment. Current test results were consistent with previous evaluations. This case is discussed with respect to a biparietal model of DGS. Apparent positive outcome of extensive academic remediation for DGS also is discussed.

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D. DEWEY, S.G. CRAWFORD & B.J. KAPLAN. The Impact of Developmental Coordination Disorder on the Performance of Children with Attention Deficit/Hyperactivity Disorder and Reading Disability on the Rey Osterrieth Complex Figure.

To investigate the impact of developmental coordination disorder (DCD) on the performance of children with attention deficit/hyperactivity disorder (ADHD) and reading disability (RD) on the Rey Osterrieth Complex Figure (ROCF). Participants included 182 children (mean age = 11.5 years, $SD = 2.1$; 137 males and 45 females). Children were classified into four groups: ADHD only, RD only, ADHD+RD, and controls. All children had FSIQs in the average range, and were given the ROCF (copy and delayed recall) as part of an assessment of psychoeducational and sensorimotor skills. The scoring system of E.M. Taylor, 1959, adapted from Osterrieth, 1944 was used. DCD status was determined based on the children's performance on the Bruininks Oseretsky Test of Motor Proficiency, the Movement Assessment Battery for Children and the Developmental Coordination Disorder Questionnaire. No significant group differences were found on the ROCF for copy or delayed recall. There was a significant effect for time with all groups performing more poorly at delayed recall. However, when the child's DCD status was included as part of the grouping variable, significant group differences did emerge ($p < .0001$). Children with DCD plus ADHD and/or RD had significantly poorer performance compared to the ADHD only group, RD only group, ADHD+RD group, and the control group. Children with DCD plus ADHD and/or RD also made significantly more misplacement errors, and displayed trends towards more rotation and perseveration errors. Results suggest that the presence of motor coordination problems (i.e., DCD) may be more pertinent than ADHD or RD to performance on the ROCF. Therefore, when using the ROCF with children with ADHD and/or RD it is important to investigate their motor skills.

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S. CRAWFORD, B.J. KAPLAN & D.M. DEWEY. The Impact of ADHD Subtype and Co-occurring Disorders on Everyday Functioning in Children with ADHD.

To investigate the impact of ADHD subtype and co-occurring disorders on everyday functioning including written language in children with ADHD. Participants ($n=94$; mean=11.8 years, $SD=2.3$; 76 males and 18 females) were divided into ADHD subtypes (31 inattentive; 7 hyperactive impulsive, and 56 combined), and grouped according to number of co-occurring disorders. The co-occurring disorders included reading disability, developmental coordination disorder, oppositional defiant disorder, conduct disorder, anxiety, and depression. Eighteen children had ADHD only, 40 had ADHD and one other disorder, and 36 had

ADHD and two or more other disorders. All children had average IQs and were assessed with the written language subtests from the Woodcock Johnson Revised Psychoeducational Battery (WJ-R), and the Parent Ratings of Everyday Cognitive and Academic Abilities (PRECAA). FSIQ, age, and gender were not significantly different among groups. No significant differences emerged among ADHD subtypes on the PRECAA or broad written language. Children with the combined ADHD subtype tended to have two or more co-occurring disorders in addition to ADHD. Significant group differences on the PRECAA language subscale ($p=.003$) and WJ-R Broad Written Language ($p=.015$) were found when children were grouped according to number of co-occurring disorders. Specifically, children with ADHD+2 or more co-occurring disorders were significantly impaired on these measures compared to the ADHD only group and the ADHD+1 co-occurring disorder group. These results suggest that ADHD subtype is not related to everyday functioning including written language performance. However, the presence of two or more co-occurring disorders with ADHD had a significant impact on general daily functioning. These findings emphasize the need for clinicians to investigate co-occurring disorders in children with ADHD.

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K. RANDALL & J. MICHEL. Perceptual and Motor Inhibition in Children with ADHD.

The dissociation hypothesis (Nassauer & Halperin, 2003) was assessed in children with ADHD to uncover the basis of inhibitory deficits by utilizing tasks that separate inhibition into different cognitive processes. Hypotheses are: 1) perceptual and motor inhibition are separate cognitive processes, and 2) children with ADHD will show greater motor inhibitory effects than controls. Inhibition was assessed in 40 male children (20 ADHD & 20 controls), 8-12, using 12 computer tasks. Tasks include color/white left/right arrows in center, or boxes on left/right of the monitor. Participants make responses (same or opposite) to target stimuli (location, color, direction) on a button bar. Mean reaction times are calculated in milliseconds. Within group variables, perceptual and motor conflict, have 2 levels, presence or absence of conflict. Separate 2 X 2 repeated measures ANOVA will be performed with group (ADHD or control) as the between subjects factors. Inhibition scores (difference between perceptual and motor conflict and no conflict reaction times) will be compared between groups. Preliminary results indicate that children with ADHD demonstrate a significantly greater motor inhibition effect with color, characterized by a slower reaction time, than children without ADHD. Interestingly, children with ADHD do not show greater motor inhibition effects with location or direction cues. Preliminary results indicate specific inhibitory effects in children with ADHD related to stimulus modality, specifically color. Final results may help uncover specific inhibitory deficits in children with ADHD by analyzing inhibition occurring from separate cognitive mechanisms, and help researchers to better understand inhibitory functioning in children.

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R. ADAMS, P. FINN, K. FLANNERY, E. MOES, B. MATANO & A. RIZZO. A Virtual Reality ADD Classroom and the BASC: A Preliminary Investigation of Convergent Validity.

This study investigated the relationship of the Parent Monitor Ratings of the BASC monitor for ADD to a Virtual Reality (VR) Classroom. A relationship was hypothesized for the Attention Problems subscale and not for Hyperactivity, Internalizing Problems or Adaptive Skills scales to the VR Classroom. Further, a relationship was assumed for the Attention Problem scale only for the VR Classroom and not for the standard Vigil given the immersive quality of the VR Classroom. 18 male participants between 8 and 14 years old with a diagnosis of ADD were

included. Following attachment to an IView eye tracker and galvanic skin response, subjects were placed in an Elumens Dome and presented a vigilance task within a Virtual Classroom then completed a standard Vigil. Concurrent with this, a parent completed the BASC. Data from this preliminary study do not include the eye tracker or physiological responding. Results indicate significant correlation for VR Classroom to Attention Problem $r(18) = .58$; $p < .01$ but no significance for the other scales and no significance for the standard Vigil and any of the BASC Parent Monitor Rating Scales. This preliminary investigation indicates the VR Classroom is related to parent ratings of the BASC for Attentional Problems as hypothesized and not to the other scales, indicating preliminary convergent validity for these measures. While the sample size does not warrant tests of equality of correlation coefficient of the VR Classroom to the Vigil at present, this study is continuing and further analyses of divergence are under investigation.

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R.B. TANGEN, P. CIRINO & K.R. KRULL. Information Processing in Children with Attention-Deficit/Hyperactivity Disorder Subtypes.

The purpose of this study was to examine components of attention and information processing in children with Attention-Deficit/Hyperactivity Disorder, Combined Type (AD/HD-C) and Predominantly Inattentive Type (AD/HD-I) using a neuropsychological testing approach (Cohen, 1993) and an experimental approach (Sternberg, 1969). It was hypothesized that the AD/HD-C group would perform more poorly on measures of Response Selection and the AD/HD-I group would perform more poorly on measures of Sensory Selection. Participants were 85 children (8 to 14 years old), who were assigned to one of three groups based on DSM-IV diagnosis of AD/HD-C, AD/HD-I, or other clinical diagnosis. Children with AD/HD-C performed more poorly than children with AD/HD-I and clinical controls on neuropsychological measures of Response Selection $F(6, 150) = 5.30$, $p < .0001$, especially on a measure of response inhibition $F(2, 77) = 15.44$, $p < .0001$. Contrary to prediction, the AD/HD-I group did not perform worse than the AD/HD-C group on neuropsychological measures of Sensory Selection. The experimental approach did not reveal significant differences in Sensory Selection (changes in stimulus quality) or Response Selection (stimulus-response compatibility) between the AD/HD subtypes or between subtypes and controls. The AD/HD-C group did show a pattern of reduced performance over time, suggesting reduced sustained attention. Results support the idea that children with AD/HD-C have deficits in inhibiting behavior over time compared to children with AD/HD-I. Results also support the idea that differences between subtypes are based on differences in impulsivity and not differences in the nature of attentional deficits.

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D.J. MARKS, M.D. KOFMAN & M.V. SOLANTO. Remediation of Metacognitive Deficits in Adults with ADHD.

Many adults with attention-deficit hyperactivity disorder (AD/HD) display deficits in meta-cognitive functioning, that are often less responsive to treatment relative to the core symptoms of the disorder. The current study employed a novel group cognitive-behavioral therapy (CBT) intervention to specifically target deficits in time management, organization, and planning. Eleven adults [5 men, 6 women; mean (SD) age = 39.36 (11.31) years] with AD/HD, who were concomitantly receiving psychopharmacological intervention(s), participated in an 8-week group psychotherapy program in which exposure to didactic techniques, modeling, rehearsal, and positive feedback were employed to foster proficiency in the following areas: time-estimation, breaking down complex

tasks, contingent self-reinforcement, and visualization of long-term rewards and consequences. Efforts were also made to identify and reconcile obstacles to applying adaptive cognitive-behavioral strategies. All participants completed both standardized (Conners Adult ADHD Rating Scale: CAARS; Brown ADD Scales: BAADS) and novel (On Time Management Organization and Planning: ON-TOP) self-report behavioral ratings immediately prior to and following the completion of the program. Paired samples t-tests applied to pre- and post-test composite scores from the CAARS (DSM-IV ADHD Symptoms Total Index), BAADS (Total Score), and ON-TOP (Total Score) revealed significant reductions on all three indices (all $p \leq .006$). Group cognitive-behavioral therapy may constitute an effective means by which to mitigate the severity of core AD/HD symptoms and associated meta-cognitive impairments even among adults receiving psychopharmacological treatment.

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A.S. PRESTON, S.C. HEATON, C. KIMBERG & R.B. TANGEN. Comparison of ADHD Subtypes on the TEA-Ch.

ADHD has three subtypes that tend to differ in their behavioral profiles as well as demographic and comorbid variables. However, research of subtype differences on attentional tests has been inconsistent. One possible explanation for mixed findings is that past measures may not address the multi-dimensional nature of attention. Therefore, the current study compared the performance of children with ADHD-Inattentive, ADHD-Combined type, and Clinical Controls on the Test of Everyday Attention for Children (TEA-Ch), a test measuring three attentional domains: selective, sustained, and attentional control/switching. Based on our previous research, we expected both subtype groups to perform worse than Clinical Controls. We further hypothesized that children with ADHD-Combined Type would perform worse than children with ADHD-Inattentive Type on TEA-Ch composite scores of Sustained Attention and Attentional Control/Switching, with no subtype differences on the TEA-Ch Selective Attention composite. Participants consisted of 144 children, ages 6-16, including 46 with Predominantly Inattentive ADHD, 70 with Combined-type ADHD, and 28 Clinical Controls (i.e., non-ADHD psychiatric conditions). Participants completed an IQ test and the full TEA-Ch. One-way ANOVAs and post hoc analyses demonstrated significant differences between Clinical Controls and ADHD-Combined group on TEA-Ch composite scores of Sustained Attention and Attentional Control/Switching. However, no significant differences were found between the ADHD-subtypes on attentional domains, or between Clinical Controls and the ADHD-Inattentive group. Results suggest that ADHD subtypes may not perform significantly differently on neuropsychological measures of attention, although the ADHD-Combined subtype seems to perform worse relative to Clinical Controls. Clinical implications are discussed.

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K. COOPER, E.B. FENNEL, G. SELKE, J.H. JOHNSON & S.U. SIDDIQI. Executive Functions and Social Skills in Children and Adolescents with Attention-Deficit/Hyperactivity Disorder: A Pilot Test of Barkley's Model of Behavioral Disinhibition.

Under Barkley's (1997) model of ADHD, impaired behavioral inhibition leads to impairment of four executive functions (working memory, internalization of speech, self-regulation of affect/motivation/arousal, reconstitution). These impaired executive functions lead to disturbances in self-control and self-directed behavior, and ultimately result in the behaviors seen in ADHD. Participants included parents or caregivers of children and adolescents with ADHD ($n=26$) and without AD/HD ($n=21$). The mean age of the ADHD cohort was 10.12 ± 2.72 (17 boys,

9 girls), and 10.41 ± 2.15 for the Control cohort (13 boys, 9 girls). Social competence was assessed using the Social Skills Rating System (SSRS-P), and executive function was assessed using the Behavior Rating Inventory for Executive Function (BRIEF). One-way ANOVA revealed significantly lower social skills in the ADHD cohort compared to controls. A stepwise regression model found that the BRIEF Inhibit score was predictive of social competence; whereas the BRIEF Working Memory score was not a significant contributor to this model. Impairments in Working Memory were seen without corresponding impairments in inhibition or social skills. This study provides evidence for behavioral disinhibition, executive dysfunction, and social impairments in children and adolescents with AD/HD. Barkley's premise that behavioral disinhibition in AD/HD gives rise to impaired goal directed behavior is supported; however, contrary to expectation, impairment of executive function (e.g., working memory) was not secondary to disinhibition or predictive of impairment in goal directed behavior. These results suggest the relationship between these deficits may not be explained by Barkley's conceptual model as tested in this study.

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A. SIM, L. TERRYBERRY-SPOHR & M. MCCREA. Relationship Between Self-Reported Learning Disability/ADHD/Previous Concussion to Baseline Scores on the Standardized Assessment of Concussion (SAC).

To provide incidence rates of learning disability (LD), ADD/ADHD, and previous head injury (HI) in a sample of high school football players and to assess whether these factors affect baseline SAC scores, 203 male high school football players were administered the SAC and a personal history questionnaire during their preseason as part of a baseline testing protocol. Consistent with the SAC standardization sample, the mean SAC Total score was 26.87. An analysis of incidence rates found that 6.3% of the sample self-identified as having been diagnosed with a LD ($n=14$), 3.6% of the sample identified as having been diagnosed with ADD/ADHD ($n=8$), and 22.3% of the sample endorsed having had a previous HI or concussion ($n=50$), of which approximately half suffered a loss of consciousness ($n=20$). ANOVAs revealed a significant difference in SAC Total scores between participants with and without a history of LD ($F=12.567$, $p<.001$). Participants diagnosed as having ADD/ADHD had significantly lower SAC Concentration scores than those with no diagnosis ($F=5.097$, $p=.025$), although there was no difference in SAC Total scores. Participants with a history of previous HI were not found to have significantly lower SAC Total scores. The present study provides incidence rates of LD, ADD/ADHD, and previous HI in a sample of high school football players. Results suggest that a history of these factors may elicit significantly lower SAC scores than those with no such history thereby underscoring the need for utilizing baseline testing protocols (vs. cutoff scores) in order to control for variability across subjects and to establish an accurate benchmark against which post-concussive test scores can be compared.

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E. MATUTE, O. BARRIOS & D. ZARABOZO. ADHD Subtypes Prevalence in a Mexican Community Sample.

Prevalence of ADHD varies from one study to another. Numerous factors related to its variation are identified such as the method employed, the diagnostic criteria and the sources of reference used. Cultural influences on ADHD behaviours have also been reported. Studies of ADHD prevalence among Spanish-speaking population are scarce and it has not been published yet in Mexican population. The purpose of this study is to investigate the prevalence of the ADHD and their subtypes in a sample of scholars of public elementary schools from the city of Guadala-

jara. A sample of 6639 scholars of 1st to 6th grade of 16 public elementary schools from the city of Guadalajara was used. Two questionnaires based on DSM-IV criteria were given, one for the parents and one for the teachers. 67% of contacted parents and teachers responded to these questionnaires. The information provided by the parents suggests that 9% of the sample presented ADHD criteria. Of the 9%, the combined type is more often reported (3.4%) than the inattentive type (3.0%) or hyperactive-impulsive type (2.6%). ADHD is more frequent in boys (69.2%) than in girls (30.4%). The prevalence in our Mexican sample is higher compared with DSM-IV prevalence report, but smaller compared to a Colombian study. Gender differences are discussed.

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A.S. PRESTON, E.B. FENNELL & R. BUSSING. Utility of a CPT in Diagnosing ADHD in a Community-Based Sample of Children: A Cautionary Study.

Continuous performance tests (CPTs) have reliably found differences between children with ADHD and normal controls. However, few studies have used non-clinically referred children or compared children with ADHD to children with less severe behavioral or cognitive problems. The current study assessed the utility of a clinically used CPT, the Tests of Variables of Attention (T.O.V.A.), in comparing children with ADHD and children with subclinical levels of attention/behavior problems in a community-based study. We hypothesized that children with ADHD would perform significantly worse on the CPT and that the CPT would predict group membership. Participants constituted a representative sample of elementary school students at high risk for ADHD. Inclusionary criteria included parent reported attentional problems. The sample consisted of 67 boys and 100 girls ranging from ages 6-14. Based on a structured clinical interview, 116 children were placed in the ADHD-group and 61 were placed in the Subclinical-control group. Participants in each group completed the T.O.V.A. We compared the ADHD-Group and Subclinical Control Group on four variables of CPT performance: omissions, commissions, response time, and response time variability. In order to determine sensitivity and specificity, we used cutoff scores as defined in the T.O.V.A manual (Greenberg et al. 2000). Results demonstrated that the groups did not differ on individual T.O.V.A. variables, and the T.O.V.A. did not accurately predict group membership. Present results do not support our hypothesis. These findings emphasize limitations of CPTs to distinguish between groups of children with attention and behavior problems in a community-based sample.

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J. WARNER, M.P. DELBELLO, P.K. SHEAR, D.E. FLECK & S.M. STRAKOWSKI. Executive Functioning Deficits in Youth with Comorbid Bipolar Disorder+ADHD: Are They Additive?

In addition to their diagnostic similarities and frequent comorbidity, both bipolar disorder (BPD) and ADHD are associated with impairments in executive functioning (EF), the regulatory processes governing planning, problem-solving and goal pursuit (Conners, 1995; Bradley & Golden, 2001; Shear et al., 2002). The goal of the current study was to compare the EF abilities of ADHD and comorbid BPD+ADHD groups to that of healthy controls to determine if EF deficits are additive when both disorders are present. Eighteen adolescents with BPD+ADHD, 17 with ADHD and 16 healthy volunteers (HV) (ages 12 to 14 years) were administered a battery of EF tests. Test variables included WCST percent perseverative errors, CPT indices of inattention and impulsivity, LNS span and BRIEF Behavioral Regulation and Metacognition indices (BRI and MCI). The BPD+ADHD group was significantly worse than HVs across all of the measures, whereas the ADHD group was im-

paired only on the BRIEF indices. Furthermore, BPD+ADHD adolescents performed significantly worse than ADHD on two CPT indices of inattention, WCST categories completed, and the BRIEF BRI. BPD+ADHD participants showed the most severe impairment across all variables, supporting the hypothesis that EF deficits are more pronounced in the comorbid condition than in ADHD alone. Because the ADHD group differed from HVs only on the BRIEF indices, the data support the existing literature that suggests a dissociation between reported EF deficits in everyday functioning and impairment as measured by laboratory tests of cognitive ability.

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J. JANUSZ, T. ROSSER, L. KAPLAN, L. GLEZER, C. STIETZLEN & C.J. VAIDYA. Effects of Methylphenidate on the Neural Basis of Working Memory in Children with Neurofibromatosis Type 1 and ADHD.

Approximately 30-50% of children with neurofibromatosis type 1 (NF1) exhibit symptoms of Attention-Deficit/Hyperactivity Disorder (ADHD) that are relieved by stimulant medication such as methylphenidate (MPH). Thus, children with NF1 present a unique opportunity to characterize cognitive function that is altered by ADHD and is related to known etiology. Working memory, the capacity to maintain information temporarily, is reduced in children with ADHD. We examined the neural basis of working memory and its improvement following MPH administration in children with NF1 who had a diagnosis of ADHD. Functional magnetic resonance imaging (fMRI) was performed in five 8 to 11 year old children with diagnoses of NF1 and ADHD, once with MPH (regular dose) and once without MPH (36 hour wash-out), during performance of a N-back task with increasing working memory load (0-back, 1-back, 2-back). Subjects made more errors with increasing working memory load and fewer errors on-MPH than off-MPH. MPH enhanced recruitment of right inferior prefrontal cortex, left premotor cortex and post-central gyrus, and bilateral hippocampi. Increasing working memory load enhanced recruitment of left inferior frontal cortex, anterior cingulate, and medial parieto-occipital cortex. Furthermore, a subset of those regions, left inferior frontal gyrus and cuneus, were selectively modulated by greater working memory load and MPH. Working memory load and MPH enhanced involvement of an overlapping neural network including regions typically involved in verbal rehearsal and attentional functioning. Ongoing research will compare this activation pattern to that of children with ADHD and without NF1.

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Z.E. PROCTOR-WEBER, J. FOLEY, M. COLLINS & C.J. GOLDEN. The Impact of Neuropsychological Test Results on Scholastic Achievement Test Scores in a College Aged Population .

Neuropsychological test results are often used to justify the granting of accommodations in test taking on the assumption that impaired scores in such areas as processing, attention and academic achievement measures adversely affect the scores on standardized tests. Surprisingly, however, there is little research showing that these assumptions are valid. The present study is aimed at determining whether such deficits are related to the scores on a students SAT in both a normal college age population and a sample of previously diagnosed LD students requesting accommodations. Investigators used neuropsychological data collected from a sample of 142 LD college students who had requested accommodations from the Educational Testing Service and an independent sample of 43 normal college students who did not request accommodations. Partial correlation analyses controlled for age, education and FSIQ were run to analyze the data. A moderate correlation was found between

normal students SAT and their scores on the NDRT (vocabulary, reading rate and reading comprehension) at the $p < .02$ alpha level. Surprisingly, this did not hold true for the LD sample, regardless of whether they were afforded additional time accommodations. Results suggest that neuropsychological variation within an LD population may not be associated with their scores on standardized tests. It is likely that the SAT reflects the long term learning of material related to college performance in general. If this is indeed the case, then accommodations based on these variables may not be an appropriate accommodation for this population.

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Symposium 12/3:30–5:15 p.m.

Classification of Mild Cognitive Impairment: Issues and Approaches

Chair: Kevin Peters
Discussant: Ronald Petersen

K.R. PETERS. Classification of Mild Cognitive Impairment: Issues and Approaches.

Mild cognitive impairment (MCI) is a general term that is often used to describe older adults with cognitive deficits that do not otherwise meet diagnostic criteria for dementia (e.g., Alzheimer disease). Individuals with MCI are important to study because they have a greater than normal risk of converting to dementia. A wide variety of specific diagnostic labels have been put forth to characterize individuals with MCI. Some of the more commonly used labels have focused predominately on memory impairment. Despite the focus of many researchers on amnesic MCI, there has been increasing awareness that MCI is a heterogeneous condition: individuals may differ with respect to cognitive impairment(s), etiology, and prognosis. In terms of cognitive impairment(s), it is becoming clear that deficits in cognitive domains other than memory are important in predicting who will and will not develop dementia. Researchers are also beginning to examine the importance of etiology as different causes of cognitive impairment in individuals with MCI may be associated with different diagnostic outcomes. Regarding prognosis in MCI, three diagnostic outcomes are possible: cognitive status may improve, it may remain stable, or it may get worse. Although most research has focused on predicting decline, it is also important to identify individuals who are more likely to improve over time so that limited clinical resources may be more efficiently allocated. The purpose of this symposium will be to address these three interrelated issues of heterogeneity in MCI and to present several different approaches to classifying individuals with MCI.

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R.C. PETERSEN. Cognitive Subtypes of Mild Cognitive Impairment.

Objective: In recent years the concept of mild cognitive impairment (MCI) has been expanded to include conditions beyond those leading to Alzheimer disease (AD). As such, other subtypes of MCI have been defined based on performance in multiple cognitive domains. Method: We have divided MCI into two major subtypes: amnesic and non-amnesic depending on the degree to which subjects are impaired in

the memory domain. The subjects were evaluated in four cognitive domains: memory, language, attention/executive function, and visuospatial skills. Depending on performance in each of the four cognitive domains, the subjects were classified as to the involvement of the memory domain (amnesic or non-amnesic) and whether there was a single or multiple domains impaired. In addition, subjects were classified on the proposed etiology of each clinical subtype yielding a diagnostic classification scheme which represented the prodromal states of a variety of dementing conditions including AD, vascular dementia, frontotemporal dementia, and dementia with Lewy bodies. Results: 353 subjects with MCI were classified according to the four subtypes and were followed longitudinally. Of those with an amnesic subtype (either single domain or multiple domain), the annual progression rate to dementia was 12.8% per year and to AD, 10.5% per year. Apolipoprotein E4 carrier state was the strongest predictor of progression to AD ($p < 0.007$). Conclusion: These data indicate that this classification system of MCI has predictive utility in describing the outcome of subtypes of MCI.

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O.L. LOPEZ. Mild Cognitive Impairment Subgroups.

Objectives: To describe the neuropsychological characteristics of mild cognitive impairment (MCI) subgroups identified in a large population study: Cardiovascular Health Study (CHS) Cognition Study. Methods: MCI was classified as follows: MCI Amnesic-type (AT; documented memory deficits but otherwise normal cognitive functioning) and MCI-Multiple cognitive deficits-type (MCDT; deficits in at least one cognitive domain other than memory or abnormal test scores in at least two other domains). MCI was considered Probable when there was no other cause that may explain the cognitive deficits, and Possible when there were systemic, neurological, or psychiatric disorders that may have affected cognition. This study included only cases with Probable MCI ($n=38$). Results: The neuropsychological performance of Probable MCI patients was statistically different from normal controls ($n=374$). Probable AT ($n=10$) had worse verbal and non-verbal memory performance than Probable MCI-MCDT ($n=28$), and normal controls. By contrast, MCI-MCDT had worse language and visuoconstructional performance than MCI-AT and normal controls. In addition, MCI-MCDT subjects had memory deficits, although they were less pronounced than those of the MCI-AT. When the MCI cases were reclassified into groups with or without memory impairment, 26/38 (68%) had memory deficits, and these cases also had impairments in other domains function. Conclusions: Neuropsychologically, MCI is an intermediate state between normalcy and dementia. However, there appears to be two syndromes, one with greater memory deficits and another with more diffuse neuropsychological deficits. The method of defining cases and the relative emphasis placed on one versus many cognitive domains results in differing classifications. Correspondence: *Kevin R. Peters, Ph.D., Psychology, Trent University, 1600 West Bank Drive, Peterborough, ON K9J7B8, Canada. E-mail: kevinpeters@trentu.ca*

K.R. PETERS, P. GRAF, S.L. HAYDEN & H.H. FELDMAN. Neuropsychological Subgroups of Cognitively-Impaired-Not-Demented Individuals.

Objectives: To determine whether subgroups of Cognitively-Impaired-Not-Demented (CIND) individuals with distinct neuropsychological profiles exist, and to determine whether subgroup membership at baseline is related to diagnostic outcome after periods of 2 to 5 years. Method: Two independent samples of CIND individuals were used. The Base Sample ($n=461$) was a population-based sample from the Canadian Study of Health and Aging. The Replication Sample ($n=166$) was a clinic-based sample the Canadian Cohort Study of Cognitive Impairment and Related Dementias. An empirical approach was used

to identify subgroups that involved performing a series of principal components and cluster analyses on neuropsychological test data. Results: Five subgroups were identified in the Base Sample ($n=461$): Verbal Dysfunction, Memory Dysfunction, Visuospatial Dysfunction, Memory/Verbal Dysfunction, and Verbal/Visuospatial Dysfunction. A very similar cluster solution was found in the Replication Sample ($n=166$). At five year follow-up, the highest rates of converting to dementia were observed in the Memory Dysfunction (65%) and Memory/Verbal Dysfunction (55%) subgroups. The Verbal Dysfunction subgroup had a relatively lower rate of converting to dementia (24%) and was the most likely to show improvement in cognitive status (26%). Conclusions: The results of this investigation suggest that reliable subgroups of CIND individuals that differ with respect to neuropsychological test profiles do exist, and that these subgroups differ with respect to prognostic outcome. The cognitive heterogeneity of CIND individuals has important implications related to the diagnosis, the prognosis, and the potential treatment of individuals with this condition.

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H.H. FELDMAN, G.R. HSIUNG, C. JACOVA & A. DONALD. Cognitive Impairment Not Dementia (CIND): Does Etiology Matter? Findings from the ACCORD Study.

Background: The term Cognitively Impaired Not Demented (CIND) has been used to broadly and inclusively describe the spectrum of mild cognitive impairment with aging. The outcomes of CIND by etiology are not well characterized within the clinic setting. Design/Methods: The ACCORD inception cohort ($n=1136$) recruited at 8 dementia clinics across Canada included 30.1% with CIND ($n=342$). CIND was etiologically sub-classified into pre-Alzheimer disease (pre-AD), non-AD degenerative, vascular, psychiatric, neurological, mixed, or not specified (NOS). To characterize these CIND subtypes, statistical methods included Chi-square test to compare categorical variables and ANCOVA, and Student-Newman-Keuls test to compare group means. Results: At 2 years, 34% of CIND had progressed to dementia, 13% had reverted to normal. Pre-AD and vascular CIND had the highest rates of dementia conversion (41% and 40%), and the lowest rate of reversion to normal (4.6% and 8%). Psychiatric and CIND NOS had the highest reversion rates to normal (20% and 30%). All pre-AD CIND conversions were to probable AD. Converters were significantly older, with significantly ($P=0.006$) more ApoE $\epsilon 4$ carriers. There were other significant differences in baseline and change scores of global, neuropsychiatric and functional measures among the etiologic CIND subgroups. Conclusions: CIND is an applicable diagnosis in the clinical setting. Etiologic subgroups have clear relevance and prognostic implications. Correspondence: Kevin R. Peters, Ph.D., Psychology, Trent University, 1600 West Bank Drive, Peterborough, ON K9J7B8, Canada. E-mail: kevinpeters@trentu.ca

Symposium 13/3:30–5:15 p.m.

HIV as a Model for Inflammatory and Neurodegenerative Brain Disease

Chair: Igor Grant
Discussant: Karl Goodkin

I. GRANT. HIV as a Model for Inflammatory and Neurodegenerative Brain Disease.

This symposium will examine the spectrum of brain changes that can occur with infection by human immunodeficiency virus type 1 (HIV).

HIV injures the brain both directly (i.e., through secretion of toxic viral products) and indirectly (through stimulation of immune cells and astroglia in the brain). Injury may result from down-regulation of trophic factors and elaboration of toxic molecules. While neurons are not themselves infected by HIV, they are affected by these processes which can result in neural injury (e.g., synaptodendritic simplification) and actual neuronal death. This symposium will review the neurocognitive changes that occur at different stages of disease, and relate these to underlying neurobiological processes, as well as considering effects on everyday functioning. The symposium will touch on injury to specific dopaminergic circuitries, reversible neuronal dysfunction versus degeneration, the effects of co-factors such as substance abuse, and potential reversibility of changes through antiviral and neuroprotective treatments. Insights from neuroAIDS may provide useful lessons for research and clinical work in other disorders in which abnormalities in immune signaling can produce neural injury.

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R.K. HEATON & J.R. SADEK. Neuropsychological Functioning in HIV-1.

Central nervous system dysfunction is a frequent consequence of HIV-1 infection. Neuropathological and neuroimaging studies indicate that pathology occurs in multiple brain regions, but that subcortical structures and frontal-subcortical circuitry appear to be preferentially affected. Neuropsychological studies show a pattern of cognitive impairment consistent with such dysfunction. This pattern involves speed of information processing, attention, learning, motor skills, and executive functions. Language, spatial skills, and memory (retention) are preserved relative to other cognitive functions, in contrast to other dementing illnesses that preferentially affect cortical brain regions, such as Alzheimer's disease. Neuropsychological impairment occurs in 30-50% of HIV-infected persons. Such impairment often results in impaired role functioning and is an independent risk factor for early mortality (i.e., even when medical predictors are controlled). The incidence of severe neuropsychological impairment (i.e., HIV-associated dementia) has declined since the advent of potent antiretroviral therapies, but milder neurocognitive disorders remain common. Also, two thirds of HIV-infected individuals who have these milder neurocognitive disorders are impaired on standardized tests of everyday functioning. Neuropsychological impairment is associated with worse performances on tests of financial skills, cooking, medication management, and vocational abilities. Rates of unemployment are higher among neuropsychologically impaired HIV-infected individuals. Occasionally, everyday functioning is impaired in the absence of neurocognitive dysfunction, and this may be attributable to depression. While the association between neuropsychological dysfunction and impaired role functioning in HIV-infection is understood, the contribution of psychiatric disturbances such as depression requires further study.

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G. ARENDT, B.A. HASLINGER & E. KOUTSILIERI. Dopaminergic Pathway Dysfunction in Neurologically Asymptomatic HIV-1-Positive Patients.

HIV infection is characterized by cognitive, motor and emotional deficits. Some of the earliest detectable abnormalities are clearly due to dopaminergic pathway dysfunction. One of the methods applied to detect early cerebral deficits in HIV-1-positive patients is neuropsychological testing (logical and figural memory, verbal abilities, among others). Motor speed is examined by finger tapping and the trail making test as well as by rapid alternating movement analysis, as a correlate of basal ganglia

function. Functional neuroimaging procedures (PET, SPECT and MRS) are performed to visualize pathology in dopaminergic pathways. CSF is analyzed for routine parameters (cells, protein, sugar, lactate and oligoclonal bands) as well as for viral load and dopaminergic as well as noradrenergic metabolites. Neuropsychological and motor tests often reveal a decline in speed-dependent, non-verbal abilities, with a slight shift to more general attentional deficits in the HAART era. Neuroimaging procedures show hypermetabolism in the basal ganglia in early infection switching to a phase of "pseudo-normalization" to hypometabolism (PET), and up-regulation of glial cell markers (MRS), with no dopaminergic receptor dysfunction (SPECT) but an increased turnover rate of dopamine and its metabolites in CSF analysis as well as marked abnormalities in noradrenaline metabolism. There is abundant evidence for dopaminergic pathway pathology in HIV-1-infection, which should be taken into account for future treatment strategies.

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B.B. GELMAN, C. HOLZER & V.M. SOUKUP. Neurodegeneration versus Neuronal Dysfunction in HIV-Associated Dementia. The Role of Transcriptional Channelopathies.

Highly active antiretroviral therapy (HAART) produced a marked decrease in severity of neurocognitive dysfunction in HIV infected people. Before HAART, presence of encephalitis and HIV-infected brain macrophages were considered the underlying substrate of HIV associated dementia (HAD). After HAART, subtle neurocognitive changes are not always clearly associated with neurodegeneration. Subjects sometimes have reversible deficits inconsistent with irreversible loss of neurons. Brain macrophages and HIV loads, encephalitis, and neuronal dropout all are correlated weakly, if at all, with neurocognitive dysfunction. Brain spectroscopic analysis shows altered chemical composition; electrical activity of cortical neurons also is abnormal, suggesting a critical role for physiological changes. Transcriptional channelopathies (TCs) are chemically documented anomalies that can produce neurophysiological anomalies; TCs represent abnormal expression of ion current carriers that control neuronal excitability. TCs were discovered in HAD recently. They were not caused by generalized neuronal dropout or glial cell proliferation and did not depend on the presence of encephalitis. Of 18 HIV-associated channelopathies, 11 decreased and 7 increased neuronal firing frequencies in model neurons. The implied disruption of neuronal excitability is consistent with many features of HAD, including potential reversibility after HIV-1 replication is suppressed, associated abnormal electroencephalographic recordings, and lack of clear-cut correlation with neurodegeneration or brain inflammation. These HAD data may represent a new paradigm to elucidate how subcortical dementias produce neocortical dysfunction. ACKNOWLEDGEMENTS: Supported by NIMH NIDCD NINDS

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L. CHANG. Insights into the Pathophysiology of HIV/AIDS and Substance Abuse from Neuroimaging.

Brain injury associated with HIV and substance use disorder remains common. Despite the introduction of potent antiretroviral medications and the significant decline in mortality and opportunistic brain diseases in patients with HIV, the prevalence of HIV-associated cognitive impairment remains high. With the longer survival and aging population of HIV infected patients, and the high prevalence of substance use disorder in this population, a better understanding of how the brain is impacted is needed to design rational therapy, evaluate treatment effects, and improve the quality of life of individuals living with HIV and those with a history of substance abuse. Several in vivo functional neuroimaging techniques can assess brain injury associated with various disorders, sometimes including the asymptomatic stages. Quantitative measurements with these techniques may serve as surrogate markers to monitor treatment effects or to evaluate the neuropathological mechanisms. Examples of these mechanisms include increased blood-brain-barrier permeability, decreased dopamine function, and reorganization of brain function in HIV infection. Imaging techniques discussed include magnetic resonance spectroscopy, functional MRI, dynamic T1-mapping with MRI, and positron emission tomography. Understanding how brain injury impacts cognitive performance requires statistical analyses with controls for relationships between neuroimaging measures and cognitive status. Relating neuroimaging studies to neuropsychological assessment should lead to a greater understanding of the pathophysiological mechanisms of HIV-associated brain injury, and, hence, new therapeutic approaches. Acknowledgments: Studies and resources supported by NINDS, NIMH, NIDA, NCRR, DOE and ONDCP).

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D. CLIFFORD. HIV Associated Cognitive Motor Disorder - Insights from Therapeutics.

The impact of HIV infection on brain has been evident from the earliest observations of this infection and has been tracked most successfully with neuropsychological testing measures. The pathophysiology of dysfunction has been linked to the virus itself and to the therapeutic success of antiretroviral therapies. With evolution from monotherapy (having a favorable impact acutely as well as decreasing dementia incidence), through dual therapy, to the current multidrug, highly active antiretroviral therapy (HAART) era, it has become inescapable that a major component of neuropsychological dysfunction is driven by viral replication. The critical location of replication for dementia has been more elusive. While replication within the CNS is often associated with fulminant disease, the hypothesis that the degree of antiretroviral penetration into brain should regulate efficacy has been surprisingly hard to substantiate. The critical control of infection governing neuropsychological performance might lie outside the CNS, leaving open the question of mechanisms for control of neurological dysfunction. This question is further propelled to the center of neurotherapeutic investigation by the ongoing evidence of impaired performance of many HIV infected individuals in the face of excellent replication control. Future research must focus not only upon the state of viral infection but also upon secondary processes precipitating neurodegeneration as well as upon more subtle drug toxicities and upon concomitant processes (such as infections contributing to ongoing neuropsychological impairment).

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Paper Session 14/3:30–5:15 p.m.

Pediatric TBI

J. DONDERS & M. WILDEBOER. Validity of the WCST-64 after Pediatric Traumatic Brain Injury.

To determine the degree to which the one-deck version of the Wisconsin Card Sorting Test (WCST-64) yields the same information as the full-length version (WCST) in children with traumatic brain injury (TBI). It was decided a priori that, in order to be considered interchangeable, the two versions should yield standard scores for Perseverative Responses that (a) shared at least two thirds of common variance, (b) fell within

1 standard deviation of each other more than 80% of the time, and (c) have equivalent correlations with external criteria such as length of coma and Full Scale IQ. 56 children, selected from a 5-year-series of consecutive rehabilitation referrals, according to the following criteria: (a) TBI through an external force to the head, (b) age between 10 and 16 years, (c) absence of prior neurological, psychiatric, or special education history. The sample was 63% male and 91% Caucasian, with 59% having neuroimaging evidence for an intracranial lesion and 38% having coma of more than 24 hours. All children completed the full-length WCST as well as the WISC-III within 1 year after injury. Protocols were then rescored to obtain the WCST-64 standard scores as well. For Perseverative Responses, the correlation between the two versions was .91 ($p < .01$) and a t-test for paired observations was not statistically significant ($p > .10$). Only 4 children (7%) had a discrepancy exceeding 1 standard deviation between the respective standard scores. The Perseverative Responses indexes from the WCST-64 yielded correlations with coma and Full Scale IQ that were not statistically significantly different from those for the full-length WCST. All three a priori specified criteria were met. The findings suggest that the WCST-64 may be used interchangeably with the original WCST in the assessment of older children with TBI.

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J.E. CASS, K.O. YEATES, G. TAYLOR & N. MINICH. Cognitive Reserve Capacity and Neuropsychological Outcome Following Pediatric Traumatic Brain Injury .

The goal of the study was to investigate whether cognitive reserve capacity moderates neuropsychological outcomes following pediatric traumatic brain injury (TBI). Participants included 53 6-12 year old children with severe TBI, 56 with moderate TBI, and 80 with orthopedic injuries enrolled in a prospective, longitudinal study. Their neuropsychological functioning was assessed shortly after injury, and at 6-months, 12-months, and approximately 4 years post injury. Measures of cognitive reserve capacity were gathered at the initial assessment, and included retrospective parent ratings of premorbid communication skills and school performance, as well as children's performance on a test of single word identification. We hypothesized that group differences in neuropsychological functioning attributable to TBI would be more pronounced among children with lower cognitive reserve capacity than among those with higher cognitive reserve capacity. Growth curve analyses generally did not reveal evidence that cognitive reserve capacity moderates neuropsychological outcomes. Whether the measures of cognitive reserve were treated individually or combined in a composite indicator, they did not interact with group membership to predict outcomes. Cognitive reserve capacity did predict individual differences in neuropsychological functioning, and also interacted with time post-injury for some outcomes, such that children with higher reserve showed more rapid cognitive growth than children with lower reserve; however, these effects were significant regardless of group membership. The findings suggest that pediatric TBI yields detrimental cognitive effects regardless of children's premorbid functioning, and challenge the applicability of the concept of cognitive reserve capacity in the context of childhood TBI.

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K. YEATES, G. TAYLOR, B. BANGERT, A. DIETRICH, K. NUSS, J. RUSIN & M. WRIGHT. Post-Concussive Symptoms in Pediatric Mild Head Injury Cannot Be Accounted For Entirely By Non-Injury Related Factors.

To examine the prediction of post-concussive symptoms (PCS) in children with mild head injuries (MHI) from both injury and non-injury related factors. Participants include 8-15 year old children with MHI

and those with mild orthopedic injuries (OI). They and their families are recruited prospectively and assessed at 1-2 weeks, 1 month, 3 months, and 12 months post-injury. Parents rate PCS, with pre-injury PCS assessed retrospectively shortly after the injury. Predictors of PCS include injury characteristics, as well as non-injury related parent and family variables. The current findings are based on 129 children with MHI and 71 with OI who have been recruited to date. Most of them have been followed through 3 months post-injury. The groups are comparable in age, gender, socioeconomic status, and ratings of pre-injury PCS. In the MHI group, 36% report a loss of consciousness (LOC) and 14% demonstrate abnormalities on MRI. Children with MHI display more cognitive and somatic PCS than children with OI. The differences are significant even after controlling for children's premorbid PCS, parental psychological distress, family functioning, and socioeconomic status, although these variables also explain significant variance in PCS. Within the MHI group, both LOC and MRI abnormalities are associated with increased cognitive PCS, again after controlling for non-injury related factors. In contrast, neither group membership nor indicators of injury severity predict emotional or behavioral PCS after controlling for non-injury related factors. The results suggest that MHI give rise to cognitive and somatic PCS that cannot be explained entirely on the basis of non-injury related factors and are related to injury severity. In contrast, non-injury related factors do account for emotional and behavioral PCS.

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G.A. GIOIA, J. JANUSZ, P. ISQUITH, E. NATALE, K. GLASS & L. YARGER. Parent and child concordance of serial post-concussion symptomatology reports.

Following a concussion or mild TBI in children and adolescents, the objective assessment of symptoms is critical but challenging. Whereas the report of the patient is important information, observations from a third party, such as a parent, can also be valuable. The objective of this paper is to demonstrate external validity of the parent symptom report in comparison with the child/adolescent report, and the concordance of serial assessment of post-concussion symptoms as reported by both the child and parent. 37 parents and their children (Mean age = 12.9, SD = 3.7) who met criteria for concussive injury (Median days post concussion: Time 1=12, Time 2=29) completed 2 serial post-concussion symptom reports (Parent=28 items, Patient=22 items; 7-point Likert scale) following the child/adolescent's injury. Parents also completed a pre-injury baseline report at Time 1. Mean total symptom scores were generated. Correlational analyses find significant concordance between parent and child total symptom report at Time 1 ($r=.65$, $p<.001$) but not at Time 2. Levels of symptom report are only marginally higher for parents at each time. Repeated measures MANOVA's find a significant increase in parent report of symptoms between Baseline and Time 1 ($p=.001$; $\eta^2=.53$) with a significant decrease in symptoms at Time 2 ($p=.001$, $\eta^2=.511$), returning to baseline levels. A similar significant reduction was seen in child ratings from Time 1 to 2 ($p<.001$; $\eta^2=.614$). Similar profiles of serial total symptom reports are found between parent and child, providing validation support of the parent as reporter of post-concussion symptomatology. The scores covaried most significantly during the symptomatic phase (Time 1). Similar overall levels of symptoms are reported by both respondents during both the active symptomatic phase with significant reduction on subsequent follow-up. Continued examination of specific serial symptom subdomain patterns is warranted.

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Paper Session 15/3:30–5:15 p.m.

Professional Issues

D. BYRD, S. ALBERT, M. TANG & J.J. MANLY. Cultural Specificity of the Relationship Between Neuropsychological Test Performance and Functional Capacity.

The present study evaluated the cultural specificity of the relationship between a neuropsychological dementia test battery, chronic medical conditions, depressive symptomatology, and concurrent functional ability in demented and non-demented elders. It was hypothesized that NP tests would be more predictive of functional status in Caucasians while depressive symptoms and medical health would demonstrate stronger predictive values for ethnic minority elders. Participants included 407 African American (AA), 565 Hispanic (HZ), and 190 Caucasian (CA) elders. Predictors included demographic characteristics, the Hamilton Depression Rating Scale, and a cumulative index of medical illness. Functional capacity was measured with the Blessed Functional Activities Scale. Significant ethnicity differences were observed on neuropsychological test performance, functional ability, and depressive symptoms. Logistic regression analyses revealed that for Caucasians, older age and low memory scores were significant risk factors for impaired functional status. However, for AA and HZ elders, older age, female gender, and poor performance on tests of executive functioning were associated with impaired functional ability. Depression, but not medical status, was equally associated with functional limitations in all ethnicity groups. The differential patterns of cognitive risk factors for functional impairment suggests that when using NP test results to forecast functional needs for the elderly, specific cognitive domains deserve increased weight depending on the cultural background of the elder.

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J. EVANS. NIMH Programs in Geriatric Mental Health Research: Opportunities for Neuropsychologists.

In 2004, the National Institute of Mental Health (NIMH) established an organizational unit focused on aging-related research. This presentation will describe the organizational changes, inform participants of current NIMH programs that support research efforts on aging and mental health, and outline specific opportunities for new studies. The initial overview will detail NIMH's extramural research divisions, the lines of aging research currently supported, and the operations of an internal coordinating consortium on aging research. It will also discuss trends and new developments at NIMH with implications for aging-related research, and other aspects of the current funding context. A discussion of the Institute's programmatic interests and priorities with re-

spect to aging-related studies in specific areas, including clinical and cognitive research on late-life mental disorders, psychosocial and psychopharmacological interventions, and the training and career development of geriatric mental health researchers will also be discussed. The presentation will include information about recent program announcements, available funding mechanisms, and general procedures for submitting grant applications. Participants will be encouraged to ask questions and identify issues of particular interest for discussion during the session.

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V. JAGAROO & M. OSCAR-BERMAN. Neuroinformatics: How it will Reinnervate the Field of Neuropsychology .

This paper seeks to introduce neuroinformatics to neuropsychology. Neuroinformatics (NI), a subspecialty of bioinformatics, is the application of computerized information-system tools, databases and data-mining algorithms in neuroscience research. This new field has thus far been effectively applied in subdisciplines such as neuro-genetics and cortical-architectonic mapping. The nature of discrete data sets in these subdisciplines has rendered them amenable to more apparent, rapidly-developed and easily manageable NI systems. Neuroinformatics, however, has no application limitations. Its identity evolves with every new application it faces in any area of neuroscience, neuropsychology being no exception. Yet until now there has been no articulation of how NI might be broadly applied in clinical and experimental neuropsychology. In the present paper, we introduce possible benefits of NI in assessing neuropsychological functions. We describe some hypothetical examples of how NI can be applied to specific problems in the assessment of language, memory, and spatial functioning. We then provide an example of an actual NI system under development, which can conduct computational assessment of hemispatial neglect and object-centered spatial perception. This example vividly illustrates (1) NI capability which cannot be achieved by conventional methods in clinical assessment, and (2) the inevitability that NI will be drawn into neuropsychological assessment in order to meet the complexity of cognition. Finally, the paper outlines the logistical challenge of a multi-user server-based NI system and the coordination of small-scale NI efforts towards a larger NI platform for neuropsychology. The launch of an international working group for NI in neuropsychology is proposed. N/A N/A N/A

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SATURDAY MORNING, FEBRUARY 5, 2005

Poster Session 10/8:30–10:30 a.m.

Subcortical Disorders (Parkinson's, Huntington's, Progressive Supranuclear Palsy)

D.J. ZGALJARDIC, P.J. MATTIS, J.S. PAULSEN, M. GUTTMAN, A. FEIGIN & D. EIDELBERG. Huntington's disease (HD) Presymptomatic Gene Carriers: A Neuropsychological (NP) Follow-up Study. HD is an inherited movement disorder characterized by progressive cognitive decline of a subcortical nature. Prior studies have been unsuc-

cessful in consistently identifying NP performance abnormalities in gene positive presymptomatic HD(pHD). However, those individuals presumed to be closer to disease onset are reported to present with greater levels of cognitive impairment (Brandt et al., 2002). In the present study, we expanded on these observations by measuring the extent of change in NP performance and symptom severity in pHD individuals over an 18-month period. A comprehensive test battery consisting of measures that assess various cognitive domains was administered to 8 pHD subjects. A cutoff score suggesting impairment was set at 1.5 standard deviations below the normative mean. Quantification analyses and paired sample t-tests were used to assess change in motor and NP performance over time. Clinical/motor severity was assessed utilizing the Unified Huntington's Disease Rating Scale (UHDRS). In addition, an index

of relative closeness to disease onset (product of CAG repeat length and age at initial testing) was calculated. A median split index score subcategorized our sample as "close" to disease onset [$n=4$] or "far" from disease onset [$n=4$]. Among cognitive tasks, at baseline, individual subject performance below normative cutoff was observed for measures of memory (CVLT; $n=4$) and sustained attention (BTA; $n=3$). At follow-up, mean group performance was within the normal range and remained relatively stable over time. However, subjects categorized as "close" to disease onset performed significantly worse on more NP measures compared to those subjects "far" from disease onset at baseline and follow-up testing. UHDRS scores did not change significantly over time. These findings support prior reports that failed to identify consistent NP abnormalities in pHD, but that cognitive deficits in pHD likely occur as patients approach clear-cut clinical onset.

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L.H. RUBIN, J. BRANDT & P.M. MAKI. Rhyme fluency in Huntington's disease.

In an earlier study, Huntington's disease (HD) patients performed significantly worse on a measure of rhyme generation derived from an implicit memory test than on standardized tests of phonemic and semantic fluency (Maki, Bylsma, & Brandt, 2000). This finding suggested that rhyme generation may be especially sensitive to frontal dysfunction. To examine this further we developed a brief rhyme fluency test consisting of two "easy" rhyme cues and two "difficult" rhyme cues called from the original implicit test. In this study, we compared HD patients ($n = 13$) and age- and education-matched controls ($n = 11$) on rhyme and phonemic fluency tests. Multivariate analysis of variance (MANOVA) showed a significant main effect of group in favor of controls and a significant interaction between group and test, with patients showing greater impairment on rhyme fluency relative to phonemic fluency. In HD patients, Quantified Neurological Exam (QNE) scores correlated significantly and inversely with rhyme fluency ($r = -.53$, $p < .05$) but not verbal fluency ($r = -.24$, ns). The motor impairment subscale was highly correlated with rhyme fluency ($r = -.64$, $p < .05$). These findings suggest that rhyme fluency may be more sensitive than phonemic fluency to frontal lobe dysfunction and disease severity in HD. More generally, measures of rhyme fluency might be particularly useful clinical tools for assessing fluent production in patients with suspected frontal lobe dysfunction.

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A.C. SOLOMON, J.C. STOUT, S.A. JOHNSON, E.H. AYLWARD, D.R. LANGBEHN, K. DUFF, J. BRANDT, J.S. PAULSEN & PREDICT-HD INVESTIGATORS OF THE HSG. Learning and Memory Performances are Associated with DNA-based Estimates of Onset and Striatal Volume in Presymptomatic HD.

Predict-HD is a prospective, longitudinal study investigating cognitive, motor, and psychiatric changes associated with presymptomatic Huntington's disease (HD). As part of baseline data collection, 400 participants (358 individuals who tested gene positive for HD and 42 individuals who tested gene negative) completed the revised version of the Hopkins Verbal Learning Test (HVLT-R). Two hierarchical regression models (controlling for demographic variables) were used to predict variance in learning and memory performances for the gene positive group. Estimates of disease onset based upon length of the trinucleotide expansion in the HD gene were significantly associated with 11 of the 12 HVLT-R variables. In another model, caudate, but not putamen, volume was significantly associated with 5 of the 12

HVLT-R indices. These findings suggest that memory performance in persons at risk for (but not diagnosed with) HD is associated with DNA-based estimates of clinical symptom onset in HD and that variability in memory performance is independently associated with caudate volume.

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L.J. BEGLINGER, D.S. O'LEARY, C. NEHL, J. KOEPEL, S. VAN DER HEIDEN, N.C. ANDREASEN, R. HICHA & J.S. PAULSEN. PET Activation During Working Memory and Spatial Attention Tasks is Abnormal in Presymptomatic Huntingtons Disease .

Working memory and attention are among the most sensitive neuropsychological indicators of early impairments in HD. PET with [(15)Oxygen]-labeled water was used to measure regional cerebral blood flow (rCBF) in 16 healthy individuals who had undergone presymptomatic testing for expansion in the HD gene (M age =31 years; M education=14 years) and 20 demographically-matched healthy controls without HD mutation. Presymptomatic participants performed within the normal range on the Unified Huntingtons Disease Rating Scale, which screens for motor, cognitive, and functional impairments. The stimuli and response requirements were identical in two PET tasks, with the only difference being whether they had to simply attend to, or remember the location of, a visual stimulus. Results showed that controls were slightly more accurate than presymptomatic participants on both tasks, but both groups performed well. Findings suggest that presymptomatic participants showed greater frontal activation (BA 9) for spatial working memory whereas controls showed greater cerebellar and parietal activation. Controls demonstrated increased rCBF in the right frontal lobe (BA 10 & 11) and right cerebellum during the spatial attention task; presymptomatic participants showed the same pattern, but less activation. Findings suggest that cerebral blood flow alterations during spatial working memory and attentional tasks may be sensitive to early disease in participants at risk for HD prior to manifestation of the movement abnormalities.

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D.J. ZGALJARDIC, P.J. MATTIS, J.C. BOROD, N.S. FOLDI, M.F. GORDON, A.S. FEIGIN & D. EIDELBERG. Self-reported apathy in Parkinson's disease.

Nondemented patients with Parkinson's disease (NDPD) can present with cognitive and affective sequelae, with executive dysfunction and depression being the most prominent. The incidence of apathy (i.e., reduced initiative) in these patients is moderate and may share characteristics with other affective syndromes associated with the disease making diagnosis difficult. Apathy has been reported to be a consequence of disease pathology rather than a psychological reaction to PD (Pluck & Brown, 2002). The purpose of the current study was to assess apathy in 32 NDPD patients and ascertain its relationship to performance on measures of executive function and on self-report behavioral inventories. Apathy was assessed using the FrSBe-Apathy subscale (Grace & Malloy, 2001). Our sample was divided into high (HA) [43.75%] and low (LA) apathy subgroups based on a normative cutoff. The two subgroups did not differ on age, education, disease duration, or mental status, albeit HA patients had significantly higher scores on the Hoehn and Yahr scale, suggesting greater clinical severity. The HA subgroup performed worse than the LA subgroup on measures of semantic and phonemic verbal fluency ($p < .05$) and reported greater symptoms of depression, disinhibition, and executive dysfunction ($p < .01$). Collapsing across subgroups, Pearson product-moment correlation coefficients revealed that behavioral inventories

assessing depression and executive dysfunction were positively correlated with apathy ($p < .001$). Using stepwise multiple regression, measures that were shown to significantly predict apathy in our PD patient sample included a self-report measure of executive dysfunction, as well as tasks assessing working memory, category fluency, and impulsivity. Levels of self-reported apathy in NPD patients do not appear to only be related to affective/behavioral factors associated with PD, but may be the consequence of increasing executive dysfunction related to disease progression.

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L. KIRSCH, D. BOWERS, J. ROMRELL, C. JACOBSON, H. FERNANDEZ & M. OKUN. Examining Apathy and Depression in Parkinson's Disease.

Apathy syndromes and symptoms are an understudied aspect of Parkinson's disease (PD). This study wished to determine the prevalence, and examine the relationship of apathy to depression symptoms in a series of 44 PD patients. Forty-four idiopathic PD patients (mean age of 69.5 ± 10.4 ; mean severity Hoehn Yahr score $2.5 \pm .66$) completed an abridged version of the Marin Apathy Evaluation (MAI), the Beck Depression Inventory (BDI), Centers for Epidemiologic Study-Depression Scale (CES-D), as well as underwent motor testing to determine the type and severity of their motor symptoms (UPDRS-M). Correlational analyses and t-tests were utilized to examine the relationships among the scales. Results indicated that 43.2% of the sample showed apathy (MAI cut score ≥ 14), and 31.8% showed depression (BDI cut score \geq). These figures included 15.9% that showed apathy alone, 4.5% that showed depression alone, and 27.3% that showed both apathy and depression (52.3% that showed neither). These prevalence figures are consistent with past research (Starkstein et al., 1992; Isella et al., 2002). Apathy and depressive symptoms (e.g. MAI and BDI) appeared to be significantly correlated ($r = .475$, $p = .001$). Depressive symptoms as measured by the CES-D were also correlated with apathy symptoms ($r = .713$, $p < .001$). For comparison analyses, groups were divided into low and high apathy groups. Depressive symptoms (BDI) were found to differ significantly between LA and HA groups ($p < .001$). These associations were in contrast to two other studies that found nonsignificant correlations between depression in LA and HA groupings. Neither severity of disease nor motor scores were significantly related to apathy or depression. This study confirmed evidence of high prevalence and severity of apathy in PD. It also suggests that symptoms of apathy and depression are comorbid in this disease. It is possible that apathy and depression symptoms are more related in PD than they are in other illnesses.

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M. SMITH PASQUALINI, G. SIMONS & J. WOOD. Facial Expressivity During Interactions Between PD Patients and Spouses.

Parkinson's disease (PD) is a neurological disorder that can result in reduced facial expressivity. We investigated the bi-directional effects of PD on social interactions. We hypothesized that PD patients would show less facial expression than controls, and that spouses of PD patients would tend to "match" the expressions with less expressivity themselves. We videotaped 14 male PD patients and their spouses, and 12 healthy couples, while they engaged in a 5-minute conversation. Using FACS, we coded frequency and duration of smiles with and without cheek raises, nods, eyebrow raises, gaze, and talking. Measures of own and spouse's perceived level of satisfaction, and estimates of how much own and spouse's facial expressions reflected feelings, were recorded on Likert scales. Facial data were also examined using GridWare, a tool that can be used for multivariate time series of dyadic sequential data, whereby

a sequence of states for each spouse is plotted on a state space grid to depict interaction changes in time. PD patients were compared with male controls, and spouses of PD patients were compared with female controls, using t-tests. Consistent with predictions, PD patients showed less talking, fewer smiles with cheek raises, fewer nods, and greater duration of gaze than male controls. PD patients over-estimated how satisfied their wives were, and overestimated how much their wives' faces reflected their feelings. Spouses of PD patients had smiles of shorter duration, and reported less satisfaction with the conversation than female controls. Examination using GridWare allowed visualization of how the spouses' reciprocal behaviors changed in time. These results suggest that spouses of PD patients tend to match the reduced expressivity of their partners, and highlight the need to investigate facial expressivity in the context of social interactions using methods that will reveal reciprocal relationships.

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J.G. BRAND, M.J. HAMBERGER, C.A. PALMESE & A.M. BRICKMAN. Trail Making Test Performance and Depression in Parkinson's Disease.

Executive dysfunction observed in Parkinson's disease (PD) patients has typically been considered a reflection of frontal-subcortical system disturbance. However, as depression is often observed in PD as well, the extent to which depressive affect impedes performance on measures of executive functioning is unclear. It has been reported that on The Trail Making Test (TMT), which assesses visual search and sequencing (Trails A), and mental flexibility (Trails B), PD patients perform disproportionately worse on Trails B. We hypothesized that the relatively poorer performance on Trails B might be related to depressed mood. Participants were 46 PD patients (mean age: 63.5; mean education: 15.1). All patients were administered the TMT (A and B) and the SCL-90-R. Trails A and Trails B age corrected percentile scores were compared via paired-samples t-test. To explore the influence of mood, we performed repeated measures ANOVA with the Depression Scale score of the SCL-90-R as the covariate. Percentile scores were significantly lower for Trails B (mean = 19.5, SD = 23.93) than Trails A (mean = 35.65, SD = 26.96; $t = 3.85$, $p < .001$). However, when the Depression score was used as a covariate (mean = 60.73, SD = 11.02), this difference was no longer significant ($p > .05$). These results suggest that depressed mood might account for at least some of the difficulty in executive functioning in PD patients. Thus, in some PD patients, treatment for poor mood might improve some aspects of cognitive functioning.

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M.R. GREHER, L.H. LACRITZ, L.M. RILLING, P.E. O'SUILLEABHAIN & C. CULLUM. Cognitive Impairment in Early Parkinson's Disease.

We examined neuropsychological functioning in a relatively young PD sample with short symptom duration, as less is known about cognitive deficits within this population. Subjects included 92 (29 F, 63 M) PD patients (age $M = 65.23 \pm 10.02$, education $M = 15.76 \pm 3.06$). Average disease duration was 3.6 ± 10.14 years and mean age at symptom onset was 61.8 ± 10.14 . Subjects were selected to have MMSE ≥ 24 ($M = 28.21 \pm 1.61$) and divided into memory impaired (MI) and non-memory impaired (NMI) groups based on Hopkins Verbal Learning Test-Revised (HVLT-R) Delayed Recall t-score ($MI < 40$ and $NMI \geq 40$). Patterns of performance across a variety of neurocognitive measures were examined for each group. 46% of participants were classified as MI, and showed deficits on HVLT-R recall as well as recognition variables. A

large proportion of the MI group were also impaired on phonemic fluency (32.5%), divided attention (31.6%), visual construction (41.5%), and visual memory (73.2%), whereas the NMI group only showed impairment in visual memory (49%). Additionally, the MI group performed poorer overall than the NMI group on phonemic fluency, visual construction, and visual memory, despite similarities in age, disease duration, and degree of motor impairment based on the UPDRS. These findings suggest that a sizeable proportion of PD patients may present with memory impairment in addition to other cognitive deficits early in the course of the disease. The overall cognitive profile in the MI group is similar to previous reports in PD, though impairments were seen in recall as well as recognition memory.

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C.M. MATHIESEN & L. TREPANIER. Sequelae of STN-DBS for Parkinsonism: A Case Study.

To evaluate the cognitive sequelae of bilateral subthalamic nuclei deep brain stimulation (STN-DBS) in a 45-year-old male with a 23 year history of MPTP-induced Parkinsonism. To determine if STN-DBS has similar cognitive sequelae for Parkinsonism as for idiopathic Parkinson's Disease and if modified neuropsychological batteries are needed. This right-handed, Hispanic male with nine years of education had initial symptoms at age 22. Over time, dopaminergic agents had significantly reduced effectiveness. Other current diagnoses include Hepatitis C and polysubstance dependence. Available neuropsychological evaluations include a cognitive screen (1995), a psychological evaluation (1997), and full batteries conducted pre-STN-DBS surgery (2003), and three and eight months post-surgery (2004). Post STN-DBS test results indicate that the patient is generally functioning as premorbid, with some specific cognitive alterations. Expected gains in motor functioning and hypophonia were found, and mood was slightly improved, although he worries about permanency of the surgery's effects. Cognitively, the most variability was noted on encoding and organization of visual material: visual-spatial functions had decreased at three-months post-operative but recovered somewhat by eight months post-op. Semantic fluency and delayed verbal memory also declined post-operative. This case provides an initial investigation of the cognitive benefits and sequelae of STN-DBS for a younger patient with Parkinsonism. Results are relatively similar to older PD patients who have undergone STN-DBS, and standard test batteries appear appropriate. Further study is necessary to better understand the outcome of STN-DBS for patients with Parkinsonism co-morbid with other medical problems.

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D.K. JOHNSON & J. GALVIN. Cognitive Impairment and Parkinson's Disease.

To examine cognitive impairment in Parkinson's disease. Two groups diagnosed with either Parkinson's Disease without dementia (PD) or Parkinson's Disease with dementia (PDD) were followed as part of an ongoing study of memory and aging at the Washington University Alzheimer Disease Research Center (ADRC). Years of education was equivalent for both groups (PD=14, PDD=12). Age (PD=72, PDD=79) and simple motor speed (Crossing Off in seconds: PD=83, PDD=136) varied. Two sets of Canonical Discriminant Analyses (CDA) were conducted, first on psychometric raw scores and then on the unstandardized residuals of individual psychometric tests, after statistically controlling for Age and Crossing-off. The raw score discrimination was very effective (89% correct classification), although the interpretation of the discriminant function was not straightforward. When interpretable, the function indicates underlying factors affecting group membership

as well as potential definitions of the dimensions along which they vary. The discrimination based on unstandardized residuals was also very effective (81%), and results were easily interpreted. Means and discriminant function scores indicate both verbal and visuospatial memory deficits present in the PDD performance. Poorer performance on verbal memory tests included Paired Associate Learning and Digit Span. Poorer performance on nonverbal memory tests included Digit Symbol and Benton Recall. These analyses support the use of domain specific testing strategies to detect the PDD as long as appropriate age and simple motor ability are statistically controlled.

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A.J. ISOMURA & H. UTSUMI. Cognitive Differences among Subtypes of Parkinson's Disease.

There have been an extensive number of literatures evaluating cognitive performance among patients with Parkinson's Disease (PD). It is widely understood that these patients often show declines in executive function, delayed free recall, visuospatial function, and psychomotor speed (e.g., Green, 2000; White, 1992). However, there have not been any studies indicating differences of cognitive performance between PD subgroups. We have conducted a pilot study to evaluate cognitive differences among PD patients. PD patients were categorized into two subtypes depending on the initial symptom manifestations, that were 1) tremor type and 2) bradykinetic type (15 participants for each group). We also compared their performance with 15 participants without neurological disorders. The brief neuropsychological battery used in this study included the following tests, 1) WAIS-R Picture Completion, Digit Span, Block Design, Digit Symbol, 2) WMS-R Logical Memory I&II, Visual Reproduction I&II, 3) List Learning Test, 4) Judgment of Line Orientation 5) Confrontational Naming Test, 4) Animal Naming Test, and 5) Trails Making Test. ANOVAs and Chi-square were conducted to examine group differences. We found that the patients in the bradykinetic group performed worse than those in the tremor group and the control group on the tasks of memory, psychomotor speed, and executive function. The result suggests that PD patients who have initial bradykinetic symptoms suffer more cognitive declines than PD patients with initial tremor symptoms. There may be different disease process among PD patients depending on the initial symptom manifestation. Future directions of this project are also addressed.

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C.C. BALDERSTON, J.E. DUDA, M.B. STERN & P.J. MOBERG. Phenylthiocarbamide (PTC) Sensitivity in Patients with Parkinson's Disease.

The inability to taste phenylthiocarbamide (PTC) has been associated with a number of medical and neurological illnesses not typically related to taste. A G-protein coupled bitter taste receptor (TAS2R38) has been identified for PTC, and has been related to abnormalities in dopamine receptor function. We examined PTC sensitivity in patients with Parkinson's Disease (PD) to determine whether taster status could represent a simple vulnerability marker. Thirty-seven male outpatients with idiopathic PD were assessed. Subjects received comprehensive neurological, physical and clinical exams. A PTC-impregnated strip of filter paper (Carolina Biological Supply Company) was placed on the tongue. Subjects were asked if they tasted anything. Subjects also rated the intensity of the taste on a 100mm visual analog line, ranging from 0mm (no taste) to 100mm (extremely strong taste). Only 43% of the PD patients were PTC tasters as compared to the average finding of 70% in healthy U.S. adults. In PD patients, tasters and nontasters did not differ in disease severity, motor impairment, or other clinical and motor variables.

Patients with Parkinson's disease demonstrated a greater proportion of PTC nontasters (57%) in comparison to the well established population-based data (30% nontasters). This higher frequency of nontasters may result from abnormal G-protein signaling or expression related to dopamine depletion in PD. As phenotypic variation in PTC sensitivity is thought to be genetic in origin, it may suggest a somewhat higher risk for illness in those subjects with recessive alleles (i.e., nontasters).

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M. HUA, P.C. SU, C. YANG & H. TSENG. Neuropsychological Function Following Bilateral Subthalamotomy for Advanced Parkinson's Disease.

Literature regarding whether the treatment of subthalamotomy affects neuropsychological function in patients with advanced Parkinson's disease (PD) seems to be relatively scanty. Some recent studies investigated the patients with unilateral subthalamotomy, and found that most of the patients did not evidence remarkable changes of their neurocognitive function. However, the issue of whether the patients with bilateral subthalamotomy have changes of neuropsychological function remains unknown. In the present study, we have studied the effects of bilateral lesions located in the subthalamotomy nuclei on neuropsychological function in parkinsonian patients. Eleven patients with advanced idiopathic PD who had received bilateral subthalamotomy were studied their neuropsychological function. The mean age of these patients was 60 years old (ranged from 45 to 71 years). Neuropsychological examinations, including memory, attention, visual perception, spatial reasoning, language, executive function, and manual dexterity, were performed pre-operatively and post-operatively (the mean duration was around 17.8 months after surgery). The data analysis (a contrast of pre- and post-test performance scores with matched pair t and chi-square procedures) revealed that there are no significant changes of neuropsychological test scores in most of the patients. On the basis of current available results, we suggest that there are no any remarkable changes of neuropsychological function following bilateral subthalamotomy for advanced PD.

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M.H. KRENGEL, V. HONN, J. WINZER & R.F. WHITE. Changes in cognition and mood status post DBS surgery for treatment of Parkinson's disease.

Recent research has shown that there is a high risk of suicide, increase in apathy and higher rates of depression in individuals who have undergone neurosurgery (deep brain stimulation; DBS) to control motor symptoms of PD. Other researchers have found that cognitive status is unchanged, medication treatment is reduced, and motor symptoms are improved in individuals 3 months and 11 months post-surgery. A sample of 30 patients who underwent DBS surgery was given a battery of neuropsychological and psychological tests to comprehensively document changes in cognition and mood. Tests included measures of executive function, short-term memory, motor control and mood. Patients were tested pre-surgery, 3 months post-surgery and 11 months post-surgery. Motor stage and medication use were documented by physician reports. Multivariate analyses were conducted on 24 patients who met criteria for inclusion. Analyses revealed that post-surgery patients showed improvement in the area of motor functioning. Diminishment was found over time in terms of acquisition of new information and retrieval of newly learned information after delays. Significant decline in cognitive flexibility was also found. Depression increased slightly overall, but there was no evidence for increased suicidality. This study provides preliminary

evidence that a subset of patients who have completed DBS may show subtle declines in measures of frontal/subcortical functioning as well as an increase in self-reported symptoms of depression. Reasons for the difference in this sample in terms of changes in mood and cognition will be discussed.

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S. FRUTIGER, S. CLOCK, K. LYONS, R. PAHWA & S. WILKINSON. Determinants of Subjective Well-Being in Patients with Parkinson's Disease.

Contributions of physical, cognitive, and emotional factors to subjective well-being (SWB) in Parkinson's Disease (PD) patients were evaluated prior to surgical implantation of deep brain electrodes. PD patients (37) and spouses (26) completed self-report measures of SWB (Temporal Satisfaction with Life Questionnaire), adaptive functioning (SIP; Sickness Impact Profile), personality and emotional functioning (Brief Symptom Inventory [BSI], Clinical Assessment Scales for the Elderly), positive and negative affect (PANAS; Positive and Negative Affect Scale), and behavioral inhibition/activation (BIS/BAS; Behavioral Inhibition Scale/Behavioral Activation Scale). Additionally, objective measures of physical (Uniform Parkinson Disease Rating Scale [UPDRS], Hoehn and Yahr Rating Scale, Schwab & Activities of Daily Living Scale) and cognitive (Mattis Dementia Rating Scale) functioning, as well as subjective ratings of adaptive functioning (Parkinson Disease Questionnaire-39), were obtained for PD patients. Ratings for pre-PD, present, and post-surgery SWB were positively correlated for PD patients, but only the past versus present SWB correlation reached significance in spouses. A significant time x group interaction (ANOVA) was noted, with the PD group rating present SWB lower than past or post-surgical SWB and the spousal group rating present and future SWB lower than past SWB. Objective ratings of physical disease severity (SIP ingestion and communication items; off-medication UPDRS motor exam) and subjective cognitive dysfunction (PDQ cognitive subscale) were predictive of patient expectations for post-surgical improvement in quality of life. In addition to SIP eating items, psychological factors were predictive of past (BAS score, PANAS Positive Affect, BSI Phobic Anxiety) and current (BSI Paranoid Ideation) absolute PD SWB ratings. Physical and emotional factors contribute differentially to PD patients absolute SWB and expectations for post-surgical improvement.

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C.A. PALMESE, M.J. HAMBERGER & J. BRAND. Immediate and Delayed Story Recall in Parkinson's Patients.

Parkinson's disease (PD) patients frequently show deficits in attention and executive functioning. These deficits are attributed to frontal system abnormalities. It has also been reported that PD patients exhibit reduced recall on verbal list learning measures, however, memory for contextually based information is not well documented. Given the attention and organizational difficulties associated with PD, together with the neuroanatomical structures implicated in this disorder, we suspected that immediate memory would be problematic due to poor organization and strategizing whereas delayed recall would show adequate retention over time. Specifically, we hypothesized that PD patients would exhibit weaker performance on immediate relative to delayed story recall. Participants were 63 non-demented PD patients (mean age: 63.5) who completed the WMS-III Logical Memory subtest. Immediate and delayed recall scaled scores were compared via paired samples t-tests. A chi square test was used to assess the proportion of patients who did and did not show the hypothesized pattern. Delayed recall scaled scores (mean=9.40, SD=3.34) were significantly higher than immediate re-

call scores (mean=8.60, SD=3.43). Furthermore, on an individual basis, a significant number of patients showed normal retention over time, whereas few patients declined on delayed testing (48 patients improved/remained same 15 patients declined=15, $\chi^2=17.29$, $p<0.001$). Further analyses indicated no significant correlation between memory and mood (SCL-90-R Anxiety and Depression scales). Results suggest that reduced memory performance in PD patients is characterized by poor initial recall with adequate retention over time, likely reflecting frontal system dysfunction and adequate temporal lobe functioning.

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K.M. MILLER, D. BOWERS, C. PRICE, H. MONTIJO, U. SPRINGER, K. FOOTE & M. OKUN. Clinical Utility of the N-back Task in Detection of Working Memory Impairment in Parkinson's Disease.

The n-back is a working memory task that has been frequently utilized in the neuroimaging literature but has not yet been validated within the domain of clinical neuropsychological assessment. Because it parametrically varies working memory (WM) load while keeping overall task procedures constant across conditions, it may potentially be a sensitive measure of WM function. Since prior studies have found WM impairments in Parkinson's disease, we hypothesized that Parkinson's patients would display significantly lower accuracy on the n-back relative to controls. We then used discriminant analysis to determine whether n-back accuracy could correctly classify participants by diagnosis. Twenty-one Parkinson's patients and seventeen age- and education- matched controls completed a visually presented n-back task that varied WM load from 0 to 3 letters. Parkinson's patients were in the mid-stages of the disease (average Hohen and Yahr = 2.6), free of dementia, and tested while on dopaminergic medication. Accuracy data were submitted to a 2X4 repeated measures ANOVA with Group as the between-subjects factor and Load as the within subjects factor. Results revealed significant main effects for Load and Group ($p<.001$). Discriminant analyses revealed that two-back performance alone correctly classified 73% of participants. These findings are consistent with prior studies that have found differences in n-back accuracy between controls and patients with ADHD, schizophrenia, and Korsokoff's. Although further examination of the convergent and divergent validity of this task is needed, the n-back shows promise as a clinical tool for differentiating between healthy persons and patients with WM impairment.

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J. GRACE, M.M. AMICK, A. D'ABREU, E.K. FESTA-MARTINO, W.C. HEINDEL & B.R. OTT. Relationship between Neuropsychological Tests and On-Road Driving in Parkinson's Disease.

The aim of this study was to examine relationships between cognitive and motor symptoms of PD and driving fitness. Previous studies have found driving safety in PD to be related to motor function and disease severity, but not consistently related to cognitive abilities. A standardized on-road driving test and a neuropsychological test battery were administered to 18 PD and 21 age- and education-matched elderly controls (EC). Driving performance was scored globally (Safe, Marginal, Unsafe), and a total driving score based on specific maneuvers also was obtained. Motor function was measured by the UPDRS-Motor scale and PD disease severity by Hoehn and Yahr stage. The majority of PD drivers were rated safe to drive (11 Safe, 7 Marginal, 0 Unsafe). While disease severity was associated with worse driving performance, even stage 3 PD drivers were not deemed globally unsafe. However, PD Marginal drivers were more impaired than Safe PD drivers on both cognitive (HVLT delayed recall, HVLT false positives, BQSS-Rey Figure,

Trails B) and motor (UPDRS) measures. Safe PD drivers performed similarly to EC on road test total scores and cognitive measures. PD were deemed to be safe drivers, especially at H&Y stage 1-2. However, Marginal PD drivers do differ from EC in driving total score performance. Marginal PD drivers had more severe disease and more impaired cognitive and motor performances. Thus, both cognitive and motor impairments contribute to marginal driving performance.

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M.M. AMICK, A. D'ABREU, J. GRACE & B.R. OTT. A Comparison of On-Road Driving Performance in Individuals with Alzheimer's Disease and Parkinson's Disease.

Disruption of driving skills is prevalent in patients with probable Alzheimer's disease (AD) but is less frequently reported in Parkinson's disease (PD). The aim of this study was to examine the relationship between disease severity and on-road driving test performance in AD and PD. Individuals with mild AD ($n=20$), PD (Hoehn and Yahr 1-3; $n=21$), and an age and education equivalent control group (EC; $n=20$) underwent a neurological evaluation, and Clinical Dementia Rating (CDR). PD motor symptoms were measured by the UPDRS-Motor scale. Based on standardized road test performance, the driving instructor assigned a global rating (safe, marginal, and unsafe) and rated driving maneuvers (road test total score). Globally, the AD group was rated as significantly more impaired at driving (AD: 9 safe, 9 marginal, 2 unsafe; PD 14 safe, 7 marginal, 0 unsafe; EC: 20 safe). AD patients, with greater dementia severity on CDR, were found to be more impaired, and make more errors on the road test than PD ($p = .001$) and EC groups ($p = .0001$). The PD group made more errors on the road test than the EC ($p = .02$). The PD patients who were rated as marginal drivers had significantly more motor disability than PD safe drivers. Among elderly patients with degenerative brain disease, dementia is more strongly related to driving impairment than age or parkinsonism. Since marginal PD drivers had greater motor disability, those with mild to moderate parkinsonism may be at risk for impaired driving. Thus, monitoring driving performance as AD and PD disease severity progresses is recommended.

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S.R. WETTER, D.C. DELIS, G. PEAVY, J. HAMILTON, M.W. JACOBSON, J. GOLDSTEIN, M.W. BONDI & D.P. SALMON. Recall Discriminability: Utility of a New CVLT-II Measure in the Differential Diagnosis of Dementia.

A limitation of the standard current method for scoring level of memory recall is that most current recall memory tests score only the number of target words correctly recalled without factoring in the intrusion rate. In an attempt to overcome this problem and to identify patients whose correct level of recall may be artificially inflated by a high intrusion rate, Delis et al. (2000) developed a new measure for the CVLT-II, which they called "Recall Discriminability." In the present study, the CVLT-II was administered to patients with either AD ($n = 16$) or HD ($n = 16$) who were matched on Mattis Dementia Rating Scale scores to assess the efficacy of the new scoring method. While the groups failed to differ on the traditional delayed recall measures (e.g., short delay free recall), HD patients performed significantly better than AD patients on several measures of Recall Discriminability. These included Total Delay and Cued Recall Discriminability ($p < .05$). These findings suggest that patients with HD and AD do not present with equivalent levels of delayed recall, as has been previously reported. The Recall Discriminability measure on the CVLT-II thus appears to be a useful new recall measure for distinguishing between different types of dementia.

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D.E. GRANT, J.J. JEONG, A. NELSON, J.H. KRAMER & B. MILLER. Qualitative and Quantitative Differences in Copying Responses in PSP and non-PSP Dementia Patients.

The purpose of the present study was to examine the visual spatial processing abilities of PSP patient's and to compare their performance to different dementia groups known to have visual spatial processing deficits and to better understand how reduced vertical gaze impacts visual-spatial cognition. Fourteen patients diagnosed with PSP (mean age: 69.9), 14 probable AD (mean age: 70.52), and 14 probable LDB (mean age: 71.2) matched on the basis of age, gender, and total MMSE score were selected. The sample consisted of 27 males and 15 females. PSP and non-PSP subjects completed a neuropsychological screening as part of a multidisciplinary team dementia evaluation. A modified Rey-Osterrieth Complex Figure (Rey-O) is a standard part of the battery. Each design was measured vertically and horizontally and a ratio of height to length was created with a larger number being equivalent to a more compacted design. Results revealed that PSP patients tend to have more compacted complex figure copies than non-PSP subjects (2.6 vs 2.2, $p < 0.05$). No difference were found between the AD and DLB groups. Results suggest that the PSP group produces copies of drawings that are both qualitatively and quantitatively different than either patients with probable Alzheimer's disease or probable diffuse Lewy Body disease. This suggests that the visual-spatial difficulties experienced is different depending on the underlying cause of the problem and that these problems will have different effects on the functional daily life of those afflicted.

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Traumatic Brain Injury: Outcome

H.G. BELANGER, G. CURTISS, J.A. DEMERY, B.K. LEBOWITZ & R.D. VANDERPLOEG. Factors Moderating Neuropsychological Outcomes Following Mild Traumatic Brain Injury: A Meta-Analysis.

The objectives of this meta-analysis were to (1) determine the effect of mild traumatic brain injury (MTBI) on neuropsychological functioning, and (2) to explore potential moderators (i.e., time-since-injury and patient selection context) of this effect. A meta-analysis of the relevant literature was conducted to determine the impact of MTBI across nine cognitive domains. The analysis was based on 39 studies involving 1507 cases of MTBI and 1186 control cases. Calculated from the data reported in each study was the effect-size estimate, d (i.e., the control group mean minus the TBI group mean, divided by the pooled standard deviation). For the effect sizes reported in this study, the averaged d s were weighted by each study sample size. We also calculated the Q statistic to examine homogeneity of effect sizes across studies. We examined the influence of potential categorical moderating variables including: cognitive domain, time since injury (< 90 days versus > 90 days) and selection context of the study participants (in litigation versus symptomatic/clinic-based versus population-based). Acute effects (less than 90 days post-injury) of MTBI were greatest for delayed memory and fluency ($d = 1.03$ and $.89$, respectively). However, by 3 months post-injury no residual neuropsychological impairments were found. These findings were moderated by patient characteristics and sampling methods. Clinic-based samples (versus population-based samples) and samples of participants in litigation were associated with greater cognitive sequelae of MTBI.

Indeed, litigation was associated with stable or worsening of cognitive functioning over time. MTBI is associated with acute cognitive decline but this effect generally dissipates by 3 months post-injury. Patients presenting to clinic and patients in litigation, however, may still show cognitive deficits. Patients in litigation may actually get worse over time.

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J. MACHAMER, N. TEMKIN, R. FRASER, J. DOCTOR & S. DIKMEN. Stability of Employment after Traumatic Brain Injury.

While some information exists regarding return to work and factors influencing it, little is known about the stability of employment. Design: Inception cohort longitudinal study of TBI cases Setting: Level I trauma center Patients: 160 workers with CT abnormalities followed 3 to 5 years from TBI Main outcome: Percent of time worked since injury Percent of time worked since injury was related to the pre-injury characteristics of the person injured as well as brain injury severity and associated early neuropsychological problems. Lower education, male gender, pre-existing conditions such as alcohol abuse, unstable work history and lower income was associated with fewer months worked. More severe brain injury and associated neuropsychological difficulties observed at 1 month after injury were also associated with greater instability of work over the 3 to 5 years after injury ($p < .05$ for each factor) Factors that affect time to return to work or employment at a fixed time after injury are also related to the stability of post-injury employment. Based on information available soon after injury, it may be possible to predict not only whether the person will return to work but also how stable their employment is likely to be.

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K.M. KRUPAN, B. LEVINE, D.T. STUSS & D.R. DAWSON. Executive Function and Coping at One-Year Post Traumatic Brain Injury.

Persons with traumatic brain injury (TBI) often have poor outcome. Poor outcome has been related to a number of factors, including executive dysfunction and the use of maladaptive coping behaviors. To date, the relationship between these two factors has not been investigated in a TBI sample. The purpose of this study was to examine the relationship between executive dysfunction and coping at one-year post TBI. TBI ($n=21$) and matched sociodemographic control groups ($n=15$) completed the Ways of Coping Questionnaire- Revised, and were administered a set of neuropsychological tests, with an emphasis on executive functions. Within the TBI group, high executive performance was related to the use of problem focused coping (considered more adaptive), and decreased executive performance was related to the use of emotion focused coping (considered more maladaptive). These relationships were not found in the control group. Hierarchical regression showed that executive function contributed significantly to the use of both problem and emotion focused coping behaviors above and beyond pre-morbid intelligence and injury severity. These results suggest a link between executive function and coping following TBI, which may have implications for rehabilitation.

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D.B. SALISBURY, T.A. NOVACK, R.C. BRUNNER & S.C. KOGOS. A Comparison of Medical, Demographic and Acute Status Variables in the Prediction of Survival And Outcome Following Traumatic Brain Injury.

Upon admission to the hospital, there is a wealth of data which has been shown to be useful in helping medical professionals gauge the likelihood

of survival and possible extent of future recovery. Unfortunately, studies have not consistently delineated which variables are most useful. This project is an effort to streamline admission data and focus on the most salient variables which may increase accurate predication of outcome. Archival data was gathered from 209 consecutive traumatic brain injury admissions to the NICU between 1994-1998. Only individuals who survived for two or more days were included in the study. Initial analysis was focused on identifying characteristic of those individuals who died ($N=20$) from those who survived. Descriptive data revealed no differences in gender, ethnicity or education. It was evident that subjects who died tended to be older ($M=44.75$ vs. 36.75) and more frequently suffered falls or violence related injuries such as gun shot wounds. Although a variety of acute medical variables were gathered (i.e. respiration, systolic blood pressure, O_2 , initial and subsequent CT imaging), logistic regression showed age ($p=.007$), pupillary response ($p=.020$) and intracranial pressure ($p=.010$) to be more related to outcome. Data regarding employment was gathered at 6 and 12 months for survivors. Acute variables which were most indicative of future employment within logistic regression included age ($p=.006$), total Glasgow Coma Scale score ($p=.001$), premorbid employment ($p=.002$) and premorbid education ($p=.012$). This suggests that medical variables are more likely to predict who will survive during the acute stage after TBI but become less relevant for long term outcome. Furthermore, basic admission data can provide professionals with valuable information about survival and future outcome. Correspondence: David B. Salisbury, Psy.D., Physical Medicine & Rehabilitation, University of Alabama at Birmingham, Spain Rehabilitation Center, Suite 530, 1717 6th Ave. South, Birmingham, AL 35233. E-mail: salisbur@uab.edu

N. PASTOREK, H. HANNAY & K. COOK. Item Response Theory Analysis of the Disability Rating Scale in Patients Representing a Continuum of Disability at Three Months Post Injury.

The Disability Rating Scale (DRS) is one of the most commonly used measures of global outcome following traumatic brain injury (TBI). Previous research indicates that the DRS is generally insensitive to change in patients with mild disability or in a vegetative state. The goal of the current study was to investigate the item and test characteristics of the DRS with factor analysis and item response theory (IRT). The sample consisted of 375 TBI survivors representing a continuum of disability at 3 months post-injury. The verbalization, motor response, and toileting items were removed due to lack of variability across response options. The five remaining DRS items were best represented by a single latent trait. Empirical selection of the IRT model indicated that a two-parameter model provided superior fit over a one-parameter model. The reduction in the number of response options for several items further improved fit of the two-parameter model. The verbalization, feeding, and grooming items showed considerable overlap in the level of disability which they were ideal for measuring, although the grooming item provided the most discrimination between patients. The level of functioning and employability item provided successively more information about higher functioning patients. However, the entire measure provided very little information about patients with DRS scores of approximately 2 or less (i.e. patients with little or no disability). In summary, the three-month DRS data best fit a two-parameter IRT model and the DRS was relatively ineffective in measuring outcome in patients with mild or no disability.

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C.E. JOHNSON, H. TAYLOR, K. YEATES & D. DROTAR. Neuropsychological Predictors of Functional Outcomes Following Pediatric Traumatic Brain Injury.

Although traumatic brain injury (TBI) frequently leads to deficits in meeting demands of daily living, neuropsychological tests may have

limited sensitivity to functional impairments. The current study examined the predictive validity of neuropsychological status early after pediatric TBI in relation to long-term adaptive functioning. Assessments of neuropsychological skills and adaptive functioning were collected as part of a prospective longitudinal study of 6- to 12-year-olds with TBI. The sample included 53 children with severe TBI, 56 with moderate TBI, and 80 with orthopedic injuries. Early cognitive outcomes were assessed at 6 months post injury and included composites for language, memory, perceptual-motor, and executive function. Long-term functional outcomes were measured by the Vineland Adaptive Behavior Scales at a 4-year follow-up. Results from regression analysis that controlled for pre-injury adaptive behavior and IQ revealed that neuropsychological skills at the 6-month visit, together with SES, predicted residual effects of TBI on functioning 4-years post-injury (R^2 totals: Communication = .44, $p < .001$; Daily Living Skills = .28, $p < .001$). Neuropsychological predictors were domain specific, with language deficiencies related to long-term impairment in adaptive communication and memory deficits related to residual impairment in daily living skills. Neuropsychological skills failed to predict impairments in Vineland Socialization or the Adaptive Behavior Composite. Results suggest that current neuropsychological measures, although related to long-term problems in adaptive behavior in children with TBI, are relatively insensitive to functional outcomes. Further work is needed to understand the cognitive basis of functional deficits and to develop measures with better predictive validity.

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N. PASTOREK, H. HANNAY & K. COOK. Revision of the Disability Rating Scale for Improved Outcome Measurement in Higher Functioning Patients Three Months after Traumatic Brain Injury.

The Disability Rating Scale (DRS) was originally designed to track recovery of patients with severe traumatic brain injury (TBI) from coma to community. The DRS has shown insensitivity to change at the extreme levels of disability (i.e. vegetative state and mild disability). The present study aimed to improve the sensitivity of the DRS in higher functioning patients through the addition of self-report symptoms that commonly persist in patients with otherwise good recoveries. Three-month post-injury DRS scores and self-report data from the Problem Checklist (PCL) of the NYU Head Injury Family Interview were available for item response theory (IRT) analysis on a sample of 349 patients representing a continuum of initial injury severity. DRS scores were available on an additional 26 patients who were unable to complete the PCL due to a vegetative state. A two-parameter IRT analysis showed that five of the original eight DRS items were best suited for assessing patients with partial to severe disability at 3 months post-injury (i.e. patients with raw DRS scores from 2 to 15). The addition of two self-report items from the PCL, getting bored easily and being forgetful, resulted in only modest improvement of the DRS for outcome assessment of higher functioning patients. There was poor monotonicity in percent endorsement of most PCL items across level of disability on the DRS (i.e. percent endorsement did not consistently increase as level of disability increased), suggesting that impaired awareness in patients with more severe disability compromised the usefulness of self-report items for TBI outcome assessment.

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T.L. VERAMONTI, N. PASTOREK & H. HANNAY. Relationship Between Disability and Awareness of Deficits at 3 Months Post TBI.

Impaired self-awareness often affects the ability of patients with traumatic brain injury (TBI) to engage in and benefit from treatment. Most

published studies have documented greater unawareness for cognitive, behavioral and emotional changes as compared to physical functioning (see Sherer et al. 1998 for review). Awareness has rarely been investigated within 3 months of TBI. The relationship between impaired awareness and initial injury severity has been equivocal. The relationship between awareness and level of disability at the same point in time has not been studied. Level of awareness at 3 months post-injury was examined in 114 patients with severe, moderate or complicated mild TBI recruited from admissions to an acute care hospital. Degree of impaired self-awareness was calculated by subtracting family ratings from patient self-ratings of how much of a problem each of 31 symptoms from the Problem Checklist (PCL) of the Head Injury Family Interview was for the patient's daily functioning. Summed discrepancy scores were calculated for each factor of the PCL (affective/behavioral, cognitive and physical/dependency). Patients with more severe disability at 3 months post-injury on the Disability Rating Scale demonstrated greater impaired awareness for affective/behavioral ($p < .03$) and cognitive ($p < .05$) problems than those with less severe disability. Unexpectedly, they also demonstrated greater unawareness for physical ($p < .01$) problems than those with less severe disability. Reasons for the present findings are examined in light of the timing of assessment and differences in item content and specificity across current available measures assessing awareness after TBI.

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L.K. SEIBERT, R.K. HEATON & B. SCHROCK. The Prediction of Everyday Functioning after Traumatic Brain Injury: The Utility of an Objective Functional Battery Relative to Neuropsychological and Common Clinical Measures.

Neuropsychological evaluation, objective assessment of functional skills, and common clinical measures of brain injury severity and disability were compared for their predictions of everyday functioning in the TBI population. Twenty adults with recent TBI were administered neuropsychological and functional test batteries at the time of inpatient discharge, and their outcomes were assessed at 6- and 12-week follow-ups. A different group of thirty adults with TBI were administered the same neuropsychological, functional, and real-world-outcome assessments concurrently, at 1- to 5-years post inpatient discharge. The objective functional assessment used was a battery of standardized tests of vocational skills and skills for instrumental activities of daily living (IADLs) that was assembled, normed, and validated on samples of neuropsychologically normal and impaired individuals by Heaton and colleagues (Heaton et al., 2004). Neuropsychological status predicted performance on the objective functional battery (tests of cooking, financial management, medication management, shopping, and vocational skills; $p < .001$). Each test battery was a better predictor of TBI patients degree of independence with IADLs and number of cognitive complaints relative to the traditional clinical measures as predictors. The functional battery was superior to neuropsychological testing in predicting individuals work status 1-5 years after TBI and number of cognitive complaints during their early recovery. Findings were less consistent regarding the relative success of the functional versus neuropsychological batteries at predicting degree of independence with IADLs. Neuropsychological evaluation and objective functional assessment are both superior to common measures of TBI severity and disability in predicting real-life outcomes. Further, each testing approach provides unique information in the prediction of employment status, independence with IADLs, or cognitive complaints.

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Traumatic Brain Injury

F. CONSTANTINIDOU & S. ZIMMERMAN. Management of Sports Concussion in College Athletes.

1) To determine the sensitivity of a neuropsychological test battery in detecting effects of concussion, 2) To assess time required for an injured athlete to return to baseline neuropsychological performance, 3) To evaluate the incidence of mild traumatic brain injury across player positions in football. Subjects: 266 athletes from five varsity sports at Miami University participated in the study. Ages ranged from 17 to 22 ($M = 18.4$). Procedures: The experimental tasks for the present study included the Pittsburgh Steelers Neuropsychological Battery, a Post-Concussion Rating Scale, and a concussion questionnaire. Data was collected from injured athletes between 4 hours and 30 days post-injury with a mean of 7.3 days for the first testing (T1) and 13.9 days for the second testing post-injury (T2). Statistical analyses indicate that the Trail Making Test (A) and the Grooved Pegboard (dominant trial) were the most sensitive tests in detecting decline. Both of these tests require speed of processing, attention, and motor throughput. Furthermore, analyses showed that the reported symptoms of concussion differed significantly from baseline symptomatology. Concussion symptoms included headache, dizziness, fatigue, and others. The mean length of time for recovery and returning to baseline was 10.07 days ($n = 38$, $SD = 9.59$) for the entire sample and 7.36 days for those athletes with baseline data ($n = 21$, $SD = 5.29$). Athletes in offensive football positions had twice the risk to sustain a concussion as compared to players in defensive positions. 1. The present neuropsychological battery is an effective method to monitor concussed athletes. 2. Most athletes recover from a concussion within seven to ten days. 3. The post-concussion rating scale provides useful subjective information when used with objective cognitive measures. 4. There is a difference in the incidence of concussion per player position in football. Players in high risk positions should be monitored closely.

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D.E. TRAHAN & C.E. ROSS. Age-related Differences in Self-reported Postconcussional-type Symptoms in Normal Adults.

Studies examining base rates of postconcussional-type symptoms have focused almost exclusively on people under age 40. Lack of normative data for those over 40 limits thus limits our ability to determine what is normal for those subjects or even whether older adults report more symptoms than younger ones. This study compared self-reported symptoms in younger and older adults using the Beaumont Postconcussional Index (BPCI), which measures symptom intensity and duration as well as frequency. Participants included 36 neurologically normal adults (age range 18-39, Mean = 21.7) matched on the bases of gender, race, and education with 36 older adults (age range 40-73, Mean = 46.9). There were 7 pairs of males and 29 pairs of females. All were administered the BPCI and all but six the Beck Depression Inventory-II (BDI-II). Older subjects produced significantly higher scores on the total BPCI index (PCI) ($t = 2.49$, $p = .015$). No age differences were observed for the Headache Index ($t = 0.26$, $p = .79$), Sleep Index ($t = 0.07$, $p = .94$), or General Symptom Index ($t = 0.89$, $p = .37$). The correlation between PCI and BDI was significant in both the younger ($r = .69$, $p = .001$) and older group ($r = .66$, $p = .001$). A comparison of self-reported symptoms in young and older adults revealed no differences on 3 of 4 indexes from the BPCI. Although the total PCI was higher in older adults, the difference was modest (7 points). The positive correlations between PCI and $BDI-II$ scores are consistent with findings of other studies. Data are continuing to be collected to increase the sample sizes.

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T.E. SITZER, K. SANDS & J.D. GFELLER. Clinically Meaningful Change Following Mild Traumatic Brain Injury: Development of Reliable Change Scores.

Repeated neuropsychological testing to assess recovery from mild traumatic brain injury (MTBI) is becoming more and more common; however, little information is available regarding the stability of performance on cognitive measures over relatively brief test-retest intervals for this population. Despite this lack of information, clinical decisions based on measured change are made regarding cognitive outcome. The aim of this study was to evaluate the reliability, within a MTBI population, of several measures sensitive to attention, memory, and processing speed, domains known to be impaired in MTBI. Reliable change indices (90%, 80%, and 70%) for these measures, adjusted for expected practice effects, were also computed. Participants were 66 males and 45 females between the ages of 18-76 (mean age = 38.5; mean education = 13 +/- 2.57), initially assessed within an average of 8 days post MTBI, and retested within an average of 32 days. Measures included AVLT, BVRT-R, COWA, Digit Span, SDMT, and the Trail Making Test. Sample sizes for the individual tests ranged from 26 to 93 participants. Test-retest reliability coefficients ranged from .21 (AVLT Delayed Recall) to .72 (Digit Span ACSS), with most coefficients falling in the .6 range. Using 90% cutoff scores, participants tended to show the greatest improvement on AVLT Delayed Recall and Trails A. For those patients who declined on selected measures, psychiatric factors were implicated. These data are believed to have utility for clinical and research settings where recovery from MTBI is assessed and they and should be considered when interpreting individual change scores.

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S.A. BROWN, S.R. MCCAULEY, C. BOAKE & H.S. LEVIN. Use of the CES-D for Assessing Depression in Minority MTBI Patients.

Understand the presentation of depressive symptoms in minority patients with traumatic brain injury. Consecutive admission at a Level-1 trauma center of 340 patients with mild-to-moderate traumatic brain injury assessed at 3-months postinjury with the Center for Epidemiologic Studies-Depression scale. Statistical significance was assessed using ANOVA. Factor analysis of the CES-D after mild-to-moderate TBI (MTBI) revealed a 4-factor model: Somatic, Depressive Affect, Positive Affect, and Interpersonal Relationships. These factors were used to assess depression in MTBI patients across racial/ethnic groups. In a sample of MTBI patients (N = 119 African American, 136 Hispanic American, 56 Caucasian American, and 29 Other), the CES-D Total Score differed significantly by race/ethnicity ($F(1,3)=3.18, p < 0.024$). Compared to Caucasians ($p < 0.013$) and Others ($p < 0.04$), African Americans reported experiencing higher levels of depressive symptomatology. A trend was indicated for Hispanics reporting greater feelings of depression relative to Caucasians ($p < 0.059$). On the 4-factor model, a significant group difference was found for Interpersonal Relationships ($F(1,3)=4.47, p < 0.004$). Compared to Caucasians ($p < 0.009$) and Others ($p < 0.004$), African Americans had greater feelings of being disliked, and relative to Caucasians, Hispanics reported similar feelings ($p < 0.015$). Overall, race/ethnicity contributes significantly to depression after MTBI. Sadness or vegetative symptoms were less prominent of features in minority patients as was feeling accepted by others. Assessment of depression in minority MTBI patients should not limit importance to standard symptomatology, but should include cultural and individual belief systems.

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S.R. MCCAULEY, C.P. JOSIC, S.A. BROWN, C. BOAKE, H.S. LEVIN, H.S. GOODMAN, S.C. MERRITT & S.I. BRUNDAGE. Confirmatory Factor Analysis of the Center for Epidemiologic Studies Depression (CES-D) Scale in Mild to Moderate Traumatic Brain Injury.

The Center for Epidemiologic Studies Depression scale (CES-D) is a frequently-used self-report measure of depression. Brief depression screens can be important in the identification and prediction of depression following traumatic brain injury (TBI). The CES-D has rarely been used in neurologically compromised populations, leaving its validity in neurologic disorders (including TBI) unexamined. The CES-D was administered to a consecutive series of 340 participants 3-months following mild (N=313) to moderate (N=22) TBI. Confirmatory factor analysis of the CES-D indicated that the data adequately fit Radloff's (1977) original 4-factor model ($\chi^2=243, df=164, p < 0.01$; Comparative Fit Index=0.97; Root Mean Squared Error of Approximation=0.038; Tucker-Lewis Index = 0.97; Standardized Root Mean Squared Residual = 0.035). The internal consistency (Cronbach's alpha) was adequate for each of the 4 factors (depressed affect = 0.90, positive affect = 0.75, somatic complaints/reduced activity = 0.81, and interpersonal relationships = 0.75), and for the CES-D total score (0.93). This study has demonstrated that the factorial structure of CES-D scale in patients with mild to moderate TBI is very similar to other factor solutions reported in samples drawn from the general population. Although Radloff advocated the use of the CES-D total score exclusively, factor-based scores could prove useful in characterizing subgroups of mild to moderate TBI patients based on their patterns of recovery and response to treatment. Given the factor structure of the CES-D in this study, our results suggest that it is appropriate for depression screening of patients with mild to moderate TBI.

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H.H. BLANTON & M.L. ROHLING. The Ecological Validity of the Meyers Short Battery in the Vocational Evaluation of Traumatic Brain Injury Patients.

The purpose was to determine whether scores on the Meyers Short Battery (MSB), once corrected for symptom validity, predicted the post-injury employment outcome of traumatic brain injury (TBI) patients. Additionally, the study attempted to determine which cognitive domain measured was most predictive and if adding the Patient Competency Rating Scale (PCRS) to the MSB scores increased this predictability. The sample consisted of 296 individuals with identifiable head trauma, whose data was drawn from the database of a practicing neuropsychologist. The MSB scores were converted into Overall Test Battery Means (OTBM) through the Rohling Interpretive Method (RIM) and logistic regression analyses were performed with dichotomous and multiple levels of employment outcome. The MSB significantly predicted employment outcome, and the addition of the PCRS scores improved predictive power somewhat. Findings indicated the Psychomotor Processing Speed domain of the MSB to be most predictive of employment status across four levels of outcome, but the Perceptual Organization domain to be most predictive when using a dichotomous outcome variable. The findings supported that the MSB significantly predicts employment outcome. The hypothesis that combining the PCRS with the MSB scores improves predictability was also supported. The Psychomotor Processing Speed domain was most predictive across four levels of outcome, but the Perceptual Organization domain was most predictive when using a dichotomous outcome variable. Therefore, when predicting employment outcome as determined by multiple post-injury employment status levels, Finger Tapping and Trails A were the most predictive measures; but, when the dichotomous outcome classification was used, WAIS Picture Completion and Block Design, as well as Rey Complex Figure Test- copy, were the most predictive measures.

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S.M. ROWLAND, F. GOULD & C. LAM. Relationship Between Non-Verbal Working Memory and Self-Awareness Deficits in Individuals with Traumatic Brain Injury.

There is a high prevalence rate of self-awareness deficits in people with traumatic brain injury (TBI). These deficits can have a negative impact on rehabilitation and employment outcome. Therefore, early and efficient identification is crucial in order to initiate the appropriate intervention. Past research indicates that non-verbal working memory may be the best predictor of self-awareness deficits. The current study examined the relationship between a measure of non-verbal working memory and two measures of self-awareness deficits. It was hypothesized that there would be positive relationships between these variables and between the two measures of self-awareness. Participants, 13 sub-acute TBI inpatients, were administered a measure of non-verbal working memory (WMS-III Family Pictures) and a semi-structured interview assessing self-awareness (Self-Awareness of Deficits Interview). Also, therapists providing rehabilitative services completed a questionnaire assessing their perception of each participant's self-awareness. Pearson correlation coefficients revealed significant relationships between immediate and delayed non-verbal working memory and scores on both measures of self-awareness, $r(11) = -.66, p = .02$; $r(6) = -.76, p = .03$; $r(11) = -.71, p = .01$; $r(6) = -.76, p = .03$. A significant relationship was also found between the two measures of self-awareness, $r(6) = .86, p = .01$. Current results support recent findings that non-verbal working memory is a good predictor of self-awareness deficits and the theory that self-awareness is an important component in working memory. Although further replication, using a larger sample size, is needed, these findings suggest that measuring non-verbal working memory may be a useful way to easily identify those with self-awareness deficits.

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E. LARSON. Assessment of Executive Functions in TBI Patients Using the EXIT.

The Executive Interview (EXIT), a brief screening instrument for executive dysfunction, has been shown to have adequate validity in outpatients with traumatic brain injury (TBI). However, marked ceiling effects were observed raising questions about whether this measure may have better utility for more acute patients with more severe impairments. The objective of the present study was to examine the validity of the EXIT for inpatients with TBI and to determine if there are reduced ceiling effects with this population. This archival study involved a review of neuropsychological test records for a sample of 23 inpatients receiving rehabilitation for TBI. The EXIT was strongly associated with cognitive impairment as measured by two neuropsychological screening instruments. The EXIT was significantly associated with the Mini-Mental State Examination ($r = -.85, p < .001$), and with the Modified Mini Mental State ($r = -.80, p < .001$). The EXIT was also significantly associated with cognitive disability as measured by subscale ratings from the Functional Independence Measure and the Rehabilitation Institute of Chicago Functional Assessment Scale V. In a logistic regression, the EXIT in combination with the Modified Mini Mental State classified patients with 84.2% accuracy into groups defined by therapist ratings of need for supervision at discharge ($\chi^2 = 7.05, 2 df, p < .03$). Comparisons of frequency distributions of EXIT scores from the inpatient and outpatient samples show that ceiling effects were much diminished in the more acute population. These data support the use of the EXIT in inpatients with TBI.

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K.F. PAGULAYAN, N.R. TEMKIN, H.S. LEVIN, F.C. GOLDSTEIN & S.S. DIKMEN. The Problem of Assessing Awareness in Traumatic Brain Injury.

Previous research suggests that people who have sustained traumatic brain injuries (TBI) under-estimate post-injury impairments, especially in the areas of cognitive and behavioral functioning. This under-estimation, based on the discrepancy between patients self-ratings and the ratings of their significant others (SO), is thought to reflect poor awareness of deficits. The aim of this study was to assess rating concordance in a sample of TBI patients at three months post injury. 56 adult TBI participants and their SOs completed the Dysexecutive Questionnaire (DEX), which assesses 20 symptoms of executive impairment. Both groups completed this measure as it relates to the current functioning of the TBI patient. Participants were recruited from Level 1 Trauma Centers. Overall, the level of impairment reported by the patient ($M = 22.04$) and the SOs ($M = 21.82$) was not significantly different, $t(55) = .102, p > .05$. Examination of the difference scores revealed that 61% ($N=34$) were in the direction of the patient reporting greater impairment. In the remaining 39% of cases ($N=22$), the SOs reported greater impairment than the patient. The lack of a significant difference between patient and SO ratings does not support previous findings that TBI patients under-report symptoms. This discrepancy may be attributable, at least in part, to sampling bias involving the utilization of convenience samples or those with complicated clinical recoveries. Future research should examine the factors that contribute to lack of concordance between patient and significant other reports, including injury severity and sample selection.

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D.B. SALISBURY, T.A. NOVACK, J.H. BANOS & S.C. KOGOS. Serial Assessment of Cognitive Functioning After Traumatic Brain Injury.

Following traumatic brain injury (TBI), neurocognitive functioning is a crucial component of the individual's ability to benefit from therapies and their capacity to regain independence after discharge. During acute inpatient rehabilitation, serial assessment of cognitive status is the preferred method of monitoring recovery. The Cognitive Log has been shown to be an effective and informative measure of neurocognitive status and recovery. This research is an effort to add to the literature regarding expected performance on the Cognitive Log following TBI. Archival data from 102 TBI inpatients that completed serial assessments was analyzed. Specific focus was placed on a subgroup of 75 inpatients that completed five consecutive assessments. Subjects were also divided into mild-moderate and severe TBI groups, as determined by initial Glasgow Coma Scores. Scores typically improve with a plateau by the fifth administration. Despite improvement, mean scores are still well below normal limits. Analysis of individual Cognitive Log items revealed that questions involving orientation and basic attention often recover first. Meanwhile learning of new information, complex attention and executive tasks remain more challenging. Implications of these findings in regards to interpretation of Cognitive Log performance and discharge planning are discussed.

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K. SEREBRO-SOREK, G. BEN SHAKHAR & D. HOOFIEN. Orienting and Habituation Responses among Persons with Traumatic Brain Injury: Distinctive Manifestations of the Apathetic and Disinhibition Syndromes.

Previous studies of attention abilities among patients with TBI revealed inconsistent results. One reason for this inconsistency may be the existence of heterogeneous deficiencies in basic attentional mechanisms. The present study aimed at clarifying this state by examining the attentional manifestations of two distinct TBI-induced behavioral syndromes: The apathetic and the disinhibition syndromes. Differences in orienting responses (ORs) and habituation were examined between three groups: Apathetic (N=9) and disinhibited (N=9) patients with TBI and controls (N=18). Skin conductance responses were used to measure ORs to novel and significant stimuli and habituation. No differences were found in ORs and habituation between the entire TBI group and the control group. However, significant differences emerged between the two TBI subgroups: Apathetic patients presented attenuated ORs as compared to disinhibited patients and disinhibited patients presented prolonged habituation as compared to apathetic patients. The results show that when the TBI patients were divided into two subgroups, significantly different pathological response patterns were revealed. Yet, when the two subgroups were grouped together these patterns canceled each other's effect and formed a seemingly normal pattern, i.e. no significant difference from the normal performance. These findings may partly explain the diversity and variance between reports on attention deficits among persons with TBI. They also indicate that the study of TBI may benefit from consideration of systematic neuro-behavioral differences within the TBI population.

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K. KIT & C.A. MATEER. The Influence of Memory Beliefs in Individuals With Traumatic Brain Injury.

Beliefs and attitudes about memory, or metamemory, have been shown to impact memory performance and symptom complaint in older adults. The purpose of this study was to explore the relationship of metamemory to post-injury symptom report, mood, and personality in individuals with traumatic brain injury and controls. 26 individuals with mild TBI (MTBI), 16 with severe TBI (STBI), and 42 non-injured adults participated in the study. All participants completed the Metamemory in Adulthood Questionnaire, Beck Depression Inventory-II, Perceived Stress Scale, Beck Anxiety Inventory, NEO-PI-R, and Post-Concussion Symptom Checklist. Analyses of variance revealed the MTBI and STBI groups believed their memory capacity was weaker, perceived change in their memory abilities, reported anxiety about their memory, and used more memory strategies, in comparison to controls. The MTBI group also placed higher importance on having a good memory than the other two groups. Additionally, the TBI groups scored higher on depression and post-concussion symptom measures, and the MTBI group was found to be more anxious than the controls. Regression analyses showed a stronger relationship between certain scales of the MIA and stress and post-concussion symptoms for the TBI groups than for the control group, and importantly, beliefs about memory were found to mediate the relationship between TBI and depression and anxiety. The findings suggest that negative affect may be, at least in part, the result of specific memory beliefs. The incorporation of interventions that address such maladaptive memory beliefs in individuals with TBI may be of significant value within a rehabilitative context.

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A.S. DAVIS, P. WALTERS-KEMP & R.C. D'AMATO. Premorbid Personality Risk Factors Associated with Traumatic Brain Injury.

When an individual has sustained Traumatic Brain Injury (TBI) salient changes often involve the individuals intellect, lifestyle, personality, and

behavior. Cognitive and personality changes following a TBI, such as problems with judgment, drug and alcohol use, and executive functioning, can play an important role in the prediction of future functioning and reinjury. However, limited research exists regarding the pre-morbid personality characteristics of individuals who have and have not sustained a TBI. The study of such variables is critical to understand and offer appropriate rehabilitation services to individuals with TBI. This study examined the relationship between risk-taking behaviors and traumatic brain injury in 145 male adults. Participants were divided into a brain-injured or non brain-injured group and then completed the Life Activities Questionnaire (LAQ). The LAQ is a self-report measure that indicates the extent to which individuals engage in dangerous and risky behaviors. The results of a Multivariate Analysis of Variance indicated that the participants with a brain injury reported taking more risks, especially in the areas of anti-social behaviors, alcohol abuse, and other risky activities (Wilks Lambda = .64, $F(30, 107) = 1.98$ $p < .01$). Individuals who had sustained a TBI were significantly more likely to engage in drug use, alcohol use, criminal behavior, and participate in risky sports. The results are discussed in terms of TBI prevention, helping neuropsychologists to identify individuals at risk for traumatic brain injuries and to prevent further traumatic brain injuries in individuals who are likely to engage in these identified behaviors.

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A. LEQUERICA, L. RAPPORT, R. HANKS, B. AXELROD, S. VANGEL & D. WHITMAN. The Occurrence of Agitation and Post-traumatic Amnesia in Traumatic Brain Injury.

A number of researchers include Post-traumatic Amnesia (PTA) as a necessary part of the definition of the term "agitation" as it applies to Traumatic Brain Injury (Sandel & Mysiw, 1996; Corrigan, 1989). Others consider agitation to be a disinhibition phenomenon observable in the absence of PTA (Fugate et. al, 1997). The present study examined the degree to which agitated behaviors may be observed in the absence of PTA. 50 brain injured patients were evaluated using the Agitated Behavior Scale (ABS; Corrigan, 1989) and the Galveston Orientation and Amnesia Test (Levin, O'Donnell, & Grossman, 1975) to determine PTA status during their first week of admission to the Rehabilitation Institute of Michigan's TBI unit. The patient sample consisted of 39 males and 11 females with ages ranging from 18 to 67. Of the 29 patients in PTA, 9 (31.0%) showed evidence of agitation. Six patients, or 28.6% of the 21 non-PTA patients received ABS scores in the agitated range as well. A Chi-square analysis showed no significant differences between groups in the occurrence of agitation. A comparison of the percentages also showed that the proportion of agitated patients in PTA and out of PTA did not significantly differ from each other. Several researchers have defined agitation in TBI patients as behavioral excess that occurs during PTA. This research suggests that agitation may be exhibited by patients even in the absence of PTA. This finding is consistent with the results of a survey conducted by Fugate et. al (1997) in which 52% of the psychiatrists surveyed supported the idea that agitation can be seen outside of PTA.

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D.S. WAGNER, P.J. ESLINGER, T.J. MOSHER, Q. YANG & A.M. BARRETT. Motor Cuing on the Line Bisection Task in Subjects with Traumatic Brain Injury.

To determine whether the influence of motor cuing or visual distraction on line bisection errors in traumatic brain-injured (TBI) subjects depends upon injury severity. 13 TBI subjects (6 women, mean age 34.1 yrs) had neuropsychological/subjective disability assessment (MMSE, WMI, BNT, COWA, HVLT and MPAI-4) and bisected 96 22.4 cm near and 22.4 cm far lines using a video apparatus and a laser pointer. Lines

were bisected with and without visual distraction: an experimenter standing on one side of the line to be bisected (32 trials each left-, right- and no-distractor). Motor cuing consisted of experimenter instruction to start each trial with the laser pointer at either the left or right side of the line. Subjects had T2* brain MRIs classified by severity and hemisphericity, by a radiologist blinded to behavioral data. Two radiological groups (mild-moderate and severe pathology) were distinguished by neuropsychological test performance. No group differences pertained based upon visual distraction or hemisphericity of lesions. There was a severity by startside by distance interaction ($p = 0.017$). Subjects with severe, but not mild, pathology (2 left, 2 right) did not err significantly when starting on the left (mean 0.88 mm rightward, SD 0.325) but erred rightward when starting on the right (mean 2.38 mm, SD 0.318; $p < 0.05$), and this tended to occur in only far space ($P < 0.10$). Subjects with traumatic brain injury may exhibit motor perseveration due to frontal-subcortical dysfunction. In these TBI subjects, more radiologically severe injury was associated with a greater vulnerability to rightward errors after receiving cues to move in that direction. Severity groups did not differ, however, in their vulnerability to visual distraction.

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A.A. PEREIRA, T.W. SCHMITZ, T.N. KAWAHARA-BACCUS & S.C. JOHNSON. Hippocampal Activity during Encoding in Persons with Traumatic Brain Injury.

Difficulties in learning and memory are commonly found among people with traumatic brain injury (TBI). The hippocampal region is accepted as an important neural structure involved in the encoding process of new stimuli. This study investigated the role of the hippocampal region in persons with TBI during a functional MRI encoding task of identifiable line drawings. Using 3.0 Tesla MRI, we examined the cerebral response to novel information in 30 participants, 15 with traumatic brain injury (gender: M = 8 and F = 7, average age = 21.4, years of education = 13.4) ranging from moderate to severe injury, and 15 healthy controls (gender: M = 6 and F = 9, average age = 22.1, years of education = 14.9). Five line drawings were presented repeatedly in two training sessions prior to the scan. During the scanning session, the participants had to differentiate between novel and previously learned drawings. A two-group random-effects analysis was performed on the medial temporal lobe region. As expected, the control group exhibited greater fMRI activation to novel items in the anterior hippocampal region ($x, y, z = -18, -6, -28$; $t = 2.94$; $p = .003$ uncorrected). These results are consistent with the commonly observed problem in learning new information after TBI. It is suggested that the TBI group exhibited less activity in the hippocampal region due to problems in the encoding stage, and this was consistent with their measured neuropsychological performance on the day of the scan.

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L.M. RITTER, H. HANNAY, C. CONTANT, C. ROBERTSON & J. GOODMAN. The Synergistic Relationship of Extracellular Excitatory and Inhibitory Amino Acids and its Effect on Traumatic Brain Injury Outcome.

The release of amino acids, both excitatory and inhibitory, into extracellular space following traumatic brain injury and their subsequent role in secondary brain injury continues to be of interest. Excitatory amino acids (EAA) have been shown to have neurodegenerative effects following head trauma, while inhibitory amino acids (IAA) have been suggested to have endogenous protective mechanisms that inhibit the release of EAA. In the following study, the impact of EAA

and IAA release on six-month outcome following a traumatic brain injury was assessed. The study population consisted of 60 individuals with a severe traumatic brain injury (mean emergency room GCS was 7 ± 3). Measurement of extracellular amino acids was done with microdialysis. Outcome was measured using the Disability Rating Scale (DRS) and the Glasgow Outcome Scale (GOS). In a linear regression model, best day one Glasgow Coma Scale motor score, pupillary reactivity, EAA, and IAA accounted for 29% of the DRS variance ($p < .0001$) and both EAA and IAA were significant predictors ($b = 0.49$, $p < .01$; $b = -.30$, $p < .05$, respectively). Interestingly, EAA and IAA impacted DRS variance in opposite directions with less IAA being associated with poorer outcomes. R2 change regression analyses suggested that EAA and IAA were not significant predictors of DRS variance by themselves. Instead IAA accounted for a significant additional amount DRS variance above that accounted for by EAA. These same findings were not replicated using 6-month GOS data. It appears that a synergistic relationship is present between EAA, IAA, and outcome as measured by the DRS.

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H.M. GENOVA, B.B. BISWAL, J. DELUCA & E.G. HILLARY. Using fMRI to Examine Cerebral Blood Flow and Oxygen Extraction Fraction Following Moderate and Severe Brain Trauma.

Pathology following traumatic brain injury has been characterized by primary injury (e.g., contusions, axonal shear injury) and secondary injury (e.g., edema, ischemia, acidosis), both of which have been extensively examined. It is now well established in both animal and human models of TBI that brain trauma significantly alters baseline cerebral blood flow (Bouma et al., 1991; Kochanek et al., 1995; Schroder et al., 1996; Golding, E.M.) and rate of cerebral metabolism of oxygen (Martin et al., 1997). In fact, investigators have shown a relationship between acute elevation in CBF following TBI and recovery from TBI. The degree of decline in baseline CBF has also been correlated with the severity of injury in experimental models of TBI (CCI) (Kochanek, Kristy, Hendrich, Dixon, et al., 2002). Because of this, it will be important to gain a better understanding how baseline physiologic parameters such as oxygen metabolism and CBF are influenced by TBI. However, to date, there are no studies using MR methods to examine CBF and oxygen extraction fraction (OEF) alterations in TBI. The current study used arterial spin labeling (ASL) to characterize baseline CBF and OEF alterations following TBI. Participants included healthy adults and individuals who have sustained a brain injury. When compared to healthy adults, individuals with severe traumatic brain injury showed reduced CBF and increased OEF both during region of interest and whole brain analyses. To our knowledge this study represents the first attempt to use MRI-based techniques to examine the influence of brain trauma on CBF and OEF in humans.

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R.S. SCHEIBEL, M.R. NEWSOME, J.L. STEINBERG, M. TROY-ANSKAYA, F. GOLDSTEIN, S. HAMANN, E. AYLWARD, D. PEARSON & H.S. LEVIN. Brain Activation During Working Memory and Inhibition Tasks in Patients with Severe Traumatic Brain Injury.

Objective: Previous investigations have reported more extensive frontal activation in traumatic brain injury (TBI) patients during working memory (WM) tasks, relative to controls. We examined WM and inhibition, both executive function processes, via functional magnetic resonance imaging (fMRI). It was hypothesized that TBI patients would exhibit more diffuse activation than controls. Participants and Methods: Six severe TBI patients were compared to six orthopedic controls matched

on age, education, and task performance. Participants underwent fMRI during Arrows inhibition and n-back WM tasks. Results: An SPM fixed effects analysis of WM data indicated that, relative to TBI patients, control subjects had greater activation within bilateral inferior frontal gyrus and left middle frontal, precentral, and cingulate gyri, as well as left insula and caudate nucleus. TBI patients had greater activation within bilateral superior frontal gyrus and left medial frontal and cingulate gyri. Random effects analysis indicated greater activation for controls within the left insula. Fixed effects analysis of the inhibition task showed that TBI patients had greater activation than controls within the right middle frontal gyrus, while controls displayed increased activation in left superior frontal gyrus, middle temporal gyrus, and subcortical areas. Random effects analysis indicated greater activation for controls within the left basal ganglia and parahippocampal gyrus. Conclusions: The pattern of brain activation differed between the groups and there was no evidence for more extensive activation following TBI. Random effects analyses indicated decreased activation of insular cortex in TBI patients during a WM task and decreases within subcortical structures during behavioral inhibition. The findings may reflect disconnection of these structures following TBI.

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S. PAVAWALLA & M. SCHMITTER-EDGEcombe. Long-Term Retention of Skilled Visual Search Following Severe Closed-Head Injury. Objective: The ability to develop and retain new complex cognitive skills is central to successful remediation. Because most complex skills are dominated by automatic component processes, it is important to understand the development and retention of automatic processes. This study investigated the long-term retention of an automatic process developed post-injury in a severe closed-head injury (CHI) population. Participants and Methods: Seventeen CHI and 10 control participants, who had earlier received extensive consistent-mapping (CM) training (i.e., 3600 trials) in a semantic category visual search task (Schmitter-Edgecombe & Beglinger, 2001), returned for follow-up testing following a long-term (5-10 month) retention interval. In a CM training situation, individuals always respond in the same way to a specific class of stimuli (e.g., the category exemplar 'arm' always required the same response). Following initial CM training, both the CHI and control groups demonstrated dramatic performance improvements and the development of an automatic attention response (AAR), indicating both stimulus-specific and task-specific learning. In the current study, retention for task-specific and stimulus-specific aspects of skilled visual search was assessed using new stimuli and the originally trained stimuli, respectively. Results: No significant group differences were found in the level of retention for either skill type. Both the CHI and control groups showed comparable levels of stimulus-specific and task-specific skill retention. Conclusions: These results indicate that once automatic processes have been developed post-injury, individuals with a severe CHI can retain these skills over a 5-10 month interval at levels comparable to normal controls, lending support to remediation techniques utilizing complex cognitive skill development following CHI.

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K.L. GLASS, M.J. NATALE, J.A. JANUSZ, G.A. GIOIA & S. ANDERSON. Initial Development of a Parent Report of Post Concussion Symptoms in Children and Adolescents.

Objective: Although concussions/mild TBI are among the most common injuries in children, reliable and valid methods to serially track sequelae and recovery have been more limited. The lack of research is not surprising given the shortage of assessment tools. Objective measurement of post-concussion symptomatology is an important component in the assessment process. With childhood injuries, parent report can also be useful in providing a repeatable and ecologically valid measure of post

concussive symptoms. We examine the scale structure of a 28-item parent report of post-concussion symptoms in a child and adolescent sample. Participants and Methods: Participants included the parents of 48 children and adolescents (Mean age = 12.9, SD = 3.7) who met criteria for concussive injury (median number of days post concussion = 12). The 28-item (7-choice Likert scale) was completed. Results: The scale was examined using two methods: internal consistency reliability and preliminary data reduction methods (factor analysis) to establish item-scale definitions. Examination of competing item-scale compositions supports a 6 scale structure with good internal consistency reliabilities, defined as follows: Physical Symptoms (7 items, $\alpha = .82$), Fatigue Symptoms (6 items, $\alpha = .92$), Cognitive Symptoms (5 items, $\alpha = .91$), Affective Symptoms (5 items, $\alpha = .90$), Antero/Retrograde Amnesia (2 items, $\alpha = .78$), and Sleep Problems (2 items, $\alpha = .87$). Conclusions: Exploratory analysis of the structure of a parent report of post-concussive symptoms revealed 6 domains, supporting the potential use of these subscales, in addition to the Total Symptom Score. Limitations include small sample size and heterogeneity of sample, which will be addressed in future research.

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J.C. WERTHEIMER, R.A. HANKS, D.L. WOOD & R.D. ZAFONTE. Functional Status and Community Reintegration in Severe Penetrating Brain Injuries.

Objective: The study examines and describes the functional status of persons surviving a severe penetrating brain injury, resulting from a gunshot wound, who require inpatient rehabilitation. There are few studies that have investigated this topic, and these previous studies have found poor outcomes. Participants and Methods: Participants included persons with severe penetrating brain injury ($N=45$) and a motor vehicle accident comparison group ($N=45$). Data was collected prospectively at four different time periods: rehabilitation admission and discharge, year 1 and year 2 post injury. Results: Results indicated functional improvements on the Disability Rating Scale (DRS) and Functional Independence Measure (FIM) from rehabilitation admission to discharge. Follow-up data revealed continued improvements on the DRS and FIM measures with the greatest improvement in recovery during the first year post injury. In addition, improved community reintegration emerged between one and two years post injury, as measured by the Community Integration Questionnaire (CIQ). Functionally, this group did not differ from the motor vehicle accident comparison group on any outcome measures. Conclusions: Persons who survive severe penetrating brain injuries may show continuing improvement in functioning over time. For persons receiving inpatient rehabilitation services, initial improvement is most likely to occur during the hospital stay and continue post-injury, with the largest improvement in the first year after injury. Community reintegration can also be expected over time. Contrary to empirical findings in the literature, one can expect similar outcomes for individuals who sustain a severe penetrating brain injury and a severe brain injury ensuing from a motor vehicle accident.

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R. ZIEGLER, R.L. SKEEL & G.F. RONAN. SEQUELAE OF TRAUMATIC BRAIN INJURY: An Investigation of Patients' Level of Engagement and Progress Within Rehabilitation.

Objective: Previous treatment efficacy literature in traumatic brain injury rehabilitation has not yielded definitive predictors of patient outcome. While several explanations for this have been presented, i.e. failure to account for injury severity, patient demographics, and effects of spontaneous recovery, research has failed to address the effects of patient engagement in treatment on rehabilitation outcome in a traumatic

brain injured population. The purpose of the current study was to investigate this gap in the literature in order to allow us to better understand the relationships between level of engagement in treatment, social problem-solving ability and progress within the rehabilitation setting. **Participants and Methods:** Forty outpatients with traumatic brain injury participated in the current study. Mean age of the sample was 37.2 years (SD = 12.8) and the mean time in treatment was 20 months (SD = 20.3). In order to assess level of engagement in treatment, a novel rating form (The Engagement in Treatment Rating Scale) was developed. Results: Pearson correlations and regression analyses were utilized. Level of engagement in treatment was significantly related to patient progress following four weeks of treatment. Furthermore, this effect was maintained across disciplines. Self-awareness of deficits did not have a significant impact on patients' abilities to successfully engage in treatment regimen. It was hypothesized that individuals with higher levels of frontal behavioral dysfunction as rated by family members and patients' self-reports, would demonstrate decreased social problem-solving performance. While this did not reach significance, analyses indicated a trend in the predicted direction, $r = -.29$, $p = .07$ and $r = -.27$, $p = .09$, respectively. **Conclusions:** Measurement of patients' level of engagement in treatment appears to be useful in predicting patient progress and outcome in a TBI rehabilitation setting. Implications and future directions are discussed.

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Symposium 14/9:00–10:45 a.m.

Biological Mechanisms Underlying General Intelligence ("g").

Chair: Rex Jung
Discussant: Richard Haier

R.E. JUNG. Biological mechanisms underlying general intelligence ("g") Intelligence can be conceptualized as a global measure of brain function representing integration of specific cognitive skills important to adaptive behavior. Factor analysis has demonstrated that a wide range of cognitive tasks are positively correlated with one another, the commonality of which was termed "g" by Spearman. While intelligence research has often been mired with controversy, researchers have continued to make great strides towards understanding how and where intelligence arises in normal human brain. For example, researchers in functional brain imaging studies have shed light on the "neural mechanisms of intelligence," implicating a distributed network including prefrontal, parietal, temporal and cerebellar brain regions. Similarly, morphometric studies have implicated discrete cortical regions within frontal, parietal, temporal and occipital lobes associated with intelligence in normal subjects. Here, we have assembled some of the leading intelligence researchers, across a broad range of disciplines, to outline the progress made in understanding the biological mechanisms of intelligence in normal human brain. Major research disciplines to be discussed as they relate to g include: 1) developmental instability (DI - Ronald A. Yeo, Ph.D.), proton magnetic resonance spectroscopy (¹H-MRS - Rex E. Jung, Ph.D.), functional magnetic resonance imaging (fMRI - Vivek Prabhakaran, M.D., Ph.D.), magnetoencephalography (MEG - Robert Thoma, Ph.D.), and positron emission tomography and voxel based morphometry (PET/VBM - Richard J. Haier, Ph.D.). A major goal of this symposium will be to explore whether elucidation of individual differences in g might provide potential utility in better understanding neurological disorders characterized by broad cognitive decline (e.g., schizophrenia, dementia).

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R.A. YEO. Developmental instability and general intelligence.

In recent years there has been a surge of interest in biological underpinnings of individual variation in general intellectual functioning, *org*. The two major lines of inquiry, behavior genetics and human brain function, have become intertwined, allowing more sophisticated analysis of pathways leading to individual variability (Gray and Thompson, 2004). In this paper we draw attention to "developmental instability" (DI) and the manner in which it may help link research on the genetics and neurobiology of human intelligence. DI refers to the imprecise expression of the ontogenetic plan for neurodevelopmental design due to the introduction of noise in developmental pathways occasioned by genetic or environmental factors. In prior research we have shown that the individuals demonstrating more fluctuating asymmetry (FA) and minor physical anomalies, the two major manifestations of DI, show increased left hand preference, atypical hand skill, and atypical functional and anatomic cerebral lateralization. In 1997 Furlow and colleagues demonstrated that FA accounted for 17-50% of variance in fluid intelligence. Four independent research groups have recently replicated this observation. As greater mutation load leads to greater FA, this suggests that there exists a wide variety possible genetic contributors to g, that the specific alleles may differ across individuals, and that genetic influences are more apt to decrease than boost intellectual functioning. Genetic influences are manifest through neural variation and the search has begun for the pathway whereby greater FA impacts g. Our ongoing studies relating FA to neural speed and brain volume, known correlates of g, are reviewed. Correspondence: *Rex E. Jung, Psychiatry Research, University of New Mexico, 1201 Yale Blvd NE, Albuquerque, NM 87131. E-mail: rexjung@yahoo.com*

R.E. JUNG. Neurochemical aspects of general intelligence.

Recent theories of brain-behavior relationships have stressed the central importance of white matter interconnections underlying multiple neuronal networks. Thus, inquiry regarding the discrete or distributed location of g within the brain would be incomplete without addressing individual differences in white matter integrity. One neuroimaging technique particularly amenable to studies of white matter function and integrity is Magnetic Resonance Spectroscopy (MRS). Using a standard MRI, this imaging modality provides a quantitative measurement of the neurochemical components of neural and glial variation in vivo. Voxels of interest may be placed to sample neurochemistry from particular brain regions, although larger white matter voxels (e.g., 8cc) are more common given current spectral resolution. Proton MRS (¹H-MRS) resolves signals from three major neurometabolites including N-acetylaspartate (NAA), creatine (Cre), and choline (Cho). Reduced NAA has been well associated with neuronal injury or death, impaired cognition, and poor functional outcome across myriad neurological disorders. Our research has established a relationship between g and white matter NAA within a cohort of neurologically normal adults utilizing both intellectual¹ and composite neuropsychological measures². We have since replicated and extended these initial findings in a cohort comprised of both normal subjects and patients recently diagnosed with schizophrenia³. Potential roles, significance, and regional implications of NAA in brain function underlying intelligent behavior will be discussed. ¹Jung, et al., (1999a). *Proceedings of the Royal Society of London - Series B*, 266: 1375-1379. ²Jung, et al., (1999b). *NeuroReport*, 10: 3327-3331. ³Jung, et al., (2003). *Proceedings of the 11th Annual Meeting of the International Society for Magnetic Resonance in Medicine*.

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V. PRABHAKARAN. Neural Substrates of Visuospatial and Mathematical Reasoning: An fMRI study of Raven's Progressive Matrices (RPM) and Necessary Arithmetic Operations Test (NAOT).

The RPM and NAOT are widely used measures of reasoning ability that reliably predict performance in reasoning tasks from a number of different domains. The Raven's test can be divided into problems that can be solved by utilizing gestalt reasoning and abstract/analytical reasoning. fMRI was utilized in order to identify neural substrates particular to these two forms of reasoning. Three types of problems were adapted from the Raven's and NAOT tests: 1. Easy problems that can be solved by a visuospatial or gestalt strategy (RPM) or involved one operation (NAOT). 2. Hard problems require abstract/analytical reasoning (RPM) or two operations (NAOT). 3. Match problems served as control tasks, and consisted of matching a pattern to one of eight choices given (RPM) or simple reading and matching of words (NAOT). For the RPM, the easy-match task activated right hemisphere and left parietal regions. The hard-match task activated novel areas in the left hemisphere including the bilateral posterior parietal, inferior temporal, extra-striate, prefrontal, and premotor areas. In the NAOT, major bilateral frontal activation and minimal posterior activation was observed while subjects solved Easy problems relative to Match problems. Minor bilateral frontal, temporal and lateralized activation of left parietal regions was observed in the Hard problems relative to Easy problems. These results suggest that fluid reasoning is mediated by a composite of working memory systems with the most significant activity occurring in bilateral prefrontal areas which have been reported to show robust activity in many complex tasks.

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R.J. THOMA. MEG Analysis of the Choice Reaction Time and Intelligence Relationship.

A negative correlation between measures of intelligence and speed in a choice reaction time (RT) task has been documented for almost a century. In addition, a negative correlation has been consistently found between various measures of neural conduction time and intelligence using EEG. In order to identify how specific processing subcomponents of reaction time may relate to intelligence, RT was divided into temporal components using Magnetoencephalography (MEG). The current study used a simple/choice RT paradigm based on lateralized visual stimulus presentation while MEG data were collected from 20 normal, healthy, right-handed, male subjects. Lateralized simple and choice RT was divided into three components, latency to the first visual dipole (Time 1), time elapsed from that dipole until the peak of the motor readiness potential (Time 2), and the time elapsed from the readiness potential to movement initiation (Time 3). In a MANOVA, there was no effect for side (lateralization) of stimulus presentation, but there was a significant choice by component interaction. That is, choice, but not simple reaction time, correlated with intelligence. In the choice condition, only Time 2 was negatively and significantly correlated with Ravens Advanced Matrices Scores. Thus, there was no relationship between Ravens score and perceptual or motor processing time, but the time period between these two, presumably involving integration of perceptual information with motor planning, was most closely related to intelligence.

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R.J. HAIR. Why size matters: A voxel-based morphometric study of regional gray and white matter correlates of general intelligence.

Many functional brain imaging studies have confirmed correlates between regional cerebral activity and various tests of mental ability associated with general intelligence. Most of these studies implicate areas in the frontal lobes as well as other areas distributed throughout the brain (1, 2). Since interpretation of functional brain imaging studies is dependent on the cognitive task undertaken during the imaging protocol, inconsistencies among study

results are difficult to resolve. Structural brain imaging with MRI is independent of any cognitive task so results correlating individual differences in brain structure to test performance may be more interpretable. Intelligence correlates of regional brain structure, however, have been difficult to determine because of inherent difficulties in traditional region-of-interest (ROI) analyses. We applied newer voxel-based morphometry (VBM) to structural MRIs to determine gray and white matter volumes in 48 normal volunteers who also completed standard assessments of general intelligence using the Wechsler Adult Intelligence Scale (WAIS). IQ score was correlated to gray and white matter volumes in a number of areas which differed according to age (3) and sex (4). The results support the view that the neural basis of individual differences in general intelligence is in specific areas distributed across the brain, and a single neuro-anatomical focus of general intelligence is unlikely. 1. R. J. Haier, N. S. White, M. T. Alkire, *Intelligence* 31, 429-441 (2003). 2. R. J. Haier et al., *Intelligence* 12, 199-217 (Apr-Jun, 1988). 3. R. J. Haier, R. Jung, R. Yeo, K. Head, M. T. Alkire, *Neuroimage* 23, 425-433 (2004). 4. R. J. Haier, R. Jung, R. Yeo, K. Head, M. T. Alkire, (under review). Correspondence: *Rex E. Jung, Psychiatry Research, University of New Mexico, 1201 Yale Blvd NE, Albuquerque, NM 87131. E-mail: rexjung@yahoo.com*

Symposium 15/9:00-10:45 a.m.

How Should We Evaluate the Efficacy of New Cognition-enhancing Medications?

Chair and Discussant: John Sweeney

J.L. REILLY. How should we evaluate the efficacy of new cognition-enhancing medications?

Although the pharmaceutical industry is rapidly developing medications that enhance cognition in brain disorders, there is no consensus about how potential procognitive effects are best measured. Many small proof of concept studies, and most large-scale treatment efficacy studies, use brief neuropsychological screening instruments as the primary and often single outcome. With only a modest body of data to guide clinical trials, real world pressures from the FDA, the pharmaceutical industry, and more recently the NIH are growing for standardization and explicit thresholds to document treatment efficacy of agents targeting cognitive symptoms. Questions about the appropriate scale of neuropsychological evaluations, the generalized utility of batteries across disorders, test-retest effects over multiple assessments, and the value of targeting cognitive domains where changes are expected due to a drug's known action on specific neurotransmitter systems, do not have clear answers. The focus of this symposium will be to discuss strategies useful for evaluating procognitive effects of new medications, and to present examples of neuropsychological, neurophysiological and neuroimaging data collected to evaluate neurocognitive effects of pharmacological interventions. The aim is to open a dialog about neuropsychological strategies in this area, and to spur interest in conducting the kinds of studies needed to insure that evaluations of the cognitive effects of new medications are conducted using the strongest methodologies available.

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N.H. PLISKIN. The Future of Neuropsychological Assessment in Treatment Investigations: Need for a Paradigm Shift.

Neuropsychological assessment has been a critical investigational tool in decades of research examining the impact of various diseases and their treatments on cognitive functioning. Indeed, neuropsychological data have made

important contributions to our understanding of how illicit drugs impact cognitive abilities, and for monitoring beneficial and adverse treatment effects in neuropsychiatric conditions. Most clinical studies of cognitive benefits of psychotropic medications have relied on standard neuropsychological tests that alone lack the specificity to localize treatment effects within specific brain regions. As the scientific community moves towards developing treatments that will be effective for improving cognition in highly prevalent conditions such as schizophrenia, dementia, TBI and ADHD, there is a growing need for integration of detailed behavioral information with specific knowledge of what brain systems are affected by new treatment agents. The use of fMRI in treatment studies allows direct detection of drug-induced changes in regional brain function, but typically provides little comprehensive information about how drugs affect human brain systems in behaviorally relevant ways. New strategies that involve neuropsychological testing in conjunction with functional brain imaging hold tremendous potential to guide drug development, establish treatment efficacy and identify mechanisms of cognitive change associated with drug treatment. This presentation will review the traditional role of clinical neuropsychological assessment in treatment studies. A review of procognitive treatment effects in specific populations will be presented to illustrate potential benefits of combining clinical neuropsychology with functional brain imaging to best learn how medications affect neurocognitive systems.

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J.L. REILLY. Treatment effects of atypical antipsychotic medication on neurocognition in first-episode schizophrenia: Differential sensitivity of neuropsychological and neurophysiological measures.

Cognitive deficits are among the most debilitating symptoms of schizophrenia. As the field moves to develop and test new approaches for reducing these impairments, determining the best way to measure procognitive treatment effects is crucial to the process of bringing effective new treatments to the clinic. We present findings from a longitudinal study of cognitive functioning in first-episode schizophrenia patients using a battery of clinical neuropsychological tests and oculomotor studies translated from neurophysiological laboratory studies of nonhuman primates. Patients in their first episode of schizophrenia were evaluated at baseline prior to antipsychotic treatment and again after 6-, 26-, and 52-weeks of treatment. Demographically matched healthy individuals were followed over an identical period. Patients showed deficits at baseline that remained stable to the one-year follow-up on neuropsychological tests of attention, verbal and visual memory, visual perception, and executive functions. In contrast, patients' impairments on oculomotor tasks at baseline in the regulation of visual attention and voluntary response inhibition were partially ameliorated with treatment. Treatment effects on oculomotor tasks were not uniform, however, as patients showed an exacerbation of baseline impairments on a spatial working memory task after treatment. Collectively, findings from neurophysiological testing revealed a complex pattern of cognitive costs and benefits associated with antipsychotic treatment that was not seen with standard neuropsychological tests. This presentation highlights the need for multi-method approaches to understanding the neural systems underlying cognitive symptoms in schizophrenia and how such systems are impacted by treatment.

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P. MAKI. Midlife Risk Factors for Dementia - A Challenge for Drug Development.

Neuropsychological measures are commonly used in randomized clinical trials to identify drugs with the potential to alter the rate of cognitive aging in the elderly. Observational (non-randomized) studies suggest that

cholesterol-lowering drugs and hormone therapy may help to maintain cognitive function and lower dementia risk when initiated in midlife. Ideally, these interventions would be examined in a randomized clinical trial, the 'gold-standard' of evidence based medicine. However, randomized trials midlife intervention on outcomes that become manifest 10- to 15-years later are not feasible. To complicate matters, there may be a limited window of opportunity within which these interventions are efficacious. This paradox underscores the need for new strategies in the development of procognitive therapies aimed at age-related decline. Neuroimaging outcomes may be helpful in identifying midlife interventions that alter the course of cognitive aging. Amyloid imaging holds great promise in this regard, as does functional neuroimaging. For example, we used functional magnetic resonance imaging (fMRI) to examine midlife hormone therapy use on brain function in women participating in Wave 2 of the Melbourne Midlife Women's Health Study. Prospective data collected through the menopausal transition (Wave 1) enabled precise characterization of hormone therapy use. Postmenopausal women who initiated hormone therapy during the perimenopause showed enhanced hippocampal activation as well as a concurrent benefit in performance on the activational verbal memory task, but no change on standardized neuropsychological tests. This finding is one example of how neuroimaging outcomes can play a central role in the identification of procognitive agents.

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Paper Session 16/9:00–10:45 a.m.

Schizophrenia

S. MOELTER, J. RAGLAND, K. FRIEDMAN, P.J. MOBERG, R.C. GUR, R.E. GUR & B.I. TURETSKY. Does Animal Fluency Reveal Cognitive and Neuroanatomical Heterogeneity in Schizophrenia?

Neuroanatomical, psychosocial, and symptom variables associated with three patterns of semantic fluency test performance were compared in people diagnosed with schizophrenia. K-means cluster analysis was used to assign patients to three groups based on theoretical expectations regarding animal fluency. Relative to controls ($n = 94$), the general impairment group ($n = 35$) demonstrated reduced output, small cluster sizes and weak semantic associations between consecutive responses. The executive impairment group ($n = 29$) showed globally reduced output and decreased cluster switching but did not demonstrate reductions of cluster size or strength of shared semantic attributes. A third unimpaired group showed near normal levels of performance on all animal fluency measures ($n = 31$). Analyses of volumetric MRI revealed significant gray matter reductions in the general impairment group ($p < .02$) that was most apparent in the left temporal lobe and the frontal lobe bilaterally. The executive impairment group showed mild, trend level gray matter reduction ($p < .10$) but elevated white matter volumes, especially in the temporal lobes ($p < .05$). Ventricular enlargement was observed only in the general impairment and unimpaired groups. Psychosocial and symptom measures showed that the general impairment and executive impairment groups were less educated, with mild negative symptom elevation relative to unimpaired patients. These results demonstrate that performance on the animal fluency test varies substantially across people with schizophrenia. The ability of semantic clustering measures to yield distinct neuroanatomical and symptom patterns was supported primarily in the general impairment group.

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M. BONAFINA-CARACCIOLI, J. HARKAVY-FRIEDMAN, J. KEILP, D. BERMAN, K. PERRINE & J. HALPERIN. Time Estimation in Schizophrenia: Relationship to Clinical and Neuropsychological Functioning.

Literature indicates that dopamine has a central role in the etiology of schizophrenia and in underlying mechanisms of time estimation. However, the investigation of time estimation in schizophrenia has been fairly neglected. The goal of this study was to examine the perception of time among such patients. We used two computerized tasks that required the verbal estimation and production of brief durations (i.e., 5 s to 90 s). Time estimation was compared between 38 inpatients with schizophrenia and 47 controls. Among patients, time estimation was assessed after four weeks on the same dose of neuroleptic medication. To study the effect of neuroleptics on time perception, a subgroup of 10 inpatients maintained medication-free during three weeks was evaluated off- and on-medication. Patients, particularly females ($F=3.72$, $p=.057$), exhibited a faster internal time sense compared to controls ($F=3.70$, $p=.058$). After neuroleptic medication, time perception became significantly accelerated ($t=3.59$, $p=.006$). It was speculated that this change was a medication effect. Additionally, the relationship between time estimation and clinical variables including symptomatology, impulsiveness, and suicidal behavior was also investigated. A moderate relationship was found between time estimation and positive symptoms, but this function was uncorrelated with impulsiveness. No significant differences were found between attempters and non-attempters. However, indicators of suicidal behavior were differentially associated to time estimation. While a high number of prior suicide attempts was associated with a fast time sense, high scores on scales assessing intent and suicidal were correlated with a slow time sense. A better understanding of time perception in schizophrenia may facilitate the reconceptualization of its core cognitive and clinical characteristics and promote effective interventions. Future research should focus on the role of medication and gender on time estimation.

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P.J. MOBERG, S.E. ARNOLD, D.R. ROALE, C.C. BALDERSTON, J. ABBAZIA, S. KANES, R.E. GUR & B.I. TURETSKY. Apolipoprotein E Genotype and Odor Identification in Schizophrenia.

Studies have suggested a link between the ApoE $\epsilon 4$ allele and odor identification deficits in both healthy elderly subjects and patients with Alzheimer's disease. Family and twin studies have suggested a genetic mediation of the olfactory deficit seen in schizophrenia. This study examined the association of ApoE allele status to odor identification in patients with schizophrenia and healthy controls. ApoE genotype frequencies and unihedral odor identification performance was assessed in a cohort of 28 patients with schizophrenia and 26 matched healthy controls. No significant differences between diagnostic groups for ApoE gene frequencies were seen nor were differences seen in UPSIT performance for either nostril between $\epsilon 4$ -positive and $\epsilon 4$ -negative subgroups. No significant relationships were observed between ApoE grade and UPSIT performance in either patients or controls. While there appears to be a genetic contribution to olfactory processing deficits in patients with schizophrenia, these deficits do not appear to be mediated at the level of the ApoE allele.

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L.R. KINGERY, S.M. MEYER, N.G. CASCELLA, J. YUN, G.D. PEARLSON & D.J. SCHRETLEN. A Voxel-Based Morphometric Study of Gray Matter Concentration in Patients with Schizophrenia and Healthy Adults.

Brain structure abnormalities are commonly found in individuals with schizophrenia, most consistently involving ventricular and temporal lobe brain regions. Previous structural magnetic resonance imaging (MRI) studies of schizophrenia have relied primarily on manually tracing brain regions of interest, but this approach is very time-consuming and typically limits the study of group differences to a small number of brain regions. Voxel-based morphometry (VBM) is a semi-automated analytic approach that quantifies tissue concentrations at the individual brain voxel level. The aim of this study was to examine potential differences in gray matter concentration between persons with schizophrenia and well-matched healthy adults. Structural brain MRI data for 14 schizophrenic and 14 healthy adults matched on age (mean = 43 ± 12 years), sex (50% male), and estimated "premorbid" IQ (mean = 99 ± 9 points) were analyzed in this study. Patient diagnoses were based on structured clinical interviews. Brain MRIs were obtained on a 1.5 Tesla General Electric Signa scanner using identical pulse sequences and image acquisition parameters. Image preprocessing and VBM analyses were conducted using the Statistical Parametric Mapping (SPM2) software. The results revealed that schizophrenic subjects have significantly less gray matter concentration in the left superior temporal gyrus and inferior and middle frontal gyri, bilaterally ($p<.005$, uncorrected, voxel threshold = 50). These results complement previous structural brain imaging studies showing reduced gray matter volumes in temporal and frontal lobe regions in patients with schizophrenia.

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G.V. NAYAK, D.J. MOORE, S.C. ROESCH, D.V. JESTE, R.K. HEATON & B.W. PALMER. Use of Hierarchical Linear Modeling to Evaluate Longitudinal Neuropsychological Performance in Middle-Aged and Older Schizophrenia Patients.

The main objective of the current study was to evaluate the stability or progression of cognitive deficits in schizophrenia by means of Hierarchical Linear Modeling (HLM). HLM has several advantages over other statistical approaches such as repeated measures analysis of variance, including the ability to better deal with missing values, and the ability to model slopes of change using all available data. In the present study, we applied HLM to longitudinal Mattis Dementia Rating Scale (DRS) data from 148 middle-aged and older (Mean age=53.1 years, $SD=8.7$) schizophrenia outpatients. All patients completed the DRS at least twice with a mean retest interval of 14.2 months ($SD=7.4$), and 86 completed the DRS 3 or more times. Results indicated that, as a group, schizophrenia patients had stable cognitive performance over time. There was, however, significant variation around the average slope. Age was the only significant predictor of this variation, with older patients more likely to show decline in performance than younger patients. Other potential predictors tested were gender, education, duration of illness and severity of negative and positive psychotic symptoms. These findings support the contention that cognitive deficits are generally stable in schizophrenia. However, there may be subtle cognitive decline among some elderly patients, which must be teased apart from decline as a function of normal aging. Other possible intervening neuromedical confounds such as sub-clinical strokes are common in the elderly and must be ruled out as etiology for cognitive decline.

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Paper Session 17/9:00–10:45 a.m.

Memory, Aging, and Memory & Aging

E. BARBUTO & N.W. PARK. The Effects of Dual-Task Performance on Retrieval from Long-Term Memory.

Currently, most studies have failed to find reduced memory performance when a concurrent task is performed during the retrieval of information. The two studies reported here investigate whether: retrieval of long-term, serially encoded information is interfered with when two tasks are performed concurrently; the representational systems hypothesis of Fernandes and Moscovitch (2000) accounts for our findings. Forty-eight participants, screened for previous brain injury, neurological disorders, and English fluency, were tested individually. For both studies participants encoded instructions for each of two matrix tasks (verbal, spatial) and then retrieved them separately (single-task condition), and concurrently (dual-task condition). The second study included a between-subject condition which directly investigated the representational systems hypothesis. For study one, participants ($n = 16$) recalled significantly more matrix instructions in single- ($M = 51\%$, $SD = 19$; $M = 67\%$, $SD = 25$) compared to dual-task ($M = 32\%$, $SD = 12$; $M = 42\%$, $SD = 17$) conditions for both verbal and spatial matrix tasks, respectively, $F(1, 15) = 25$, $p < .0001$. For study two ($n = 32$), the same pattern of results emerged, with participants recalling considerably more matrix instructions under single- ($M = 62\%$, $SD = 20$; $M = 59\%$, $SD = 30$) compared to dual-task ($M = 42\%$, $SD = 13$; $M = 38\%$, $SD = 24$) conditions for both verbal and spatial matrix tasks, respectively $F(1, 28) = 32$, $p < .0001$. There were no between-group differences in performance, $F(1, 28) = 32$, $p < .0001$, suggesting that decrements could not be explained by the representational systems hypothesis. The large interference effects at retrieval stand in contrast to other studies of dividing attention which suggest that retrieval is relatively automatic. We are currently investigating what factors are responsible for the decrements in memory performance during retrieval under dual-task conditions.

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A.M. BRICKMAN, M.S. BUCHSBAUM, L. SHIHABUDDIN, M. HAZNEDAR, R.E. NEWMARK, J. BRAND, A.D. CHEN & E.A. HAZLETT. Age-associated Change in Orbital, Cingulate, and Dorsolateral Frontal Lobe Gray and White Matter Volume.

Evidence from neuroimaging and neuropsychological studies of normal aging suggests age-related decline in functioning of frontal systems. It is unclear whether this change is due to selective reduction in tissue type in specific frontal regions. The purpose of this study was to use MRI to examine age-related relative gray and white matter volume changes in four discrete prefrontal brain regions. Seventy neurologically and cognitively healthy adults were recruited as part of a study examining age-related changes in glucose metabolism using PET. There were 5 men and 5 women represented in decades 20 through 80 (men: mean age=54.5+/-20.1; women: mean age=54.4+/-20.4). All subjects were scanned with high-resolution 1.5T MRI, and prefrontal regions were segmented into orbital (BA:11,12,47), medial/cingulate (BA:24,25,32), dorsolateral (BA:44,45,46), and lateral (BA:8,9,10) gray and white matter using a stereotaxic atlas method. Relative volumes were analyzed with a Decade by Region by Brodmann Area by Tissue Type by Hemisphere by Sex mixed-design ANOVA. Total frontal lobe volume declined linearly across the seven decades, with the lateral and cingulate frontal areas showing the greatest amount of decline, and orbital and dorsolateral regions remaining relatively stable. In general, gray

matter showed a gradual decline across the decades, whereas white matter remained relatively stable until the last two decades, particularly in lateral, dorsolateral, and orbital regions. Interactions involving Sex indicated that women had relatively more frontal lobe gray matter than men, particularly in medial/cingulate and lateral regions. The findings indicate that medial/cingulate areas, important in attention, impulse control and affect regulation, may show greater volumetric loss with age than other frontal regions; these functions might be important in mediating cognitive deterioration in aging. Future research should examine cognitive correlates of these effects.

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E.C. LERITZ, A. KING, C. LEONARD, I. SCHMALFUSS, L. ABRAMS, M. MARSISKE, E. FENNELL, W. PERLSTEIN & R.M. BAUER. Associative priming, explicit memory, and their relationship to hippocampal volumes in aging and mild cognitive impairment.

In individuals with amnesic mild cognitive impairment (MCI), memory is affected disproportionately to what would be expected in normal aging; evidence of atrophy to relevant brain structures such as the hippocampus has supported this idea. The purpose of the current study was to evaluate the relationship among associative priming, explicit memory, and hippocampal volumes in normal aging and amnesic MCI. An additional goal of the project was to investigate the distinction between explicit and implicit associative memory. Forty-five participants completed an associative priming experiment which assessed implicit associative memory for novel (i.e. unrelated) and semantic (i.e. related) word pairs. Following the experiment, all participants completed an unannounced explicit cued-recall test (incidental memory). Additionally, a brief neuropsychological screening battery was administered for purposes of group classification. Structural magnetic resonance imaging (MRI) of the hippocampus was then completed on all participants. Results revealed that while MCI and control groups differed significantly on standardized explicit measures of memory, there were no significant differences on priming measures, or on incidental cued-recall. Additionally, within the entire sample, there was no association between measures of priming and standardized memory measures. However, regression analyses revealed that novel associative priming and a standardized measure of explicit memory together accounted for a significant portion of variance in left hippocampal volume. These results suggest that while novel priming may depend in part on the hippocampus, amnesic MCI, which is associated with volume loss in the hippocampal system, does not result in an impairment of implicit associative memory.

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A.L. JEFFERSON, A. D'APRILE, D.F. TATE, R.H. PAUL, J. GUNSTAD, K.L. MACGREGOR, L. BAUSERMAN & R.A. COHEN. Verbal Learning and Memory Performances Among Geriatric Cardiac Participants: Relationships to Apolipoprotein E (ApoE) Gene Polymorphisms.

Specific ApoE gene polymorphisms ($\epsilon 4$ allele) are associated with increased risk of dementia. This study examines verbal learning and memory performances (a prominent feature of dementia) as a function of ApoE status among older adults with heart disease at risk for cognitive decline. Outpatients with treated, stable heart disease and no history of neurological illness ($n=142$, ages 53-80) were administered the CVLT. ApoE genotyping was used to stratify participants into 3 groups: at least one $\epsilon 2$ ($n=17$), $\epsilon 3/\epsilon 3$ ($n=89$), or at least one $\epsilon 4$ ($n=36$). ANCOVAs were used controlling for age with Tukey post-hoc comparisons. Participants with at least one $\epsilon 4$ allele performed significantly worse than individuals with the $\epsilon 3/\epsilon 3$ combination on immediate recall ($t(123) =$

2.43; $p < .01$), though they benefited significantly more from repeated administration as evidenced by their learning slope ($t(123) = -2.12$; $p < .04$). There were no significant differences for long delay recall or recognition. Pilot longitudinal data on a sub-sample of participants ($n=10$) possessing only the $\epsilon 2$ or $\epsilon 4$ allele revealed that over a one-year period participants possessing the $\epsilon 4$ allele committed an increased number of perseverations ($F(1, 7) = 11.16$; $p < .01$). Though participants with the $\epsilon 4$ allele perform similarly on long delay and recognition trials as compared to those with the $\epsilon 3$ allele, the $\epsilon 4$ polymorphism is associated with more learning difficulty. Over time, these patients have increased perseverations as compared to those with the $\epsilon 2$ allele suggesting possible increased executive dysfunction or source memory difficulties.

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Poster Session 11/10:45 a.m.–12:45 p.m.

Child Development

A.P. KEY, M. FERGUSON, D.L. MOLFESE, K. PEACH, C. LEHMAN & N. PRAIT. Effects of Smoking During Pregnancy on Speech Discrimination Ability in Newborn Infants.

Due to adverse effects of nicotine on utero-placental blood flow and the amount of oxygen available to the fetus, development of the central nervous system in babies of smoking mothers can be compromised. Behavioral data in children associates maternal smoking with poorer performances in the verbal domain and specific language/auditory tests. The current study examined the effects of maternal smoking during pregnancy on newborns' speech discrimination ability as measured by event-related potentials. Electrical brain activity (ERPs) was measured within 72 hours of birth in two groups of healthy newborn infants of smoking ($n=8$) and nonsmoking ($n=8$) mothers. Participants were matched on sex, gestational age, birth weight, Apgar scores, mother's education and family income. Smoking during pregnancy was determined by parental self-report and medical records. ERPs were recorded using a 128-channel high-density array in response to six CV syllables presented in random order with equal probability. PCA-ANOVA analysis sequence identified multiple group effects within 0-440ms after stimulus onset. ERPs of babies of non-smoking mothers were characterized by typical hemisphere asymmetries with larger amplitudes over the left hemisphere, especially over temporal regions. No hemisphere differences occurred for babies of smokers. Further, infants of nonsmokers discriminated between greater number of vowels and the CV syllables relative to smokers. Results indicate that prenatal exposure to nicotine in otherwise healthy babies results in significant changes in brain physiology associated with basic perceptual skills. Newborns of smoking mothers demonstrated less efficient speech discrimination that could lead to behavioral differences at later ages.

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E. RATAJCZAK, D.L. MOLFESE, A.P. KEY, K. PEACH, M. FERGUSON & S. STRAUB. Early Sex Differences in Auditory Memory Mechanisms: Evidence From 1-Year-Old Infants.

Numerous electrophysiological studies note that very young infants discriminate between familiar, or frequent, and novel, or infrequent, events. The current study examined the effects of infant's sex on auditory mem-

ory as indicated by event-related potentials (ERP) recorded during a novelty task. Auditory ERPs were recorded using a 128-channel high-density array in 14 healthy infants (mean age=13 months; 7 females) using a habituation/novelty paradigm with 2 tones differing in the onset of the 2nd formant by 60 ms. Infants passively listened to repeated presentations of one tone and, after a 20-sec break, heard the habituated tone intermixed with a novel tone. PCA-ANOVA analysis sequence indicated that approximately at 100 ms after stimulus onset, female brain activity differed from males in response to novel and habituated stimuli. In females, novel items elicited larger amplitudes over the left frontal regions while the reverse was true for males. Males generated larger ERPs to novel items at left posterior temporal regions (opposite to females). Further, only females discriminated between the habituated items and the baseline stimuli with the latter producing larger brainwaves over the right anterior temporal regions. These findings provide new information indicating that sex-related brain differences related to sound processing and auditory memory are present early in life. Male and female infants evidenced memory for tonal differences but engaged different brain regions for auditory memory processes. Further, female infants appeared to make finer distinctions between different auditory events, suggesting that at this stage their auditory memory systems are more advanced.

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M.C. FERGUSON, S.L. STRAUB, A. FONARYOVA KEY, D.L. MOLFESE & E. RATAJCZAK. Influences of Nutrition on Early Brain Processing in Breast-Fed and Bottle-Fed Infants.

Previous research indicates that breastfeeding during infancy provides benefits that influence long-term brain development, cognitive processing and developmental outcomes (Quinn et al., 2001). Numerous studies report positive effects of breastfeeding on infant development. For example, Gomez et al. (2003) found that breast-fed infants scored higher than bottle-fed infants on the Mental Developmental Indices of the Bayley Scales of Mental Development. This current study investigated the underlying neurological mechanisms associated with speech processing in groups of breast-fed and bottle-fed infants. It was hypothesized that there would be differences in brain activity between the groups. Event-related potentials (ERPs) were recorded to speech syllables from 128 electrodes placed over left and right hemisphere sites of twelve 6-month old infants. A main effect for Groups indicated that the ERPs from 40-216 ms differed between breast-fed and bottle-fed infants, $F(1,10)=9.07$, $p < .02$, observed power=.77. A significant Group x Hemisphere interaction for ERPs was noted between 160 and 548 ms, $F(1, 10)=6.59$, $p < .03$, observed power=.64. Post-hoc analyses revealed significant left brain lateralization for breast-fed infants, $t(5)=2.77$, $p < .04$, but no significant lateralization effects were found for bottle-fed infants. These findings have important implications for early language acquisition and long-term cognitive development.

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K. PEACH, A.P. KEY, D.L. MOLFESE, C. WETTIG, E. RATAJCZAK, M. FERGUSON, S. STRAUB & J. WU. Language Development During the First Two Years of Life: Changes in Brain Organization.

The time course of infants' brain organization during the early stages of language development has long been a major discussion topic in the scientific community. The current project examined changes in brain activity associated with language development in infants from birth to 2 years of age. Auditory event-related potentials (ERPs) were recorded using a 128-channel high-density array in 10 healthy infants (5 males,

5 females) at birth, 1 year, and 2 years of age. A speech sounds discrimination task (6 computer-generated consonant-vowel syllables) was used as an indicator of language processing. PCA-ANOVA analysis sequence identified numerous age-related changes in brain activity. Age differences were noted over the left hemisphere within 100 ms after stimulus onset where amplitudes at 1 year of age were lower than at birth or 2 years of age. Largest age differences occurred over left frontal, anterior temporal, and posterior temporal regions where highest amplitudes were noted at age 2 years. At approximately 250 ms, age effects were noted in brain responses to consonant sounds over the left hemisphere where the amplitude increased from birth to 1-year and decreased at 2 years of age. The results indicated that during the first two years of life brain activity associated with speech processing undergoes multiple changes in functional organization. While numerous changes in ERPs were noted from birth through 2 years, most of them involved the left hemisphere, especially frontal and temporal regions.

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M. HRABOK & K.A. KERNS. Attention, Working Memory, and Emotional Regulation in Four Year Old Children.

Preschool is a time in which significant advances are made in social and emotional domains and within the domain of executive functioning. Understanding behaviour as the intersection of both social and biological factors is reflected in the work of Posner and Rothbart (2000), who focus on the relationship between self-regulation, temperament, and attentional systems. This project examined these ideas by investigating the relationship between their proposed attention networks [orienting, vigilance, and executive attention], aspects of working memory, and emotional regulation in a group of 4 year old children. The hypotheses were that emotional regulation would be related to performance on measures of executive attention and working memory, but would not be related to performance on tasks reliant on the orienting and vigilance networks. Forty five children were tested on measures of working memory as well as the orienting, vigilance, and executive attention networks. Emotional regulation was assessed both via parental report and through children's performance on a dyadic competitive game where 'disruptive behaviour' was coded. Measures of emotional regulation did not relate to performance on tasks assessing orienting and vigilance networks. Correlations were found between lower accuracy scores and higher reaction time scores on measures of executive attention and 'cheating behaviours' during the competitive game. Additionally, executive attention and age were significantly correlated across the span of the 4th year. Implications of the role of the executive attention network and working memory on emotional regulation will be discussed.

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E.M. WANG, Z.W. ADAMS, K.W. SAUNDERS, A.P. FONARYOVA-KEY & D.L. MOLFESE. Electrophysiological Correlates of Shape Discrimination in 5-year-olds.

The neuropsychology and behavioral literature are replete with reports indicating differences in math and spatial abilities between males and females although the bases for such differences remains unclear. Furthermore, the time that such differences emerge is also in dispute. The ability to process geometrical and spatial information via the shape discrimination task is thought to be linked to early math skills in young children. Sex differences in 10 preschool children (age 5 years, 5 females) performing a geometrical shape match/mismatch discrimination task were investigated using a high-density array of a 128-electrodes to detect differences in visual event-related potentials (ERPs) while children were engaged in a shape matching task. This task required chil-

dren to view pairs of geometric figures (e.g. a circle and a triangle), and to indicate if the two shapes were identical and matched or different and did not match by pressing different buttons. Repeated measures analyses of variance was conducted on the output of a principal components analysis of the ERP data. Significant effects were noted for the first initial negative ERP component (N1) and a later occurring positive component (P3) that discriminated match from mismatch conditions over parietal, occipital, and temporal brain regions for females, but not males, $F(1,18) = 3.58$, $p < .05$. Observed power = .82. These results indicate clear differences in the way that the brains of male and female preschool-age children discriminate shapes. Such differences are well established before entry into the elementary school system.

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R.C. CUTIONGCO. Metacognitive Strategies in Reading among Filipino Fourth Graders.

Previous studies on reading in the Philippines examined products of comprehension (e.g., scores on reading comprehension tests) rather than the processes involved in reading. This study compared the metacognitive reading strategies of good and poor readers using a think-aloud procedure while participants read texts of different kinds and in different languages. Thirty-one fourth grade children (average age of 10 years, 10 months), classified as either good or poor readers, were asked to read texts and were stopped at designated points so that they could say what they were thinking and doing while reading. This think-aloud procedure was employed while children read narrative or expository texts in English and Filipino. Although overall frequency of strategy use among good (528 times or 43.7%) and poor (681 times or 56.7%) readers did not differ significantly, good readers used a wider variety of strategies than poor readers. Good readers used more of the elaborative and higher-order strategies like inferencing and imaging, while poor readers often just retold parts of the stories. The type of text and language used did not seem to affect strategy use. This study demonstrated that reading ability is related to the form of metacognitive strategy use, replicating across languages the implications of past studies (Ryan, 1981; Collins, et al., 1996). This study also demonstrated that cognitive processes could be made conscious through verbal self-report, and that fourth graders are capable of metacognitive reflection — of thinking about what they were thinking while reading.

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H. COMES, M. DUFF & V. WOLFSON. Children's Performance on Auditory and Visual Simple, Selective, and Divided Attention Tasks.

There are fundamental modality differences in the characteristics of auditory and visual information signals, the mechanics of their respective peripheral sensory apparatus, and their neural pathways. These differences have implications for associated attentional processes. In this study, auditory and visual attention were compared using simple, selective and divided attention tasks. Subjects were a group of 37, 7 to 10 year-old children (23 boys; $M = 8$ years, 3 month; $SD = 10$ months) referred to a NIDCD funded project for problems in school. They were presented with one or two streams of stimuli (identified by frequency [1000Hz and 2000Hz] or shapes [circles and squares]). Children responded to infrequent less intense stimuli (softer in intensity tones, dimmer in luminance shapes) in all tasks. In addition, they attended to a second target in the divided tasks. The values for the infrequent targets were individually determined during a pretest to ensure that the difficulty of the discrimination was relatively equivalent across children and modalities. Data was analyzed using repeated measures ANOVAs and Pearson correlations. Children

did more poorly on all of the auditory than visual tasks, despite the pretesting. In addition, they exhibited a much larger decline in accuracy from the auditory simple to selective task than from the visual simple to selective task. Age and IQ scores were correlated with numerous measures of performance on the tasks, however receptive language skills were only correlated with the size of the auditory targets as determined by the pretest and hits on the auditory divided attention task.

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A. CLEMENTS, L.E. CUTTING, J. SCHAFER, J.J. PEKAR & S.H. MOSTOFISKY. Developmental Differences in the Neural Mechanisms Associated with the Judgment of Line Orientation.

The Judgment of Line Orientation (JLO) has been traditionally used to assess parietal lobe functioning; however, to date, there has been little research examining the functional neural circuitry associated with this task, particularly developmentally. In the current study, fMRI was used to investigate whether differences are seen in the neural circuitry between children and adults when performing an analogue of the JLO task while in the scanner. Participants included 16 neurologically normal children (8 females) and 16 neurologically normal adults (8 females). Participants viewed a "fan" of eleven lines (two highlighted in yellow) at the bottom of the screen and were asked to compare the orientation of the highlighted lines to two yellow lines above the fan. Participants indicated via button press whether the yellow lines were the same or different in orientation. A visual discrimination control task was used in which participants indicated whether the top and bottom lines were the same or different color. Results of random effects analysis for each group showed significant activation in the right superior parietal lobe, right prefrontal motor areas, and bilateral occipital lobe. Two-sample t-tests were used to examine differences between adults and children. Adults showed greater activation than children bilaterally in the cerebellum, while children showed greater activation than adults in left precuneus and bilateral medial frontal gyrus and cingulate. The findings suggest developmental differences in neural circuitry important for visuospatial processing.

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Drugs, Toxins, Alcohol

S. STRAUMAN & W. MITTENBERG. Neuropsychological Effects and Mood Change Associated with Occupational Exposure to Nitrous Oxide in Dentists.

The behavioral effects of day-to-day exposure to second-hand nitrous oxide (N_2O) were assessed in community dentists in the workplace. Practitioners ($n = 20$) who work under relatively high ambient N_2O pollution conditions ($M = 350$ ppm TWA) were compared with those dentists ($n = 10$) whose office atmospheric levels met NIOSH/ACGIH guidelines (<50 ppm N_2O TWA). Also, dentists with a long-term history of having worked without scavenger systems ($n = 12$) were compared to those who had always employed effective N_2O control measures in their work environments ($n = 18$). Dependent measures included Verbal Fluency, WAIS-III PSI, Grooved Pegboard, Rey-Complex Figure, Rey-AVLT, and visual analog mood scales. N_2O was monitored using 8-hour passive-absorptive dosimeters. Performance on neuropsychological tests and mood scale ratings were significantly associated with the level of ambient N_2O in the subject's breathing zone. Decrements were evident in executive functioning, fine motor manipulation, speed of information processing, and self-described mood state. Memory for verbal material was found impaired for those with an extended history of lack of scavenger use. Most effect sizes were large (Cohen's $d > 0.9$). Neuropsychological

evaluation revealed previously undocumented lingering sub-acute effects of exposure to these trace levels of nitrous oxide. Different remote chronic effects were also manifest. Postulated explanatory mechanisms include possible N_2O induced elevations in serum homocysteine levels, with the attendant decrease in Vitamin B12 (*cobalamin*) and folate, bioavailability and synthesis. These sequelae may eventuate from re-occurring exposure to N_2O . Repeated systemic body chemistry/metabolic cycle disruptions may result in changes to higher cortical functioning.

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M.W. HAUT, H. KUWABARA, L.A. MORROW, G. HATFIELD, M.W. PARSONS, A. SCOTT & A. DUCATMAN. Solvent-Related Neuroimaging Changes in Railroad Workers.

Many studies have documented neurobehavioral deficits in workers occupationally exposed to organic solvents. Few studies have utilized neuroimaging to document the underlying brain pathology. The current study examined functional and structural differences between Railroad Workers (RR) with past solvent exposure (greater than 10 years) and matched controls. Thirty-six RR workers (mean age = 54, mean education = 12.4, mean NART = 99) and 35 controls (mean age = 52, mean education = 13.0, mean NART = 100) served as participants. Subjects received a resting $O[15]$ water PET scan and a subset received a high resolution MRI scan (1.2mm slices). Each resting scan was normalized to standard space and the groups were compared for differences using SPM2. The total volume of the frontal cortex (gray and white matter) and total volume of the corpus callosum were drawn by hand in native space using all three planes. Measurement was done blind to group membership and interrater reliabilities were high (.94). Significantly lower resting blood flow was present in the thalamus and medial frontal cortex in RR workers. These differences remained when subjects were removed who had a medical history of hypertension or diabetes and current or past psychiatric disorders. Using only the medically healthy subjects from both groups, RR workers had smaller frontal gray matter (corrected for total intracranial volume) and smaller volume of the corpus callosum (corrected for total intracranial volume). The corpus callosum volume was inversely correlated with years of exposure. We observed differences in resting blood flow, as measured by PET, and brain structure, as measured by high resolution MRI, in a carefully selected group of solvent exposed workers and matched controls. Differences in the corpus callosum are consistent with hypotheses that solvents damage the white matter of the brain. In addition, the frontal gray matter may be particularly compromised as evidenced by both PET and MRI.

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M.L. ROHLING & G. DEMAKIS. A Meta-Analysis of the Neuropsychological Effects of Occupational Exposure to Mercury.

This paper reports a meta-analysis of 36 peer-reviewed published studies of the neuropsychological effects of exposure to mercury, which yielded 43 independent samples. Because the independent variables defining mercury exposure varied across studies, effect sizes were calculated for exposed versus non-exposed workers. Dose-response relations were considered for measures of mercury levels in air, blood, urine, years of exposure, and whether the exposure was current or occurred in the past. Cohen's d statistic yielded a weighted study-mean effect size of $-.23$, $p < .0001$. None of the exposure variables revealed a significant dose-response relationship. Objective test scores yielded slightly smaller effect

sizes than self-reported symptoms. Measures of executive functions, psychomotor skills, and visuospatial skills were most impaired by mercury exposure. The overall weighted study-mean effect size suggests that the prevalence of neuropsychological deficits due to occupational exposure to mercury is likely to be small and difficult to detect on an individual, case-by-case basis.

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K.L. MEDINA, P.K. SHEAR & K. CORCORAN. Ecstasy (MDMA) Exposure and Neuropsychological Functioning: A Polydrug Perspective.

This study examined the relationship between ecstasy exposure and cognitive functioning among men and women after controlling for other drug use, premorbid intelligence, and demographic variables. Furthermore, we assessed whether gender was a potential moderator of the relationship between cognitive functioning and ecstasy use. Data were collected from 65 men and women. Participants were recruited using a quota-bin sampling technique in order to ensure that the final participant pool included individuals with a wide range of lifetime MDMA use histories. These categories were then combined and data were analyzed utilizing a continuous variable reflecting lifetime ecstasy exposure. Participants were interviewed using the Time Line Follow-Back technique to assess drug use, and were administered a brief neuropsychological battery focused on memory, executive functioning, and attentional abilities. The primary finding was that ecstasy exposure was significantly related to poorer verbal memory ability, while no such dose-dependent relationship was observed between ecstasy exposure and executive functioning. Gender was found to moderate the relationship between ecstasy consumption and cognitive functioning. The general pattern of results suggested that a stronger dose-dependent relationship existed between increased ecstasy use and poorer cognitive performance among the male, compared to female, ecstasy users. These results reveal that a dose-dependent relationship exists between ecstasy use and verbal memory ability after controlling for potentially confounding variables such as gender, age, education, and other drug use. Further, the study revealed that gender is a potential moderator variable between ecstasy use and cognitive functioning. There are several implications of the current study, including the clear need for psychoeducation aimed at informing young adults of the negative dose-dependent impact that ecstasy use has on new learning and memory ability.

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B. FREILICH, C. RAMESAR, Z. ALTUN & A. MEDALIA. The Neuropsychological Sequelae of Ethylene Glycol Intoxication - A Case Study.

Ethylene glycol (EG), when ingested, can cause a clinical syndrome marked by renal, cardiopulmonary, and neurological dysfunction. To date, there have been no studies examining the neuropsychological sequelae of EG intoxication. We present a case of a 43-year-old female with EG intoxication. Neurological and neuropsychological findings several days to weeks after EG ingestion and again at follow-up six months later are provided. We also review the literature on the radiologic findings following EG intoxication. 25% of these studies found normal CT scans in the first several days following EG ingestion, 50% found damage to subcortical structures, including the basal ganglia, thalamus, cerebellum, and pons, 38% found diffuse cerebral edema, and 25% found damage to the mediobasal temporal lobes. All but one study reported normal radiologic findings at follow-up. In our case, CT scans of the head on days one and two post EG ingestion were essentially normal and an MRI of the brain on day five revealed nonspecific cerebellar white

matter abnormalities. Neuropsychological testing at 3-4 weeks post admission indicated global cognitive impairment with deficits in attention, processing speed, language, visuospatial/constructional ability, memory, and executive functioning. Follow-up testing six months later shifted from global to focal cognitive impairment with remaining deficits in language and visuospatial/constructional ability. There can be lasting cognitive deficits following EG intoxication despite normal brain scanning results.

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K. SCHMIDT, J. GALLO, C. FERRI, N. SESTITO, T. GIOVANNETTI & D.J. LIBON. The Neuropsychological Profile of Alcohol-Related Dementia Suggests Both Cortical and Subcortical Pathology.

Neuropathological and neuropsychological findings associated with chronic alcohol abuse are inconsistent across studies. Consequently, some researchers have called into question the existence of an alcohol-related dementia (ARD) that is not secondary to Wernicke-Korsakoff syndrome. We attempted to address this issue by comparing the neuropsychological profiles of 13 ARD patients, 14 non alcohol-related Alzheimer's patients (AD), 14 patients with subcortical vascular dementia (VaD), and 23 normal controls (NC). ARD was diagnosed based on Olsin et al.'s (1998) criteria for probable alcohol-related dementia. Patient groups were matched for age ($M=79$), education ($M=12$ years) and dementia severity (MMSE; $M=22.1$). On tests of executive control (clock drawing, mental control), ARD and VaD patients made more perseverations and exhibited greater difficulty in maintaining mental set than the AD group, but were not different from each other. No significant differences between patient groups were identified on language tests. On verbal serial list learning, delayed free recall was lower in the ARD and AD groups as compared to VaD patients. By contrast, the ARD group obtained a better score on delayed recognition. The NC group differed from all patient groups across most tasks, with the exception of a lack of a differentiation between NC and AD on tests of executive control. In sum, we present evidence suggesting a distinct neuropsychological profile for ARD patients that includes differential impairment on executive control and memory tests. This pattern of performance suggests that long-term alcohol abuse, in comparison to AD and VaD, is associated with both cortical and subcortical neuropathology.

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J. GALLO, K. SCHMIDT, C. FERRI, N. SESTITO & D.J. LIBON. Behavioral and Psychological Symptoms in Alcohol-Related Dementia.

Behavioral and psychological symptoms are common features of Alzheimer disease (AD) and vascular dementia (VaD). However, little is known about the presence and severity of these symptoms in patients diagnosed with alcohol-related dementia (ARD). This study aimed to gain a better understanding of the degree and pattern of behavioral and psychological symptoms reported by caregivers of ARD patients, as compared to those reported by caregivers of AD and VaD patients. Participants were outpatients from a memory assessment program who were diagnosed with either ARD ($n=10$), AD ($n=11$), or VaD ($n=7$). All participants were matched for MMSE ($M=22.13$), age ($M=79$ years), and education ($M=12$ years). As part of the standard dementia evaluation, the Neuropsychiatric Inventory (NPI) was administered to a caregiver of each participant. Means were computed for 12 individual NPI symptom domains, total NPI score, and total caregiver distress score. An ANOVA was run to determine if differences exist between patient groups with respect to individual NPI symptom domains, total NPI score, or caregiver distress. There were no significant differences between patient groups

with respect to individual or total NPI scores, nor the caregiver distress score. In sum, ARD patients demonstrated as many behavioral and psychological symptoms as AD and VaD patients, as reported by caregivers. Furthermore, caregivers of ARD patients reported as much distress associated with these changes as do caregivers of other dementia patients. Correspondence: *Kara Schmidt, Ph.D., Center for Aging, UMDNJ-SOM, 42 E. Laurel Road, Suite 1800, Stratford, NJ 08084. E-mail: stutzschmidt@juno.com*

R. GONZALEZ, J. JACOBUS, A. BECHARA, D.L. PITRAK, G. NUNNALLY, R.M. NOVAK & E.M. MARTIN. Factors Affecting Gambling Task Performance among Substance Dependent Individuals with HIV.

Substance dependent individuals (SDIs) evidence impairments on the Iowa Gambling Task (IGT): a neurocognitive measure of "decision making capacity" putatively subserved by ventromedial prefrontal brain circuits. However, not all SDIs show IGT deficits. Similarly, HIV+ SDIs show impaired performance on the IGT as a group, but individually these subjects perform variably. In this investigation, we examine if several demographic, medical, and substance use variables account for IGT performance among HIV+ SDIs. We studied 70 HIV+ polysubstance users with multiple DSM-IV diagnoses for past alcohol, cocaine, and/or heroin dependence. The association of selected demographic, medical, and substance use variables on IGT performance were examined using multivariate procedures. Only history of injection drug use (IDU) was significantly associated with IGT deficits ($p < .01$). Non-significant trends were observed between IGT deficits and lower education, positive hepatitis C serostatus, detectable HIV RNA in plasma, and more recent drug use ($ps < .10$). Other medical, demographic, and substance use parameters were not significantly associated with IGT performance. Further analyses revealed that history of IDU remained a statistically significant predictor of IGT performance when examined with several covariates. Among various medical, demographic, and substance use factors, history of IDU best predicts poorer performance on the IGT. Further studies may determine if IDU, in itself, is more neurotoxic (directly or indirectly) than other routes of drug administration, or if other behaviors or illnesses associated with IDU account for poorer "decision making" abilities in this population. Supported by R01DA12828.

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L. MESSINIS, A. BIRIS, K. ASIMAKOPOULOS & I. PARTSALAKI. Effects of Long-term Frequent Cannabis Use on Neuropsychological Functioning in a Greek Sample.

The possible therapeutic use of cannabinoids in medicine emphasizes the need to examine the effects of these compounds on the CNS after long-term, frequent use. In the present study, we examined the effects of long-term, frequent cannabis use on neuropsychological functioning in a sample of Greek Men and Women. Using a comparisons group design we compared 15 long-term frequent cannabis users with a mean of 16.2 (SD= 6.9) yrs of use, with frequency of use ≥ 4 times/week, with 12 shorter-term users with a mean of 8.5 (SD= 5.8) yrs of use, with frequency of use ≥ 4 times/week. The mean abstinence period of cannabis use was ≥ 24 hrs for both groups. Groups were matched on measures of premorbid intelligence, age and drug use. Standard neuropsychological tests that assessed attention, executive functions, memory (learning, forgetting, retrieval) and language were used. Results indicated that long-term cannabis users performed significantly less well than shorter-term users on measures of attention and memory. Long-term users showed higher impaired ability to learn and retain new information than shorter term users. Execu-

tive function and language performance did not differ significantly between the two groups. These results, although preliminary, confirm that long-term frequent cannabis users performance on neuropsychological functioning in certain cognitive domains worsens with increasing years of frequent cannabis use.

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A.D. SCHWEINSBURG, B.J. NAGEL, C. BURKE, A. PARK, S.A. BROWN & S.F. TAPERT. fMRI in Adolescent Marijuana Users After 30 Days of Monitored Abstinence.

Neuropsychological studies suggest that cognitive abnormalities among chronic marijuana using adults may resolve after a month of abstinence, indicating no lasting decrements, but it is unclear whether adolescents may be differentially affected. We previously demonstrated altered functional magnetic imaging (fMRI) response to spatial working memory (SWM) in heavy marijuana using (MJ) adolescents after approximately seven days abstinence, but the persisting neural effects are largely unknown. Therefore, we examined fMRI of SWM among MJ teens after 30 days of monitored abstinence. Participants (16 - 18 years old) were 10 MJ teens with limited alcohol and other drug experience and 10 demographically similar non-using controls. Teens underwent one month of observed urine toxicology screens every two to three days. After one month, abstinence was further confirmed by hair toxicology, and participants completed neuropsychological testing and performed an SWM task during fMRI acquisition. MJ teens performed worse than controls on verbal learning, but better on visuospatial tests. Compared to controls, MJ teens showed less fMRI response in the right middle/inferior frontal gyri and left cuneus, but more activation in the right insula/inferior frontal gyrus (clusters > 943 microliters, $p < .05$). This preliminary study suggests that MJ teens may show abnormalities in verbal learning and brain response to an SWM task compared to controls, even after one month of abstinence. The activation pattern among MJ teens may reflect long-term functional reorganization due to heavy marijuana use, or premorbid features that contribute to maladaptive patterns of substance use. Supported by National Institute on Drug Abuse R21 DA15228 (Tapert)

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M.W. JACOBSON, S.L. ARCHIBALD, I. GRANT, T.L. JERNIGAN & HNRC GROUP. Visuospatial Attention and Methamphetamine Dependence: Increased Regional fMRI Activation and Response Latency.

To use a visual attention paradigm and functional neuroimaging to identify methamphetamine-related changes in 1) fMRI activation patterns in striatal and parietal regions, and 2) response latency in spatial attention shifting. Participants were 7 methamphetamine dependent adults (METH+ group) and 6 matched controls. The visual attention-shifting paradigm uses numbers constructed from global/local Navon-type figures. Using a response box, the subject identifies target numbers (1 - 4) among distractors (5-9) appearing at either the global or local level in directed and divided attention conditions. fMRI results for whole-brain cluster analysis: the METH+ group had increased blood oxygenation level dependent (BOLD) changes in response to the divided attention condition ($p < .05$), especially in thalamus, inferior and superior parietal and occipital lobes compared to controls. Behavioral data indicated that the METH+ group had significantly longer response latency in both directed and divided attention conditions (814 & 975 msec) compared to controls (623 msec & 746 msec respectively). Increased

FMRI BOLD response in the METH+ group suggests a possible compensatory mechanism in neural regions supporting visuospatial attention. Behavioral data indicate deficits in spatial attention-shifting, largely the result of increased latency when the switching response required inhibition of prepotent global targets. These preliminary findings are consistent with recent studies noting brain structure/function alterations resulting from METH-related damage and neurotransmitter dysregulation. Behavioral data are consistent with inhibition, learning and attentional shifting deficits previously noted in this group.

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J.N. WILKINS, C. HINKIN, S. WILKINS & W. VAN GORP. Procedural Memory in Smoking and Non Smoking Males.

To assess the effect of nicotine use on procedural learning and memory, specifically time on target for the pursuit rotor task. 27 subjects were included, 8 cigarette smokers and 19 nonsmokers. Smokers and non-smokers were all African-American males except one and were not statistically different for age and education. All subjects were administered 6 trials of the pursuit rotor test, a task of procedure learning & memory, on 3 days (day 1, day 21 and day 45). Smokers were allowed access to cigarettes at their request, and were not in withdrawal. Over the series of 3 test days all participants demonstrated improvement in time on target on the pursuit rotor. Interestingly, the non-smokers were significantly superior in their performance across all three test days, as measured by two tailed t tests. Day 1 $p = .007$, Day 21, $p = .000$, and day 45 $p = .004$. Recent positron emission tomography data (Sokolovskas, et al., *Am J Psych* 157:632-634, 2000) demonstrated significantly higher uptake of [18F] DOPA in the putamen (17.3%) and caudate (30.4%) of smokers than nonsmokers, and smoking-induced increases in ventral striatal dopamine (Brody et al., *Am J Psych* 161:1211-1218, 2004). In this context, the finding of diminished procedural learning and memory in smokers suggests they have experienced down regulation of striatum-associated neural structures that regulate procedural learning and memory. Down-regulation in the smokers may have occurred as a form of neural adaptation to chronic smoking-induced increases in striatal dopamine.

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B.W. JASPER, R.O. HOPKINS & L.K. WEAVER. Prevalence of Affective Sequelae Following Carbon Monoxide Poisoning: A Prospective Longitudinal Study.

Carbon monoxide (CO) poisoning may result in cognitive and neurologic sequelae yet affective outcome information is limited. The purpose of this study was to assess the prevalence of affective sequelae following CO poisoning. A second purpose was to assess the potential contributions of the mode of poisoning (accidental vs. suicide-attempt), cognitive sequelae (cognitive sequelae vs. no cognitive sequelae) and oxygen dose (hyperbaric oxygen vs. normobaric oxygen) on affective sequelae. We prospectively assessed affective sequelae in 127 CO poisoned patients at 6 weeks, 6 and 12 months. *A priori* affective sequelae were defined as scores on 2 or more measures of depression including the MMPI or SCL-90-R depression subscale T-scores ≥ 65 , BDI score ≥ 15 , or GDS score ≥ 11 ; and anxiety the SCL-90-R anxiety subscale T-score ≥ 65 or BAI score ≥ 15 . The mean COHb was $25.1\% \pm 9.6\%$, 51% lost consciousness, and 35% attempted suicide. 45% of patients had affective sequelae at 6 weeks, 44% at 6 months, and 44% at 12 months. Patients with suicide-attempt were 4 times more likely to have affective sequelae at 6 weeks (odds ratio, 3.8 [95% C.I., 1.7 to 8.7]; $p < 0.01$). Patients with cognitive sequelae were more likely to have affective sequelae at 6 weeks (odds ratio, 3.01 [95% C.I., 1.3 to 6.8]; $p < 0.01$) and 6 months (odds ratio, 2.4 [95% C.I., 1.1 to 5.2]; $p < 0.05$). There was no effect of oxygen dose on affective sequelae. Carbon monoxide poisoning results in significant affective sequelae, that persists up to 12 months.

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M. FEARING, R.O. HOPKINS, L.K. WEAVER & E.D. BIGLER. Basal Ganglia Lesions following Carbon Monoxide (CO) Poisoning.

CO poisoning may result in neuropathological findings, including basal ganglia lesions. This study assessed basal ganglia lesions following CO poisoning. A literature review for studies of CO poisoning with basal ganglia lesions on MR or CT scans identified 59 case and 21 group studies. Of the case studies ($n=59$), 88% had globus pallidus lesions, 6% had caudate and putamen lesions, and 10% had total basal ganglia lesions. Of the 21 group studies, 29% had globus pallidus lesions, 4% had caudate, and 5% had putamen lesions. We prospectively assessed 73 CO poisoned patients for lesions in the basal ganglia. MR scans were obtained on day one, two weeks, and six months following CO poisoning. There were 73 patients (67% males) with a mean age of 35 ± 14 years (range 16 to 86 years), mean educational level 12.1 ± 2.8 years (range 2 to 20 years), and mean COHb $22\% \pm 11\%$ (range 1.2% to 39%), 1 CO poisoned patient had bilateral globus pallidus lesions at 2 weeks and 6 months (normal MR on day 1). Group and case studies showed significant variability in basal ganglia lesion prevalence and location. We found only 1 patient with globus pallidus lesions at 2 weeks and 6 months. While globus pallidus lesions occur following CO poisoning, our findings suggest they may be less common than previously reported. Our findings differ from previous studies as we included consecutive CO poisoned patients rather than a cohort of selected subjects.

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Pediatric TBI

B. SLOMINE, A. DORSCH, J. CHRISTENSEN & M. MCCARTHY. Agreement between Parent Reported Measures of Cognitive Functioning, Adaptive Functioning, and Neuropsychological Functioning in Children following Trauma.

Traumatic brain injury (TBI) is a leading cause of disability for children; however, few studies have been devoted to identifying children in need of a comprehensive neuropsychological evaluation. This study explored if parent ratings of cognitive functioning obtained by telephone could be used to identify children needing clinical evaluation. Parents of 37 children who were 3-months after trauma (TBI or orthopedic injury) were administered the Pediatric Quality of Life Measure, including the cognitive functioning scale (PedsQL-CFS), and the Behavioral Rating Inventory of Executive Functions (BRIEF) by telephone. Telephone ratings were compared to scores on the Vineland Adaptive Behavior Scale (VABS), obtained through in-person parent interview, and neuropsychological tests tapping attention, memory, executive functioning, and processing speed. The PedsQL-CFS and BRIEF were moderately to highly correlated with VABS domains and total score. PedsQL-CFS and BRIEF were moderately correlated with some neuropsychological measures (i.e., fluency, story memory, processing speed). When children were categorized as impaired and unimpaired on the VABS, the impaired group was rated as significantly worse on the PedsQL-CFS and most scales of the BRIEF. When impairment was based on selected individual neuropsychological tests, no differences on the PedsQL-CFS, but worse BRIEF ratings were observed. In conclusion, ratings of cognitive functioning correlate well with results of in-depth interview of adaptive functioning and moderately with specific objective tests of speed, memory, and executive functioning. Results suggest that the PedsQL-CFS and BRIEF can be used to identify children with cognitive and "real world" impairments who would benefit from further evaluation and intervention.

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L.K. AYR, K. YEATES, G. TAYLOR, B. BANGERT, A. DIETRICH, K. NUSS, J. RUSIN & M. WRIGHT. Sources of Variability in the Reports of Post-concussive Symptoms in Children with Mild Head Injuries.

To examine reports of post-concussive symptoms (PCS) associated with pediatric mild head injuries (MHI) as a function of informant, format, symptom type, and time post-injury. Participants include 129 children with MHI and 70 children with orthopedic injuries (OI), from 8-15 years of age, recruited during an ongoing longitudinal study. Parents and children report on PCS within 2 weeks of injury and at 3 months post-injury. At baseline, parents also report on pre-injury symptoms. PCS are assessed using a structured interview that asks respondents to report the presence/absence of 15 symptoms based on the DSM-IV research criteria for Postconcussional Disorder. PCS also are assessed using a 50-item rating scale on which respondents rate symptom frequency on a 4-point scale, ranging from "never" to "often." The OI and MHI groups did not differ premorbidly on any symptoms, based on parents' baseline structured interview. Parents and children in the MHI group reported more cognitive and somatic symptoms, but not more emotional symptoms, than those in the OI group. However, they only reported headaches more frequently at 3 months post-injury. Similar results were found for the rating scale, with significant differences found at baseline for a variety of cognitive and somatic symptoms but not behavioral or emotional symptoms. The differences were no longer significant at the 3-month assessment. Immediately post-injury, children with MHI display more cognitive and somatic symptoms than children with OI, but not more emotional or behavioral symptoms. The symptoms largely resolve by 3 months post-injury. Symptom reports are fairly consistent across informants and report format.

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J. JANUSZ & G.A. GIOIA. Re-Examination of the Construct Validity of the Post-Concussion Symptom Inventory- Self Report (PCSI-S) in Children and Adolescents.

Assessment of symptoms following concussion includes standardized neurocognitive assessment, as well as ratings of post-concussive symptoms. The Post-Concussion Symptom Inventory (PCSI-S) is a self-rating of 22 symptoms commonly seen after concussion. Recent analyses of this measure with a combined pediatric sample (concussed and non-concussed) determined four specific clusters of core symptoms. This study provides a re-examination of the scale's construct validity based on a larger sample of concussed children and with respect to a conceptual model for parent-report of post-concussive symptoms. The PCS was administered to 151 children (age 7-18; 130 boys, 21 girls) with a history of concussion. The 22-item scale was submitted to a principal factor analysis with Promax rotation. Internal consistency reliabilities were also calculated to examine the integrity of the item-scale membership. Examination of competing solutions supports a five-factor solution as most statistically and theoretically sound, accounting for 69% of the variance. The solution is defined by a Somatic Symptoms factor (7 items), a Cognitive Problems factor (4 items), a Fatigue factor (5 items), a Sleep Problems factor (2 items), and an Affective Problems factor (5 items). Internal consistency reliabilities were acceptable for the five factors (Somatic $\alpha = 0.86$; Cognitive $\alpha = 0.81$; Fatigue $\alpha = 0.87$; Sleep Problems $\alpha = 0.81$; Affective $\alpha = 0.80$) and the total scale ($\alpha = 0.94$). Re-examination of the factor structure of the PCSI-S reveals five specific domains of

post-concussive symptoms. This factor structure is similar to the parent-completed version. These findings support the use of this subscale configuration, in addition to the total symptom score, in clinical interpretation. Future research will focus on further scale refinement, as well as the clinical utility of the scale for monitoring symptoms over time.

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S.R. MCCAULEY. Delaying the Execution of To-Be-Performed Actions Over Brief Delays Impairs Performance Following Mild Traumatic Brain Injury in Children.

To determine the effect delaying the execution of a prospective memory task was negatively affected by mild TBI in children. Children with orthopedic injuries (N=16) or mild TBI (N=14) were asked to read a series of short paragraphs from a computer screen and answer content questions about them following intervening tasks. The subjects were also told to watch for 3 cue words in these paragraphs and to press a specific key once they reached a task presented on a blue screen (prospective memory-PM). The delay between the PM cue and the presentation of a blue screen was set at 5 or 15 seconds. Following these trials (Control condition), a visual reminder to mentally rehearse a phrase to enhance PM performance ("blue screen-press key") was presented during paragraphs containing a PM cue (Rehearse condition). Results of the 2 X 2 X 2 mixed ANOVA on the accuracy of PM responses indicated a Group X Condition interaction ($F(1,87)=16.47, p<0.0001$), a main effect of Condition ($F(1,87)=16.47, p<0.0001$), and a main effect of Group ($F(1,87)=16.47, p<0.0001$); there was no main effect for 5 vs. 15-second delay ($p=0.18$). Rehearse condition performance exceeded the Control condition, and the TBI group performed more poorly than the Ortho group. Planned comparisons indicated that the TBI group performed more poorly in the Control condition compared to the Ortho group (45.2% vs. 77.1%), but performed similarly in the Rehearse condition (98.8% vs. 99.9%). Delaying the execution of a PM task by very short intervals impairs performance in mild TBI, but can be mitigated by rehearsal.

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A.J. BROWN, D.C. WEERS, R.E. JUNG, J.P. PHILLIPS, R.C. CAMPBELL, S. KERNEN, W.M. BROOKS & R.A. YEO. Variance in NAA Distinguishes Between Brain-Injured and Healthy Children and Predicts Cognitive Performance in Total Sample.

Decreased concentrations of N-acetylaspartate (NAA) have been associated with brain pathology, including traumatic brain injury, by many researchers using magnetic resonance spectroscopy (MRS). Typically these studies utilize a single voxel technique, which measures the neurometabolites in one location. In contrast, proton magnetic resonance spectroscopic imaging (SI) allows the simultaneous assessment of neurochemistry across many brain regions, permitting analysis of neurometabolic variance. Such variance might be expected to increase with pathology as control mechanisms are compromised and injury effects might not be uniformly distributed. A sample of 9 brain injured and 10 healthy children (ages 9-18) were studied using SI techniques on a 1.5 Tesla GE Signa MR scanner. Data were analyzed on LCModel and compared to an overall z-score from a broad test battery. Variance in NAA predicted injury status ($R^2 = .427, p = .001$). Variance in NAA correlated with overall performance on a cognitive battery ($r = -.518, p = .023$) in the total sample, but not within groups. Variance also correlated with NAA mean ($r = .595, p = .007$) in the total sample but not within groups. Mean NAA correlated with cognitive performance in the total sample ($r =$

.766, $p < .001$) and in the injured group ($r = .668$, $p = .049$). A regression equation including both mean NAA and variance in NAA to predict cognitive performance was highly significant ($R^2 = .592$, $p = .001$). Neurometabolite variance is a useful index of pathology and function in brain injury.

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S.J. KERNEN, R.A. YEO, J.P. PHILLIPS, R.E. JUNG, R.C. CAMPBELL, A.J. BROWN & W.M. BROOKS. Spectroscopy Study of Pediatric TBI: A Hierarchical Analysis of Trail Making Tests A and B.

Recent reports (Yeo et al., 2003; Weers, et al., under review) used proton magnetic resonance spectroscopy (1H-MRS) and neuropsychological testing to assess effects of traumatic brain injury (TBI) on cognitive function in children. 1H-MRS provides an in vivo analysis of metabolites, including N-acetylaspartate (NAA), choline (Cho), and creatine-phosphocreatine (Cre). Children with TBI had lower mean NAA/Cre and higher mean Cho/Cre than controls, and scored more poorly on composite neuropsychological tests. We identified specific functions, and we compared relationships between neurometabolites and Trail Making Tests A and B (TMT-A&B) and dominant hand motor skill (DHMS). Hypotheses: (1) DHMS predicted best by neurometabolites, then A & B equally predicted, with equal motor. (2) With complexity, B would be best predicted, then A followed by DHMS. (3) With processing speed, A & B would be equally predicted, then DHMS. Methods: 27 children were recruited from inpatients, $N = 27$, Mean age = 14.63 (SD=2.56). 12 community controls ranged from, $N = 12$, Mean = 15.00 (SD=1.60). All were scanned with a 1.5 Tesla GE Signa clinical MR scanner (TE=62ms). SPSS 12.0 was used to analyze all data. DHMS performance between groups were averaged to provide an overall measure of DHMS. Results: All neurometabolite and test results differed significantly across groups. Partial correlations (excluding age) are shown below for TBI patients. DHMS TMT-A TMT-B NAA/Cre .13 (ns) .58 ($p < .05$) .48 ($p < .05$) Cho/Cre -.06 -.54 ($p < .05$) -.44 ($p < .05$) Regression analyses were used to estimate variance accounted for in the 3 testing variables by the 2 neurometabolites; 34% of the variance in TMT-A was accounted for by NAA/Cre and Cho/Cre ($p = .008$), as compared to 30% ($p = .03$) in TMT-B and 10% in motor skill (ns). These results suggest that NAA/Cre and Cho/Cre were more highly predictive of the speed of basic cognitive information processing than motor skill or cognitive complexity.

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B. SLOMINE, S. CYNTHIA, M. GRADOS, R. VASA, J. CHRISTENSEN & J. GERRING. Attention, Memory, and Executive Functioning in Children with Severe Traumatic Brain Injury with and without ADHD after Injury.

Although the development of Attention Deficit Hyperactivity Disorder (ADHD) after traumatic brain injury (TBI) has been described, it is unknown whether children with TBI and ADHD have greater neuropsychological impairments than children with TBI alone. This study compared performance on measures of attention, memory, and executive functioning in children following severe TBI with ADHD to children with severe TBI alone. Eighty-two children (6-16 years) with severe TBI were examined. Parents completed a structured interview to diagnosis pre-morbid ADHD at enrollment and post-injury ADHD 1-year after injury. Neuropsychological testing was conducted 1-year after injury. Results indicated worse performance in the TBI with ADHD group on measures of attention and concentration (Freedom from Distractibility, Response Time Variability), learning and memory (California Verbal Learn-

ing Test for Children), and one test of executive functioning (4-Ring Tower of Hanoi) compared to TBI only group. Other variables of sustained attention and executive functioning were not different between the TBI with ADHD and TBI only groups. Within the TBI with ADHD group, no significant neuropsychological differences were noted between children with newly developed ADHD (i.e., secondary ADHD or S-ADHD) compared to those with premorbid ADHD that persisted after injury (i.e., persisting ADHD or P-ADHD). Results suggest that the addition of ADHD to severe TBI is associated with worse performance on specific measures of attention, memory, and executive functioning. Further research is necessary to clarify neuropsychological differences in children with P-ADHD and S-ADHD following severe TBI.

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S. WARSCHAUSKY, R. AYYANGAR, J.B. KAY & J. HEMME. Differences in TOVA Continuous Performance Profiles in Children with TBI or ADHD.

A subset of children with TBI has been shown to exhibit symptoms similar to ADHD. Recently, Hemme et al. did not find significant differences between groups with TBI or ADHD in focused/selective attention, sustained attention, working memory, or processing speed. This study further examines group differences in attention by comparing TOVA omission and commission error rates during high versus low frequency target conditions. Two samples, identified from neuropsychological databases at a tertiary care university medical center, were comprised of 56 children, ages 6-16, including 24 children who sustained a moderate/severe TBI and 32 diagnosed with ADHD. Children were evaluated two months to nine years post-injury (months: $M = 37$; $SD = 37$), and their ages at the time of injury ranged from 7 months to 16 years (years: $M = 8.7$; $SD = 4.7$). Time since injury was not related to the variables of interest. Of the 32 children diagnosed with ADHD, 15 were Predominantly Inattentive Type and 17 were diagnosed with Combined Type. Children were similar with regard to age, race, gender, socioeconomic status, and intelligence, as indicated by the WISC-III Full Scale IQ. Participants were administered a brief neuropsychological evaluation that included the TOVA and the WISC-III. The TOVA is a 23-minute objective, standardized, continuous performance test of attention. The visual version of the TOVA was utilized in the current study. There was no main effect for group on overall omission error rates. However, the TBI group showed significantly increased omission error rates under the high frequency target condition. Main effects and interactions for Commission errors were not significant. There appear to be subtle differences in the attentional profiles of children with TBI or ADHD that are not captured by more global scores on neuropsychological tests. Findings may be associated with processing speed deficits commonly noted after TBI.

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M.D. SCHRODER & S.C. HEATON. Memory Functioning after Pediatric Traumatic Brain Injury: What's the Trouble?

Memory impairments are common following childhood traumatic brain injury (TBI; Yeates, 2000). While memory deficits have been shown to be more extensive for severe injuries (Farmer et al., 1999), findings have been mixed regarding the pattern of impairment across specific dimensions of memory. The current study examined various aspects of memory measured by the Children's Memory Scale (CMS). Children ages 7-16 with Mild TBI ($n=9$), Severe TBI ($n=11$), and non-TBI Orthopedic Controls ($n=8$) were evaluated within 6 months of injury. The groups did not significantly differ on age, time since injury, gender, ethnicity, or Verbal IQ. Participants completed core subtests of the CMS, and

performance was examined on Learning, General Memory, and Delayed Recognition Indexes, as well as calculated Percent Retention scores. ANOVAs with Bonferroni-corrected post-hoc tests were conducted to compare the groups. The Severe TBI group performed significantly worse than both the Mild TBI and Orthopedic Control groups on the Learning, General Memory, and Delayed Recognition Indexes. The Mild TBI and Orthopedic Control groups performed within the Average range on all indexes. In contrast, all three groups demonstrated good Percent Retention rates (Severe TBI group means over 87%), with no significant group differences. In summary, children sustaining Severe TBI showed worse *learning, recall, and recognition* functioning than children with Mild TBI and Orthopedic Controls, but showed similar *retention rates*. These findings suggest that children sustaining severe TBI may benefit from interventions that target the initial acquisition of learning material rather than focusing solely on recall or retention strategies. Correspondence: *Marie D. Schroder, B.S., Department of Clinical and Health Psychology, University of Florida, P.O. Box 100165, Gainesville, FL 32610-0165. E-mail: mschrode@phhp.ufl.edu*

L.G. COOK & S.B. CHAPMAN. Self-Regulation and Planning in Children with Severe Traumatic Brain Injury: A Novel Naturalistic Approach.

A traumatic brain injury (TBI) in childhood may disrupt executive functions such as planning and self-regulation. Thus, children with TBI are at risk for emerging academic failure and increasing difficulty on everyday, naturalistic tasks requiring these higher-order cognitive abilities. Whereas studies have revealed impairment in naturalistic action production in adults with brain injury, the question as to whether there is a similar disturbance in children with brain injury remains unexplored. The current study investigated planning and self-regulation abilities in children with severe TBI ($n=11$) as compared to normally developing children ($n=21$) during a naturalistic action task in the context of a birthday party. The "Birthday Task" assessed the ability to perform three familiar tasks using real objects (both necessary items and distractor items) while adhering to specific rules. The GLM analysis revealed that the TBI group exhibited increased use of distractor objects in place of target objects (object substitutions) when carrying out the required tasks as compared to the non-injured children ($p=.017$). Additionally, trends were demonstrated by children with TBI in greater exclusion of necessary steps (omission errors) as well as in increased rule violation during the task. Children's ability to implement an effective plan and practice self-regulation (e.g., following rules) in the face of competing schemas (e.g., resisting distractor elements) may be impaired after severe TBI. Two possible explanations for lower performance in the TBI group include either decreased supervisory processes or inefficient top-down activation of naturalistic action, with a bias toward bottom-up activation.

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S.R. BEERS, A. SKOLD, E. DIXON & D. ADELSON. The Use of a Dopamine Agonist to Enhance Recovery after Pediatric TBI.

Pediatric TBI results in cognitive deficits, affective disturbances, personality changes, and behavior problems. Chronic difficulties in executive skills mediated by frontal brain systems influence learning, the essential task of childhood. Although there is evidence dopamine agonists attenuate executive deficits, there is minimal information regarding pharmacological interventions. This study evaluated the safety and efficacy of amantadine hydrochloride (AMH) to improve behavior and neuropsychological status of children post-TBI. Age- ($p=0.57$), gender- ($p=0.57$), and severity- ($p=0.54$) matched children 6-16 years, who met screening criteria for behaviors consistent with frontal dysfunction, were randomized to AMH ($n=17$) or standard care ($n=10$). Behavior Rating Inventory of Executive Function (BRIEF) and performance-based measures

were completed at baseline and after the 12-week treatment regimen. AMH was administered according to the lowest recommended dose by weight. Side effects were tracked daily (Week 1) and weekly thereafter. Side effects generally remitted by Week-2; with one exception, side effects Weeks 2-12 were classified as minor/very minor. ANOVA indicated decrease in BRIEF GEC ($F[1,25]=21.82$, $p=.007$), MI ($F[1,25]=8.52$, $p=.007$), and BRI ($F[1,25]=18.17$, $p=.000$) scores in the AMH group. No significant differences were noted on performance-based measures. Post hoc analyses of children with > moderate TBI and <24 months postinjury showed > medium effect sizes for Trail Making, Stroop, and Tower of London. AMH was safe and improved behavior. Effect sizes indicated AMH improves cognition in recently injured children. Although preliminary, findings suggest that AMH administered during active recovery assuages behavioral and cognitive sequelae of TBI. Double-blind studies are required to confirm our findings.

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G. HORNEMAN & I. EMANUELSON. Traumatic Brain Injury in Childhood; Cognitive Outcome Ten Years Later.

Long term outcome in adolescents and young adults who suffered TBI in childhood. 165 survivors of TBI injured during 1987-1991 in the age-group 0-17 years were identified. The traceable individuals (132) were invited to a follow-up investigation of which 53 accepted and took part in a neuropsychological investigation 10 years post injury. A neuropsychological test battery consisting of Vocabulary and Block Design from WISC-III and WAIS-R, Rey Auditory Verbal Learning Test (RAVLT), Rey Complex Figure Test, Children's Category Test, de Renzi and Faglioni's Token Test, TMT A and B and Test d2 were administered. A control group of healthy individuals, matched for gender and age was tested for comparison purposes. 38/53 (72%) individuals had not been offered any rehabilitation services. The study group showed significantly lower results compared to the control group regarding Vocabulary ($p=0.000087$) and block Design ($p=0.0173$) on WISC-III/WAIS-R. They also exhibited poorer results on RAVLT, total learning ($p=0.0001$), immediate recall ($p=0.0179$) and total recall ($p=0.0067$). There were no significant differences on Rey Complex Figure Test. This subgroup did not differ from the original group concerning severity of injury and length of unconsciousness. The most striking feature is the impaired verbal learning capacity and poor verbal memory resulting in lower IQ.

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C. WELLS, D.W. BEEBE, L.S. KRIVITZKY, S. WADE, H.G. TAYLOR & K.O. YEATES. Sleep Disturbances & Neuropsychological Outcome Following Moderate to Severe Pediatric TBI.

We recently reported significant parent-reported sleep problems in school-age children post-TBI that were predictive of later behavior problems. Outside of TBI, pediatric sleep problems have also been linked to neuropsychological problems. This study investigated whether sleep problems were also predictive of cognitive deficits post-TBI. As part of a larger study, 109 school-age children with moderate to severe TBI were compared to 80 children who sustained orthopedic injuries only. Parent-reported sleep data collected at 6 months and 1-year post-injury, and neuropsychological findings 1-year post-injury were examined. Prior research indicated that parents in the TBI group (post-injury) more frequently endorsed "trouble sleeping" and "overtired" (6 & 12 months), and "nightmares" and "sleeps more than normal" (12 months). Regression analyses were performed to develop predictor models for each of several neuropsychological tests, entering age at injury, sex, ethnicity, and SES first as covariates. At 12 months post-injury, the TBI group

fared significantly worse on tests of mental flexibility, visual construction, verbal memory, and verbal abstraction. Covarying the four sleep problems at 12 months did not substantially reduce the variance in test scores that could be attributed to TBI. However, the two sleep problems at 6 months often predicted deficits at 12 months and substantially reduced the variance accounted for by TBI at 12 months on most tests. Parent-reported sleep problems at six months post-TBI predict later functioning in several neuropsychological domains. Sleep problems may represent markers for neuropathology and are worthy of further clinical and research attention.

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Sex Differences/Sex Hormones

A.S. DAVIS, A.N. BARDOS, R.C. D'AMATO & A.W. SHUNK. Neuropsychological Gender Differences in Planning, Attention, Simultaneous and Successive Processing.

Research conducted using the Planning, Attention, Simultaneous and Successive (PASS) theory based on Lurias work has suggested that female learners have superior cognitive processing abilities in the areas of Planning and Attention. However, research is lacking regarding cognitive processing and gender differences in adults. This study used the Cognitive Assessment System for Adults (CASA), a neuropsychologically based test that is in the early stages of development to measure gender differences in 109 normal adults. The CASA consists of 16 tasks that are based on the PASS model. A MANOVA indicated no significant gender differences found on the Planning, Attention, Simultaneous and Successive index scores; Wilks Lambda = .96, $F(4, 104) = 1.23$, $p > .05$. The results of a Repeated Measures MANOVA revealed no significant gender differences within the group of male participants on the four composites of the CASA; $F = .68$, $p > .05$; and there were no significant differences within the group of female participants on the four composites of the CASA; $F = .73$, $p > .05$. The amelioration of gender differences found in this study suggests that previous research which observed gender processing differences in children and adolescents may be related to divergent gender-based rates of cortical growth, especially in the area of the frontal lobes that are related to executive functioning. This presentation will present and discuss these results as they relate to neuropsychological gender differences, as well as the validity and utility of the CASA.

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J. IMIG, K. MORDECAI, S. ALL, A. HARTZELL & R. ERWIN. Sex Differences in Emotional Recognition and Hemispheric Asymmetry: The Impact of Hormonal Fluctuations throughout the Menstrual Cycle.

Previous studies have identified sex difference in cognitive abilities including a verbal expression advantage for females and a spatial rotation advantage for males. Until recently, findings regarding possible sex differences in emotional recognition processes remained equivocal. In our previous research (Erwin et al., 1992; Imig et al., 2000) employing both whole face and chimera stimuli, we identified sex differences in the recognition of facial emotion and in the asymmetry, as measured by a left visual field bias, associated with facial emotion processing. The current study is designed to evaluate the role normal fluctuating hormonal concentrations may have on these processes. Thirteen right-handed female participants were tested during the menses and midluteal phases of the menstrual cycle and compared to 13 right-handed male participants

yoked to time between testing. Confirmatory ovulation blood assays of estrogen and progesterone (females only), self-report measures of depression, anxiety, positive and negative affect, and a test of mental rotation abilities were collected at both times of testing. Preliminary analysis of female asymmetry data indicated stable asymmetry scores across time for both happy and sad chimera tasks; however, individual variability existed and possible contributing factors will be investigated. Additional analysis indicated a significant difference across time in self-reported depression. Females indicated significantly more ($p < .05$) depressive symptomatology during the menses than the midluteal phase of the cycle. These findings suggest that asymmetry may be a relatively stable property with greater individual than group variability. However, self-reported depression appears to be particularly sensitive to normal fluctuations in hormones. As a result, future studies examining gender difference in depression may need to evaluate the impact of phase of cycle on depressive symptomatology.

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M.A. ZELLER, J.J. DUNKIN, N. RASGON, K. WAGNER-STEHL, L. ALTSHULER & A. RAPKIN. The Effects of Circulating Hormones on Cognition Within a Sample of Depressed and Non-Depressed Postmenopausal Women.

Literature suggests the influence of cortisol on cognition fluctuates throughout development. Prenatal exposure to high levels of cortisol have been associated with improved spatial ability among girls. Increased cortisol levels among premenopausal women have been associated with decreased reaction times, but increased verbal fluency. However, controversy exists in the literature regarding the effects of circulating hormone levels among postmenopausal women. For instance, high cortisol levels have been associated with poor explicit memory, selective attention, and category fluency, while high levels of estradiol have been associated with better verbal and visual memory, but other studies have demonstrated that hormones are not correlated with cognition. This study examines hormone levels and cognitive functioning in depressed ($N=27$) and non-depressed ($N=23$) postmenopausal women. Prior to receiving ERT, subjects were tested for baseline levels of estrogen, cortisol, follicle stimulating hormone (FSH), dehydroepiandrosterone (DHEA) and prolactin, and were administered a complete neuropsychological battery. Test scores were standardized on the mean and standard deviation of the control group and Z-scores were averaged to create four composite scores: attention, verbal memory, nonverbal memory, and executive functioning. Results were nonsignificant for estrogen, FSH, DHEA, and prolactin. Multiple linear regression analysis revealed a significant interaction between cortisol and diagnostic group, as higher cortisol was associated with worse attention in the control group and better attention in the depressed group. This may be due to an overall down-regulation of the hormonal milieu in postmenopausal depressed women, making them less vulnerable to negative effects of cortisol, in contrast to previous findings in younger samples. Therefore, prior conflicting results may be partially explained by menopausal status of the sample.

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P. DAHLSTROM, S. MACDONALD & A. HERLITZ. The Effect of Free Testosterone on Cognitive Performance in a Population Based Sample.

The relationship between testosterone and cognitive performance has been explored to some extent, often yielding conflicting evidence. Increased testosterone has, for example, been shown to both positively and negatively influence block design performance. The objective of the present study was to investigate the relation between bio-available testos-

terone and cognition, specifically addressing methodological difficulties and differences regarding sampling procedures and analyses of hormone levels, inconsistencies in cognitive batteries, and variations in age groups. A population-based sample of 286 women and 251 men (45 to 90 years of age) from the Betula Study (Umea, Sweden) were assessed individually on the WAIS block design task, the Mini-Mental State Examination, and on semantic and episodic memory tasks. Serum free testosterone was analyzed using fluoroimmunoassay. Statistical covariates included age, education level, and medications that might influence cognitive performance. Preliminary results show that free testosterone significantly influences block design performance for men, with higher levels of free testosterone exerting a larger influence than lower levels across four of the five age groups. Female results show a non-significant trend in the same direction. In addition, results show that women in the low testosterone group performed better on a female-favoring episodic memory task than all other groups. The current results support the notion that hormonal action has different functions across genders and that testosterone benefit male performance on spatial visualization.

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M. LACY, E. PELUSO, S. GUPTA, K. KUBALL & M. RODIN. Neurocognitive Impact of Adjuvant Hormonal Therapy in Postmenopausal Breast Cancer Women.

In a recent study, Tamoxifen was associated with lower semantic memory scores and frontal hypometabolism (Eberling, Wu, & Tong, 2004). While the use of hormonal therapies for breast cancer treatment is common, few studies have examined the cognitive effects of such anti-estrogen therapies in older survivors. The current study presents neurocognitive and functional data of an accruing cohort of postmenopausal women before and after beginning adjuvant hormonal therapy. Twenty-one participants underwent a comprehensive neurocognitive assessment prior to starting treatment, with fifteen tested again at 3 and 6 months. Inclusion criteria included early stage BCa participants, age > 50 years, with planned adjuvant tamoxifen or anastrozole treatment. Exclusion criteria included previous history of cancer, chemotherapy, and baseline (MMSE) scores < 23. Baseline analyses indicated intact global cognitive functioning (MMSE=28), yet subtle verbal memory, cognitive flexibility, and motor speed inefficiencies when compared to normative samples. Subsequent analyses indicated that 9 of the initial 21 participants (43%) were cognitively impaired (1.5 standard deviations below normative samples) on >2 assessment measures. Three-month post-treatment analysis revealed significant declines in visual learning (BVMT immediate $p = .02$, delayed $p = .001$, recognition $p = .03$) and a trend towards decreased working memory (digit span backwards $p = .07$). At six months post treatment, visual memory deficits persisted ($p = .02$). Prior to initiating treatment, older women diagnosed with breast cancer display subtle cognitive deficits. Furthermore, following hormonal treatment, survivors exhibit persisting declines in visual memory abilities. Etiology of such dysfunction is still uncertain, but several hypotheses will be discussed.

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J.J. DUNKIN, N. RASGON, K. WAGNER-STEHL, M. ZELLER, S. DAVID, L. ALTSHULER & A. RAPKIN. Effects of Estrogen on Cognition in Depressed and Nondepressed Postmenopausal Women.

Research on the effects of depression on cognition has been mixed as to whether treatment ameliorates deficits. Estrogen (E2) has been found to be beneficial to mood, but its effects on cognition are con-

troversial. In this study, we examined effects of E2 on cognition in depressed and nondepressed postmenopausal women in a 10-week randomized trial. Depressed subjects ($n=20$) met DSM-IV criteria for Major Depression. Controls ($n=17$) had no psychiatric history. All depressed subjects were treated with sertraline and randomly assigned to augmentation with E2 or placebo; controls were randomized to E2 or placebo. A neuropsychological battery was administered before and after treatment. Scores were standardized based on the mean and S.D. of the control group and averaged to create 4 composite scores: executive functions (EXEC), verbal memory (VMEM), nonverbal memory (NVMEM), and attention (ATTN). Data were analyzed using 2x2x2 ANCOVAs, with time, drug (E2 vs placebo) and group (depressed vs control) as factors, and years since menopause, verbal IQ, and HAM-D change score as covariates. Results of the ANCOVAs for NVMEM, VMEM, and ATTN were nonsignificant. Results for EXEC revealed a significant time x drug interaction, such that scores of the placebo group dropped over the course of the trial relative to the estrogen group. There was a significant interaction between time x drug x years since menopause, such that younger women demonstrated greater positive change in executive functioning than older women in the E2 treated group. Results suggest that regardless of diagnostic group, treatment with E2 had a mild positive effect on executive functions, after controlling for premorbid VIQ and treatment response. In addition, women who benefitted the most tended to be those who were more recently postmenopausal. The results raise the question of whether there is a "critical window" just after menopause when treatment with estrogen is most beneficial to cognition.

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C.M. GENEST, K.J. MILLER, L.M. ERCOLI, P. SIDDARTH & G.W. SMALL. Cognitive Effects of Hormone Replacement Therapy in Post-Menopausal Women.

The effect of estrogen on cognition is a widely studied, and controversial, topic. Studies of both estrogen replacement therapy (ERT) and combination hormone replacement therapy (HRT) in postmenopausal women have yielded mixed results. Some investigators have reported that ERT users perform better than both non-ERT users and HRT users on measures of verbal memory, verbal fluency, and executive functioning. The current analyses examined neuropsychological performance on measures of immediate and delayed verbal memory, verbal fluency, attention, and executive functioning in nondemented postmenopausal women. 147 women (89 non-HRT users, 25 ERT users, 33 combination HRT users; mean overall age \pm standard deviation = 63.75 \pm 9.66) were included in the analyses. Subjects were excluded based on Mini-Mental Status Exam (MMSE) scores (<25) consistent with dementia. Controlling for both age and education, the current study found that women taking HRT performed better than women taking no HRT on a measure of immediate verbal memory (Buschke Total Recall; $F(2, 142) = 5.59$, $p < .01$), and somewhat worse on measures of attention and executive functioning (Trails A and B; $F(2, 142) = 3.65$, $p = .03$; $F(2, 142) = 2.99$, $p = .05$). Alternately, women taking ERT performed more poorly than women taking no HRT on these same measures. No significant differences were found between groups on either measures of verbal fluency or delayed verbal memory. These findings suggest possible benefits of HRT in terms of cognitive functioning, while calling for further analysis of both HRT and ERT in the aging process.

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C.L. KERNAN, K.J. MILLER, C. GENEST, P. SIDDARTH, L. ER-COLI & G.W. SMALL. Cognitive Profile During Perimenopause: Parallels to Post-menopause?

While controversy continues over the medical risks associated with hormone replacement therapy (HRT) in postmenopausal women, recent research indicates that HRT may protect against depression and cognitive decline. While mood problems are associated with changing estrogen levels during perimenopause, little is understood about the effects of these fluctuations on cognition. The objective of the current study is to explore a possibly distinct cognitive profile for perimenopause. A sample of 11 men age-matched to 11 women was examined; in addition, neuropsychological test results from two case studies are presented to provide a clinical portrait of perimenopausal cognitive difficulties. The sample of age matched data revealed no differences in mood, but several trends for cognitive differences, including: better verbal memory for the men (Verbal Paired Associates, $p = 0.09$; Buschke LTS, $p = 0.03$; Buschke TR, $p = 0.07$) and better executive functioning (WCST Learning to Learn, $p = 0.09$; Perseveration Errors, $p = 0.05$). The case studies illustrate that both women (ages 48 and 49) reported few mood symptoms, but exhibited marked reductions on verbal memory tasks and tests of executive functioning. These results are particularly striking given their intact performance in other domains and their high levels of education and pre-morbid intellectual functioning. In conclusion, these perimenopausal women exhibited profiles similar to those published on postmenopausal women. This study indicates that verbal memory and executive difficulties associated with declining estrogen levels may begin in the earliest stages of menopause — warranting further exploration of this cognitive profile.

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J.N. HOOK, B. GIORDANI, M. STARKMAN, D.E. SCHTEINGART, K. GUIRE & S.A. LANGENECKER. Tracking Cognitive Change after Successful Treatment of Cushing's Disease.

Chronically elevated levels of cortisol are associated with changes in cognitive functioning and brain morphology. Using Cushing's disease (CD) as a model to assess the effects of high levels of cortisol on cognitive functioning, patients with CD were examined at pre-surgery and three follow-ups post successful surgical treatment to see how and when cognitive functioning would change with decreasing cortisol levels. 27 patients with ACTH-dependent CD were examined at baseline and three periods post successful surgical treatment (3-5 months, 6-12 months, and 13-18 months). At all four time periods, patients were administered tests of verbal fluency, recall, and brief attention; alternate forms of these measures were used to control for practice effects. At all four assessment periods, plasma and urinary free cortisol was measured. Repeated measure ANCOVAs (controlling for age, education, and baseline cortisol) showed that there is a specific pattern of significant cognitive improvement following successful treatment. Verbal fluency and verbal recall both showed recovery following surgery, though a test of brief attention did not. Using a median-split for age and entering it into a repeated measure model, age of participants was a significant factor as to when recovery of function occurred, such that younger patients (17-39 years) regained and sustained their improvement in cognitive functioning more quickly than did older participants (40-72 years). Improvement in verbal recall was associated with a decrease in cortisol levels. Overall it appears that at least some of the deleterious effects of prolonged hypercortisolemia on cognitive functioning are potentially reversible, up to at least 18 months post treatment and that age is related to when recovery may occur.

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SATURDAY MORNING, FEBRUARY 5, 2005

Symposium 16/11:00 a.m.-1:00 p.m.

The Natural History, Cognitive Profile and Brain-Behavior Correlates of Vascular Cognitive Impairment (VCI)

Chair: David Nyenhuis
Discussant: David Garron

D. NYENHUIS. The Natural History, Cognitive Profile and Brain-Behavior Correlates of Vascular Cognitive Impairment (VCI).

Vascular dementia is only one component of Vascular Cognitive Impairment (VCI), which also incorporates Vascular Cognitive Impairment No Dementia (Vascular CIND) and Mixed Vascular + other disease, most commonly Alzheimer's disease (AD). This symposium will explore VCI from the perspectives of epidemiology, neuropsychology and neuroimaging. Dr. Nyenhuis will provide an overview of the epidemiology of VCI, including both the natural history and risk factors for the condition. He will present data from the Risk Markers for Dementia After Stroke study that thus far shows a much smaller conversion rate from Vascular CIND to dementia than has been seen previously. Dr. Libon will then provide an overview of the neuropsychology of VCI and explore how the different aspects of Baddeley's working memory model relate to patients with mild or moderate-severe leukoariosis. Dr. Mungas will then introduce the challenges of differentiating VCI from AD. His study introduces structural MRI variables for cerebrovascular disease (CVD) and AD, and shows that baseline and longitudinal outcomes are dependent on the presence or absence of these imaging markers. Dr.

Stebbins will then compare two pre-dementia conditions, Mild Cognitive Impairment (MCI) and Vascular CIND, using voxel-based morphometric techniques. He finds that while the Vascular CIND group shows decreased thalamic, frontal and parietal densities, the MCI group shows decreased densities in medial aspects of the temporal lobes. Dr. Garron will then discuss the four studies in the historical context of AD and VCI research.

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D.J. LIBON, K.S. SCHMIDT, J. GALLO, M. LAMAR, C. PRICE, N. SESTITO & C. FERRI. Disambiguating Components of Baddeley's Working Memory Model in Patients with Subcortical White Matter Alterations.

Introduction - Smith et al. (1998) have linked areas of the brain to Baddeley's working memory model (WM): Brodman area 7 to storage, area 45 to rehearsal, and area 46 to manipulation/ inhibition. Our research applies the research of Baddeley and Smith to the WM deficits in dementia patients with subcortical white matter alterations. Methods - Dementia patients with mild Leukoariosis (LA, $n=18$) versus moderate/severe LA ($n=14$) were administered a digits backwards task (DBT). The DBT consisted of spans of 3, 4, and 5. A WM-storage component (SC) was measured by span length. The WM-rehearsal component (RC) was defined by the production of sequence, omission, and commission errors. The WM-manipulation component (MC) was defined by stimulus-bound errors. Results - Moderate/ severe LA made more total errors ($p < .001$). The span x diagnosis interaction was significant. Moderate/ severe LA made more errors on each span suggesting greater WM-SC compromise. The error type x group interaction was significant ($p < .001$). No difference in RC versus MC errors was found for mild LA. Moderate/ severe LA produced more RC than MC errors ($p < .001$).

indicating greater WM-rehearsal than WM-manipulation deficits. Moderate/severe LA demonstrated greater storage/rehearsal impairment. Regarding manipulation, there were no striking between group differences. Discussion - Past research demonstrates that patients with significant LA are impaired on executive control. These data suggest the effect of LA on WM may not specifically compromise the prefrontal cortex, but derail the ability of the frontal lobes to coordinate cognitive functions, perhaps mediated by other brain areas.

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D. MUNGAS, C. DECARLI, B. REED, W. JAGUST, J. KRAMER, M. WEINER & H. CHUI. Structural MRI and Cognitive Status: Cerebrovascular and Alzheimer's Effects on Cognitive Impairment and Dementia.

This study examined how structural brain components associated with cerebrovascular disease (CVD) and Alzheimer's disease (AD) relate to cognitive status: Normal (N) vs. Mildly Impaired (MI) vs. Demented (D). Participants with and without subcortical CVD whose cognitive status varied from N to D were recruited for a longitudinal study. Volumetric MRI measures of subcortical lacunes (Lac) and white matter hyperintensities (WMH) were regarded as measures of CVD, decreased hippocampal volume (HC) was considered an indicator of AD, and cortical gray matter volume (CGM) was considered a marker of both AD and CVD. Logistic regression analyses evaluated the following relationships: 1) cross sectional MRI and cognitive status, 2) longitudinal change in MRI with change in cognitive status, and 3) baseline MRI predictors of change in cognitive status. These different analyses provide converging evidence about how structural brain components relate to cognition, but have different implications for understanding disease processes that influence MRI variables and cognition. HC consistently was associated with differences among all cognitive status groups and with longitudinal change in status. CGM also was associated with progression to dementia, and discriminated N from MI. Lac and WMH were related to differences between N and MI and to progression from N to MI, but did not explain differences between MI and D or conversion to D. These results suggest that CVD is an important determinant of MI and support the concept of vascular cognitive impairment. Brain components associated with AD appeared to be more important determinants of dementia in this sample.

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G.T. STEBBINS, D.L. NYENHUIS, D.A. FLEISCHMAN, K.A. BANGEN, L. DETOLEDO-MORRELL, D.A. TURNER, D.A. BENNETT, P.B. GORELICK & J.D. GABRIELI. Voxel Based Morphometry Gray Matter Density Study of Mild Cognitive Impairment and Vascular Cognitive Impairment No Dementia.

Both MCI and vascular cognitive impairment no dementia (VaCIND) manifest with select cognitive impairments insufficient to meet diagnostic criteria for dementia. The neuropathological differences between MCI and VaCIND are controversial. Loss of gray matter volumes in the medial temporal lobe (MTL) have been associated with MCI but have not been studied in VaCIND. In this study, we investigated group differences in gray matter volume between MCI and VaCIND participants. High resolution 3d SPGR T1 weighted MRI scans were acquired for 11 MCI and 38 VaCIND. Diagnosis of MCI was based on a modification of the Petersen criteria and diagnosis of VCI was based on Rockwood criteria. Optimized voxel-based morphometry (VBM) was used for whole brain comparisons of MCI vs VaCIND gray matter densities. The comparison revealed significant gray matter density decreases ($p < .01$) in medial temporal lobe (MTL) regions in MCI (including hippocampal, parahippocampal, perirhinal/entorhinal regions) compared to VaCIND and significant decreases in the thalamus, frontal, and parietal lobes in

the VaCIND compared to MCI. The dissociation between MTL damage in MCI and thalamic damage in VCI suggests that the neuropathology differs between the two conditions, and that cognitive impairment associated with stroke reflects thalamic and other cortical regional damage, rather than MTL neuropathology. Support Contributed By: AG09466, AG17934, AG17133, AG10161

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D. NYENHUIS, E. GENCHEVA, S. FREELS & P.B. GORELICK. Neither Vascular CIND or Stroke Patients Without Baseline Cognitive Impairment Convert to Dementia When Followed For Up to Three Years.

Objective. The Canadian Study of Health and Aging (CSHA) reported that 46% of Vascular Cognitive Impairment No Dementia (Vascular CIND) patients in their sample converted to dementia over five years. Few other similar studies have been completed and more longitudinal data are needed to define long-term cognitive outcome following stroke. Data are now presented that compare dementia conversion rates during up to three years of follow-up in Vascular CIND ($n=32$) and Stroke No Cognitive Impairment (NCI, $n=55$) patients. Participants and Methods. Patients were seen for neuropsychologic, neurologic and epidemiologic examination within 6 months following ischemic stroke and annually thereafter for up to three years. Vascular CIND and dementia were diagnosed using standard research criteria. Results. 1. To date, two Vascular CIND and zero Stroke NCI patients have converted to dementia. Using lifetable methods to account for partial follow-up on some patients, this is an average annual Vascular CIND conversion rate of .0196, which does not significantly differ from zero ($p > .05$). 2. 22 Vascular CIND patients have converted back to Stroke NCI. This "back conversion" has also been seen in longitudinal mild cognitive impairment studies. 3. Neither MMSE or a summary neuropsychological principle component score (mean = 0, sd = 1) shows significant decline for either Vascular CIND or Stroke NCI group during follow-up. Conclusions. To date, neither the Vascular CIND or the Stroke NCI patient group shows significant cognitive decline or dementia conversion. The natural history of Vascular CIND will be discussed in light of both CSHA and the present findings. Supported by AG17934, PIs: PBC & DLN

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Symposium 17/11:00 a.m.-1:00 p.m.

The Role of Neuropsychology in Sport-Related Concussion

**Chair: Christopher Randolph
Discussant: Jeffrey Barth**

C. RANDOLPH. The Role of Neuropsychology in Sport-Related Concussion.

The medical management of sport-related concussion has received a great deal of media and scientific attention over the last decade. Neurocognitive testing has been repeatedly emphasized as a potential measurement tool for monitoring recovery from these injuries. As a result, the use of neurocognitive testing in this context has rapidly proliferated at the professional, collegiate, and even high school and elementary school levels. The purpose of this symposium is to critically review the scientific basis for the role of neuropsychology in the

management of sport related concussion. This includes a review of the rationale for employing neurocognitive tests in this setting, a discussion of the psychometric issues involved in this application, and a review of existing data from both pencil-and-paper testing as well as data from newer computerized tests developed for this purpose. All of the symposium participants have extensive experience in this area. Dr. Randolph will provide an overview of the basic issues involved, and Dr. McCrea will discuss the application of neurocognitive measures in "sideline testing". Dr. Barr will provide a critical review of data accumulated from the use of standard pencil-and-paper testing, and Dr. Woodard will review similar information from the newer computerized tests developed for this purpose. Dr. Jeffrey Barth will serve as the discussant.

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C. RANDOLPH. The Role of Neuropsychology in the Management of Sport-Related Concussion: Introduction to the Issues.

Approximately 300,000 sport-related concussions occur in the US alone every year, and there is a great deal of ongoing controversy regarding management guidelines for these injuries, primarily revolving around return-to-play decision-making. Neuropsychological (NP) testing has been proposed as one technique for detecting and monitoring the effects of concussion for this purpose. This has included 'sideline' testing for immediate return to play decision-making following very mild concussions, and 'baseline' testing to monitor recovery from more significant concussions. The NFL and NHL, as well as many collegiate teams, have employed pencil-and-paper NP tests for this purpose for a number of years. More recently, a number of computerized tests have been developed and extensively marketed for this purpose. A number of important questions regarding the clinical validity and utility of these tests remain unanswered, however, and these questions pose serious challenges to the applicability of NP testing to the management of sport-related concussion. The rationale behind the need to monitor symptom resolution in sport-related concussion will be reviewed, as will the necessary criteria for routine clinical implementation of NP testing for this purpose.

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M. MCCREA. Sideline Testing: Measuring Acute Effects and Early Recovery from Concussion.

There has been a relatively recent movement toward the standardization of methods for assessing neurocognitive functioning, postural stability, and symptomatology on the sports sideline during the acute phase after concussion. Several brief clinical measures have been designed to move away from a subjective assessment of injury by quantifying the acute effects of concussion and objectively tracking post-injury recovery. The traditional model of lengthier neuropsychological evaluation has called into question the clinical accuracy and utility of these screening tools. Several studies have demonstrated the reliability, validity, sensitivity and clinical utility of these measures, however, in the evaluation of sport-related concussion. Standardized measures of mental status and other post-concussive symptoms are valuable tools to assist clinicians in the assessment and management of concussion, but should not be viewed as a replacement for more sophisticated neuropsychological testing or considered a stand-alone means for return-to-play decision-making. In a larger sense, application of these measures has provided a framework for neuropsychologists to prospectively study the natural history of mild traumatic brain injury from its most acute stage to long term recovery,

and to better understand factors that predict post-concussive recovery. This portion of the program will focus on a review of established clinical instruments to assess acute head injury in sports, clinical and methodological limitations of these measures, what has been learned from studies on the acute effects and early recovery of concussion, and advantages of the sport-concussion research model to advancing our overall scientific understanding of acute mild traumatic brain injury.

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W.B. BARR. Baseline Testing: The Status of Traditional Pencil-and-Paper Approaches.

The foundation of clinical neuropsychology is based on the use of traditional 'paper-and-pencil' testing. This method of assessing brain function has provided valuable information in studies of athletes for over forty years. Its use in early research on NCAA football players was critical to the development of methodology that continues to be used to this day for measuring symptoms and tracking recovery in injured athletes competing at the high school, college, and professional levels. Use of traditional neuropsychological testing in the sport setting offers the advantage of utilizing well-studied instruments with known psychometric properties. Many of these methods have been shown to be sensitive to detecting cognitive deficits in non-athlete samples. The challenge remains to cross-validate these measures in studies of athletes with concussion, while determining the potential impact of demographic influences, test-retest effects, and factors resulting with repeated injury. It is also important to determine how these methods can be used more effectively with younger 'little league' athletes. This presentation will review what is currently known about the validity and reliability of paper-and-pencil testing as it has been used in the sport setting. We will outline the rationale for using either the Reliable Change Index (RCI) or Standard Regression Based (SRB) indices for evaluating test-retest changes. The discussion will include data on the sensitivity and specificity of traditional measures in comparison to other test methods. While new technology is emerging, traditional testing remains the benchmark methodology in monitoring neurocognitive recovery from sport-related concussion.

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J.L. WOODARD. Computer-Based Approaches to Monitoring Concussion Recovery: Old Wine in New Bottles?

A number of computerized tests designed for detecting and monitoring of neurocognitive impairment following sport-related concussion have been developed and commercially marketed over the last few years. Computer-based neurocognitive testing offers a number of distinct potential advantages over traditional paper-and-pencil assessment. Some of these potential advantages include standardized administration and error-free scoring, the capacity to titrate test difficulty level to match subject ability level, portability, response timing accuracy at the millisecond level, and the presentation of instructions and stimuli in multiple sensory modalities. Like traditional pencil-and-paper tests, however, computerized tests must demonstrate basic psychometric criteria (e.g., sensitivity, reliability) necessary to interpret individual performance data and justify clinical utility. In addition, a number of other methodological concerns specific to computer-based testing exist, including reliability across platforms (e.g., desktop versus laptop). This presentation will review the psychometric properties of existing computerized tests proposed or marketed for the management of sport-related concussion (ANAM, CogSport, Headminder, ImPACT). In addition, recommendations for

the next generation of these measures will be proposed. These include continuous, 'smart' monitoring of effort level throughout testing, standardization of response manipulanda, utilization of speaker-independent voice recognition, implementation of virtual reality paradigms, and more effective use of multimedia presentation.

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Paper Session 18/11:00 a.m.–1:00 p.m.

Cognitive Neuroscience of Brain-Behavior Relations

N. COYAL, A. FLANDERS, L. JOSEPH, N. PETER, W. BRIGID & J. TRACY. **Listening To Your Body: An fMRI Analysis of Attention to Internal Body Signals.**

We tested the hypothesis that the region encompassing the anterior parietal cortex (Brodmans Area 5/7/40) proximal to both somatosensory and posterior parietal cortex mediates attention to an internal somatic signal. This is based on the potential convergence of a neural system for monitoring external stimuli with mechanisms that process somatic information. Given the right hemisphere bias evident in other types of corporeal processing, we expected activation during our internal somatic attention task to be biased toward the right hemisphere. We measured regional brain activity through functional magnetic resonance imaging during a blocked-design paradigm that directed subjects to attend to their own heartbeat, and to a heartbeat played on an external tape. In the key experimental condition, participants ($n=17$; 6 males, 11 females) were instructed to place their right, dominant hand over their heart upon hearing the verbal cue "chest". Participants focused their attention inward and attended to their own heart beating, and counted the number of beats silently. Region of interest and whole-brain mapping statistical procedures revealed the importance of right (non-dominant) parietal cortex to actively directing attention internally to one's somatic state and focusing on a specific body signal. The anterior parietal activation we observed suggests it is taking advantage of the monitoring skills typically utilized for vigilance to the external environment that are available through posterior parietal cortex. In addition, its location in association areas posterior to the primary somatosensory region fits with the notion that this region is working as a higher-level recognition system for signals emerging from the somatosensory homunculus. The finding suggests the parietal cortex plays a central role in an interoceptive attention system that monitors somatic signals and bodily states, and may be perturbed in conversion, somatic, and psychogenic disorders.

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K. REINKE & C. ALAIN. **Neural Underpinnings of Speech Separation and Identification.**

The ability to process speech sounds in noisy environments is an integral part of human communication. Yet, little is known about the neural correlates of speech separation and identification. Here, we investigated the neural basis of distinguishing concurrent speech sounds by means of the double-vowel task. In this task, listeners are presented with a mixture of two phonetically different vowels, which could have the same or different fundamental frequency (f_0). In all experiments, normal hearing, native English speaking adults (19-35 years of age) were presented two phonetically different vowels simultaneously. In separate

experiments, we measured event-related brain potentials (ERPs) or fMRI signals while listeners were either required to identify both vowels or to passively listen to the sounds while watching a mute video with subtitles. The likelihood of correctly identifying both vowels increased with larger f_0 separation between the two vowels. These behavioral effects were paralleled by two neural events as measured by ERP, reflecting the automatic registration of Δf_0 and the conscious identification of vowels, respectively. The successful segregation and identification of concurrent vowels was associated with enhanced BOLD response in auditory cortices. We have identified some of the neural mechanisms for segregating concurrent vowels. Not only have they been identified, but we have shown that with attention and training (from a previous experiment) they can be modulated. By understanding these changes, we may be able to develop rehabilitation techniques to help individuals experiencing speech perception problems.

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D. TRANEL & H. DAMASIO. **Retrieval of Unique Names Depends on Neural Systems in Left Temporal Polar Region.**

Lesion and functional imaging studies have indicated an association between proper naming and the left temporal polar region (TP). Here, we used a lesion approach to investigate further the association between proper naming and left TP, in two categories of unique entities (faces, landmarks). We tested the following hypotheses: (1) Face naming and landmark naming would be strongly associated; (2) Damage to left TP would be associated with impaired naming of faces and landmarks. Study 1 included 110 patients with focal, stable brain damage, selected from our Patient Registry. We utilized two standardized experimental tests, the Famous Faces Test (155 items) and the Landmark Test (65 items). Study 2 included 89 patients from Study 1 who had lesions that could be analyzed with our MAP-3 technique. Both hypotheses were supported. In Study 1, the Pearson correlation between face naming and landmark naming was strong and positive ($r = .65$, $p < .001$). In Study 2, 22 patients had impaired face naming ($M = 54.0$, $SD = 17.8$; normal $M = 92.3$, $SD = 6.2$) and impaired landmark naming ($M = 57.7$, $SD = 12.7$; normal $M = 88.0$, $SD = 8.0$). A lesion overlap map for unimpaired patients was subtracted from the lesion overlap map for impaired patients, yielding a maximal overlap difference in left TP. The findings provide further support for the idea that the left TP region is important for the retrieval of names for unique entities, regardless of category, and they fit with our proposal that left TP contains convergence regions that operate as intermediaries between conceptual knowledge retrieval and lexical retrieval for classes of unique stimuli.

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J. DORFLINGER, K. SZABO, P. CAFFARRA, S. DURGERIAN & S. RAO. **Distributed Neural Systems Supporting Number Processing: An Event-Related fMRI Study.**

Behavioral studies suggest that number processing is influenced by number size, calculation procedure (addition vs. multiplication), and whether the calculation is exact vs. approximate. Lesion studies suggest that number processing may be differentially affected according to lesion location. Whole brain fMRI was conducted to examine the neural correlates underlying these factors. Fifteen (9 F) right-handed healthy adults participated in an event-related fMRI experiment with randomized trial types. The trial types investigated in this study consisted of small (1-5) vs. large (5-9) digits and three number processing procedures: addition vs. multiplication vs. symbol matching. Participants responded using one of two keypresses. Accuracy exceeded 95% for all trial types. Reaction times were significantly shorter for small digit compared to large

digit problems (subitizing effect) during multiplication procedures. A trend in this direction was observed for addition procedures. Imaging results revealed: (1) increased MR signal intensity in bilateral inferior parietal cortex for addition and multiplication; (2) large digit, compared to small or mixed digit problems, recruited a distributed neural network which included basal ganglia, parietal cortex, frontal cortex, and right temporal lobe; (3) small and mixed digit problems recruited left inferior frontal gyrus and left superior and middle temporal gyri. These results support and extend previous fMRI studies demonstrating the importance of bilateral inferior parietal cortex for arithmetic calculations as well as demonstrating the different neural networks responsible for processing non-automatic, large number calculations compared to automatic, small number calculations in attention/working memory and language systems, respectively.

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L.J. BUXBAUM, K.M. KYLE, M. GROSSMAN & H. COSLETT. Left Inferior Parietal Representations for Skilled Hand-Object Interactions: Evidence from Stroke and Corticobasal Degeneration.

Patients with ideomotor apraxia (IM) are often more impaired in producing and imitating object-related (transitive) than non-object-related (intransitive) gestures, but reasons for this dissociation, and its anatomical underpinnings, remain unclear. Our theoretical model of praxis (Buxbaum, 2001) postulates left inferior parietal lobe (IPL) gesture representations coding the position and movement of the body and hand for skillful manipulation of familiar objects, as distinct from superior fronto-parietal calculations of the current spatial position of the body that apply equally to familiar and novel, transitive and intransitive movements. This predicts two distinct patterns of IM. Imitation of transitive, intransitive, and meaningless gestures was tested in 21 patients with IPL damage after stroke (CVA) and 4 patients with superior fronto-parietal involvement due to corticobasal degeneration (CBD). Production was scored with respect to hand posture, arm posture, amplitude, and timing. Consistent with predictions, CVA were more impaired with transitive than intransitive gestures, whereas CBD were not, $F(23,1) = 11.2$, $p < .002$. Second, the hand posture component of transitive gestures was the most impaired aspect of gesture in CVA, but the least impaired aspect of gesture in CBD, $F(3,69) = 8.7$, $p < .0001$. Finally, CVA were more impaired with transitive hand postures than meaningless or intransitive hand postures, whereas CBD showed the opposite pattern. These data suggest that the left IPL mediates representations of skilled hand-object interactions, as distinct from dynamic coding of the body in space, and that it may have evolved to map between representations of object identity and the body in space mediated by the ventral and dorsal streams.

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