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# 08.24.18

* Discussion based class
* There is a term paper
  + Talk about the adolescent brain
  + Potential for publication
  + Have it relate to your Thesis
* Exams will be based on stuff we go over and the articles
* Email discussion questions by noon the day before being Discussion leader.
* The history of Neuropsychology
  + Brain wants to do more things with less work: it’s and efficiency machine
  + Brain damage is permanent, but the functional impairment is not necessarily permanent. The brain has the ability t adapt to brain damage
    - It’s also not always apparent
    - Plasticity!
  + Alcohol itself does not kill brain cells
    - Btu it interrupts connections
    - Drinking a ton *can* have this ability though
  + Cognitive skills do not decline at age 40
    - Well, technically yes. But it depends what your measuring
    - It really is processing speed the declines.
  + After about age about 14, IQ stays relatively constant.
  + Dualism by Descartes: mind and body are separate but can intercact
    - Believe the pineal gland was the seed of the interaction between the physical body and the mind
      * Because it is one of the only structures in the brain that there is only one of.
  + Materialism: Idea that rational behavior can be fully explained by the workings of the nervous system
    - Functional localization: Certain areas of the brain are responsible for certain behaviors.
* What is Neuopsychology?
  + Scientific study of the relationship between behavior and the brain.
  + We find a lot of information about the brain from clinical trials, brain imaging, and really, when something goes wrong in the brain.
  + Current two current theories in neuropsych:
    - Brain Hypothesis: The brain is the source of behavior
    - Neuron Hypothesis: The unit of brain structure and function is the neuron
    - Not necessarily competing hypotheses. Both work in different contexts.
* Regarding TBI’s. Often times depression and other precede the TBI’s but can be emphasized post TBI. Often times people blame TBI even though prior behavioral issues are more to blame.
* Losing cerebral matter is way more serious as an adult.

# 08.31.18

* Understanding morality
  + Brain areas:
    - Frontal lobe
      * VM-PFC
        + Encodes the value of stimuli
        + Adherence to social norms
    - Cingulate gyrus
      * Mediating conflict and emotions
      * Posterior cingulate: processes emotions and social ability
    - Parietal lobe
      * Associated with working memory
    - Subcortical structures
      * Amygdala: basic moral and emotional processing
    - Genes and hormones play a large role in morality and aggression
  + Frontal lobe is very complex processing
    - Ours is much larger than many other animals
  + Studies are typically lab based
    - Hard to invoke a behavior
    - Missing the spontaneity of the situation
  + Gender skew of population
    - These studies may be a biased towards gender because women express aggression in different ways.
  + Neuron
    - Cell body: contains mechanism to keep cell alive
    - Dendrites communicates and receives info
    - Axon: tube with fluid that transmits signals to other neurons
    - Myelin: coats axon and speeds message transduction
    - Axon terminal: Sends messages to next cell
    - Action potential
      * General term for axon firing
      * Must reach threshold of excitation
      * Strength of firing is all the same
    - Seizure = uncontrolled firing of neurons
  + Nervous system into 2 sytems
    - 1.) peripheral nervous system
      * Communicates parts outside of brain (i.e arms)
        + Somatic nervous system

Voluntary movements

Cranial nerves

Help control head neck and trunk… eyeballs too.

Much more involuntary

Spinal nerves

Voluntary motor control

* + - * + Autonomic nervous system

Heart beating etc

Sympathetic nervous system

Fight or flight

Parasympathetic nervous system

Regenerates resources

Homeostasis = creating a steady state between symp and parasymp systems

Bio feedback = helping the auto nervous system

* + - * 2.) Central nervous system
        + Divided into like 6 portions
        + Gray Matter: Neurons, holds genetic material
        + White matter: Myelin, coats axons and facilitates communicates between cells.
        + Different parts are more myelinated than others

Frontal lobe is heavily myelinated because of quick reactions, functionality towards other brain functions

* + - * + Laminar structure

Brain tissue

Layered

* + - * + Telencephalon

The hemispheres

Not left or right brained

Some processes are localized to one hemisphere though

Left side

Language hemisphere

Controls right side of body

Right brain

Visual hemisphere

Controls left side of body

Ability to recognize faces

Corpus collosum

Connecter between hemispheres

Frontal Lobe

Executive control

Emotion, problem solving, memory, language judgement and sexual behavior

Temporal lobe

Primary role in processing & understanding

Primary auditory cortex

Parietal lobe

Integrates sensory information

Somatosensory strip

Portion of brain that processes different senses

Occipital lobe

Visual cortex

Ventral stream

What something is

Doral stream:

Where something is

* + - * + Subcortical telencephalon

Basal Ganglia: coordinated motor movements

Amygdala Processing emotions

Hippocampus: Consolidating info to long-term memory stores

* + - * + Stores higher order thinking skills
        + Diencephalon

Thalamus: relays sensory info

Hypothalamus: Produces hormones

Works with pituitary gland

Pituitary gland: Regulates activities of endocrine glands

* + - * + Limbic System

Contains main structures: Hypothalamus, Thalamus, amygdala

Involved in motivation, emotion, learning

Will come up a lot

* + - * + Mesencephalon

Tectum

Inferior Colliculi: auditory processing

Superior Colliculi: Visual processing

Tegmentum

Reticular formation: regulate sleep wake cycle

Pariaqueductal grey matter: regulation of perception of pain

Substantia Nigra: regulation of motor behavior.

* + - * + Metancephalon

Cerebellum: Controls coordinated motor movements

Pons: Relays motor messages, involved in sleep-wake cycle

* + - * + Myelencephalon

Reticular formation: regulates level of consciousness

Medulla Oblongata: Controls autonomic functions.

* Cerebral Vascular system
  + Blood Brain Barrier
    - Blood never touches the brain: Just the nutrients the brain needs
  + Vascular structure
    - Internal carotid artery
      * Provides ginificant amount of cerebral nutrients
      * 2 Branches
        + 1.) Anterior cerebral artery (ACA)

Supplies blood to the interior portions of the frontal lobes and parietal lobes.

Middle cerebral artery

Supplies blood to larger portions of the temporal and parietal areas

Important areas: Broca’s aphasia

Wernicke’s Aphasia

* + - * + 2.) Posterior Cerebral Artery (PCA)

Supplies blood parietal lobe, occipital, temporal lobe

Cerebral Vascular Damage

Stroke

# 09.07.18

## **Developmental Article**

* Neural Tube
  + Precursor to the neural system
* Fetal Period
  + Neocortex develops
  + Brain is initially smooth, and the sulci and gyri maximize “real estate”
  + Apoptosis: Neural progenitors (pre neural stuff) dies
    - It’s a function of pruning
* Post-Natal (post birth)
  + Neurogenesis continues in hippocampus and olfactory bulb
  + Apoptosis of glial cells
* Premature kids
  + Birth weight is a huge indicator of premature birth, rather than time of birth
  + Increased risk, not a determinant of deficit

## **Autism article**

* Neurodevelopmental disorder
* Hyper connectivity in younger; hypo connectivity in older
* Uses a developmental approach
* Need for morelongitudinal studies
  + Study the function across the lifespan

## **Lecture**

* Plasticity
  + Brain changing throughout the course of time
* Plasticity and injury
  + Early injury the brain is malleable
* Factors influencing recovery
  + Severity
  + Age
    - Brain is wired to preserve function
      * Kennard principle – The earlier the better
      * Some sections are more preserved than others
        + i.e language processes
      * But these might come at an expense to other areas
  + Intelligence is a predictor of success
  + Women have a better ability to recover
    - Women brain is less lateralized
* Embryonic neurons
  + Seem to be pre-programmed prenatally
* Lissencephaly: “Smooth Brain”
  + Develops when there is not enough neural migration
  + A reason the brain has bumps and ridges Is because it allows for more surface area
  + Symptoms: functional impairment, shorter life expectancy
* Synaptogenesis: Generation of synapses between neurons in the neurons in the nervous system
  + During the first 12 months of life we have hyper synaptogenesis
  + Then Pruning occurs
    - Unused neurons are pruned away
* Early brain development
  + Infancy
    - Vision nearly complete first
  + Adolescence
    - Rate of growth much slower
    - Prefrontal cortex changes the most dramatically than any other area
    - Grey matter volume peaks in adolescence
      * Little later in boys… because boys hit puberty later
      * Contains cell bodies and connections between cells
    - Medial prefrontal cortex is more active
      * Because… Adolescents and adults use different behavioral approaches
    - Functional changes
      * Limbic system matures: inhibition begins to overrule the limbic system
    - Increase in executive skills:
      * Seeing things from other persons perspective
  + Adulthood
    - Still slow… but increase in myelination
* Autism Spectrum Disorder (ASD)
  + Restricted/repetitive patterns of behavior
  + Hyper or hypoactivity in sensory input
  + Does not require cognitive impairment
  + Historical figures may have had ASD
    - Newton, Einstein, Picasso etc.
  + ASD can mask cognitive skills
  + Autism
    - Etiology is unclear
      * Brain overgrowth
      * Abnormal neuroanatomical development
      * Localized damage
      * Perinatal influences (cell growth abnormality)
    - Multiple models of autism exist
      * Because there are different presentations of the spectrum
    - Inferior Olivary Complex
      * Heavily associated with the cerebellum
    - Hippocampus
      * Damage often leads to inability to store new information into memory
        + Cells often are more densely packed in certain areas
    - Amygdala
      * “Social brain”
    - ASD Social Brain differences
      * Errors in fusiform gyrus
        + Responsible for recognizing faces
        + Also associated with motions, the ability to pick up physical cues.
        + Even unable to pick up strangers faces
  + Related to abnormal activity
    - Cerebellum
    - Social Brain mechanisms

# 09.14.18

## **OCD article**

* DSM characterizes OCD as of obsessive thoughts and/or compulsive behavior
* Adolescence 12-14 and early adulthood is when it is often detected
* Gender differences in clinical data. But epi data shows that the gender difference is not there.
* Characteristic of brain and OCD
  + Executive dysfunction
    - Lack of impulse control
  + Modulatory control
    - Orbital frontal cortex cingulate gyrus
    - Indirect pathway – inhibition and negative feedback loop
  + Lack of amygdala research

## **Schizophrenia Article**

* History
  + It has changed to prevent the onset of psychosis
* Heritability
  + Genetics (premorbid and prodroamal phases)
    - Adolescent and adult onset
  + Environmental impact
  + Neurocognitive impairment
    - Working memory
    - Crystalized and fluid intelligence (7-13 years old)
    - Poor attention/arousal/alertness

## **ADHD**

* Diagnostic criteria
  + Unable to focus and attend to information efficiently
  + Cognitive efficiency is one of the main deficits of ADHD
  + Inattention
    - Distractibility
    - Poor direction following
    - Difficulty with focus
    - Unable to pay attention to details
  + Hyperactivity/Impulsivity
    - Fidgeting
    - Trouble staying seated
    - Excessive movement
* Highly genetically correlated
* Differences in brain exists in 8-year old’s but the structures normalizes by 16 year old’s
* Associated with:
  + Prefrontal cortex
  + Caudate nucleus
  + Basal Ganglia
* Functional abnormalities in ADHD
  + Lots of neuropsych capabilities abnormalities
* Other considerations
  + Some research suggest that it may be about immaturity
    - In kids a difference in a year is a huge difference
* ADHD does not produce cognitive impairment
  + Can impact performance, not underlying skills
* Treatment
  + Lots of controversy
  + Combo of medication and environmental structuring is most effective
  + Medications should serve as a tool, not a cure.

## **Schizophrenia**

* Symptoms
  + Hallucinations
    - Perceptual experiences that occur even when there is no stimulus
    - Thoughts may be interpreted as actual outside voices
    - Hallucinations may be experienced in all symptoms
  + Catatonia
  + Flat affect
  + Delusions
    - False beliefs that are fixed and hard to change even when presented with conflicting information
    - Types:
      * Persecutory: ex. Fbi out to get you
      * Grandiose
      * Reference: ex. A song on the radio is played just fr you
      * Thought insertion: ex. Others are controlling your thought
  + Paranoia
* It is NOT split personality
* Positive symptoms
  + Paranoia
  + Delusion
* Negative symptoms
  + Decreased motivation
  + Lack of energy
  + Anhedonia
    - Lack of motivation to what you normally do
* Anosognosia
  + Lack of awareness of a deficit
  + Often people with schizophrenia are unaware of the fact they have it
* Environmental risk factors
  + Co-occurs with schizophrenia… but not causative
  + Problems during pregnancy
  + Complications at birth
    - Hypoxia: lack of oxygen to brain at birth
    - A**no**xia: complete cutoff of oxygen to the brain at birth
  + Children born to older fathers
  + Cannabis use
  + Urban settings
  + Minority status

## **Obsessive Compulsive Disorder (OCD)**

* Anxiety disorder
* Pattern of repetitive thoughts and behaviors that are senseless and distressing.
* Tricotiliemia (sp) = pulling out hair obsessively.
* Prevalence not clear since so many keep behaviors secret
* Affects more Males
* 1% of population
* Can be impactful on even high functioning individuals
* Symptoms:
  + Obsessions
    - Unwanted ideas or impulses that repeatedly occur
    - Persistent fear that something may happen to themselves and others
  + Compulsions
    - Repetitive behaviors
    - Most common = washing and checking
    - Mental problems], such as repeating phrases
* Causes
  + Comorbidity is high with other disorders
  + Genes are linked to OCD (Not just one gene)
  + Abnormal serptpmergic in the basal gangia
  + SSRI treatment helps
  + Probably due to serotonin and dopamine abnormalities
  + Reduced White mater
    - White matter = connections
  + Less efficient communication in brains
* OCD pathways
  + Orbitofrontal cortex
    - Region of frontal lobe
    - Hyperactive in ocd
      * Send out to false alarms
  + Caudate nucleus
    - Primary site of initiation of movement
    - Fails to block “False Alarms”
  + Cingulate Gyrus
    - Associated with understanding verbal emotional cues and grooming
    - Relayer of the “alarms”
  + Basal Ganglia
    - Associated with inhibition of competing motor behaviors
    - Causes misfiring of neurotransmitters
* Summary:
  + Faulty alarm system in the brain
  + SSRI works on treatment for some
    - Behavioral od therapy is used
  + If the behaviors are adaptive it is not a disorder. They need to be maladaptive in life to be OCD
* Watch movie: *What about Bob*
  + And *The Aviator*

# 09.28.18

## **Memory & Dementia**

* What is Memory?
  + Processes involved in retaining and retrieving and using info about stimuli, images, events, ideas, and skills after the original information is no longer present
* William James (1890)
  + Believed in primary and secondary memory
* Modal Model of memory
  + Three different types of memory
    - 1.) sensory memory: Initial stage that holds all incoming memory for seconds and fractions
    - 2.) Short term memory: Holds five to seven “items” for about 15 to 20 seconds
      * Included both new info received from sensory stores and info recalled from long-term memory… Remembering what you ate breakfast is considered long term memory
    - 3.) Long-term Memory – can hold a large amount of information
      * Archive of information about past events and knowledge learned
      * Can be a few moments to very long ago memories
      * Types of long-term
        + Explicit memory

Episodic: memory for personal events

Involves mental “time travel”

Semantic: facts and knowledge

Interaction of semantic and episodic

Autobiographical memories: memory of a specific personal experiences

* + - * Implicit memory: Memory for doing things that usually involved in learned skills
        + AKA skill memory
        + Classical Conditioning
    - 4.) Working memory
      * Limited capacity system for temporary storage and manipulation of information for complex tasks such as comprehension, learning and reasoning
* H.M.
  + Surgical resections to treat intractable seizures
    - * Lost 2/3rds of his hippocampus regions
  + Could remember events/facts in his distant last
  + Couldn’t remember facts right before surgery
  + Medial temporal lobe (MTL) is important for explicit memory… NOT implicit
  + Plays a role in consolidation of explicit memories
  + Can still have intellectual ability (i.e. no changes in IQ, dependent on how IQ is measured)
* Clive wearing = Worst case of anterograde amnesia. Impaired long term memory
* Parietal lobes are associated to short term memory
  + Parietal lobe processes sensory info.
* Constructive memory
  + What happens + person’s knowledge, experiences and expectations
  + Memories are comprised of details from various sources
  + Allows us to “fill in the blanks”
  + Helps with inferences
  + Adapt if original memory is wrong
* Power of suggestion
  + Misinformation effect: misleading information presented after a person witnesses an event can change how that person describes the event later.
  + Retroactive interference
    - Things that happen after the fact of a memory can influence change in memory
  + False memories
    - Associated with confabulation and more extreme cases
  + Repressed memory
    - Memory that is repressed because of the anxiety it engenders
  + False Recognition
    - Innocuous false alarm to stimuli
  + Eyewitness testimony errors
    - Poor attention can impact memory
    - Errors due to familiarity
      * Source monitoring
  + Errors due to suggestion
    - Confirming feedback
    - Post-identification feedback effect

## **Retrograde amnesia**

* Neural Replay: Reactivation of neural networks associated with memory
* Animal studies
  + Remote memory can be still good after hippocampal lesions
  + Animals can’t express memories
  + Hippocampus appear to be associated with episodic memories
  + Semantic memories seem to be associated with the cortex
* Genes and neurophysiological features over time
  + Neocortical tags
    - Set at time of memory encoding and time-dependent changes in interactions occur between the hippocampus and neocortex.
* Sleep
  + Replay: reactivation of patterns of networks activity that match the actual experience
    - Can occur while awake though
  + Downscaling: Strengthens relevant connections and weakens irrelevant
* “Tagging” memory trace is rapidly formed in cortex
  + Role of hippocampus can be bypassed when memory gets put into cortex
* Memory consolidation involves a dialogue between neocortex and hippocampus
* Rate of process depends on how new info is related to previous knowledge (known as “schemas”)
* Trauma & Memory
  + History of exposure to childhood abuse or combat is related to reduction in volume to of the hippocampus
  + Deficits in problem-solving
  + Deficits with long & short term memory
* Late life Brain Development
  + Deficits initially seen as neuronal degeneration at the beginning of research of aging
  + Age = disease and loss of neurons functioning
  + Studies are non-representative
    - But studies show that after 60 your IQ decreases
  + As you get older you find yourself in less novel situations (i.e. taxes don’t seem so bad!)
  + Number of cells remains the same
  + Harder to learn new things
  + Change is not constant across individuals
  + Change does not imply functional deficit
  + Memory is largely impacted
* Cognitive aging
  + Associated with
    - Cortical thickness
    - Decline is white matter
* Alzheimer’s disease
  + A type of dementia that causes problems with memory, thinking, and behavior
  + Progressive in nature
  + Causes trouble with synaptic communication
    - Disrupt long term potentiation
  + Disruption occurs due to the formation of amyloid plaques
* Korsakoff syndrome
  + Memory deficit secondary to history of alcoholism
    - Especially problematic with accompanying malnutrition
* Alcohol does not kill braincells
  + It inhibits pathways to communicate
  + Herpes simplex encephalitis: Damage to temporal lobe areas impacted memory performances
* Impact of dementia
  + 5-7% of pop over 65 have dementia
  + 25-50% of population over 80 have dementia
* Acquired and persistent syndrome of intellectual disease
* Mad cow disease: ask about history at break
* Watch *still Alice*
* The *Alzheimer’s project* videos

## 10.05.2018

* Trephination = drilling in the brain

Presentations:

Present area of research

Just explain the background research

And how it helps

Maybe propose an intervention?