CONFERENCE PROGRAM

CHICAGO AREA
Undergraduate Research Symposium

April 02, 2011
Museum of Science and Industry
Chicago, Illinois

DePaul University • Illinois Institute of Technology • Loyola University Chicago
Northwestern University • University of Chicago • University of Illinois at Chicago

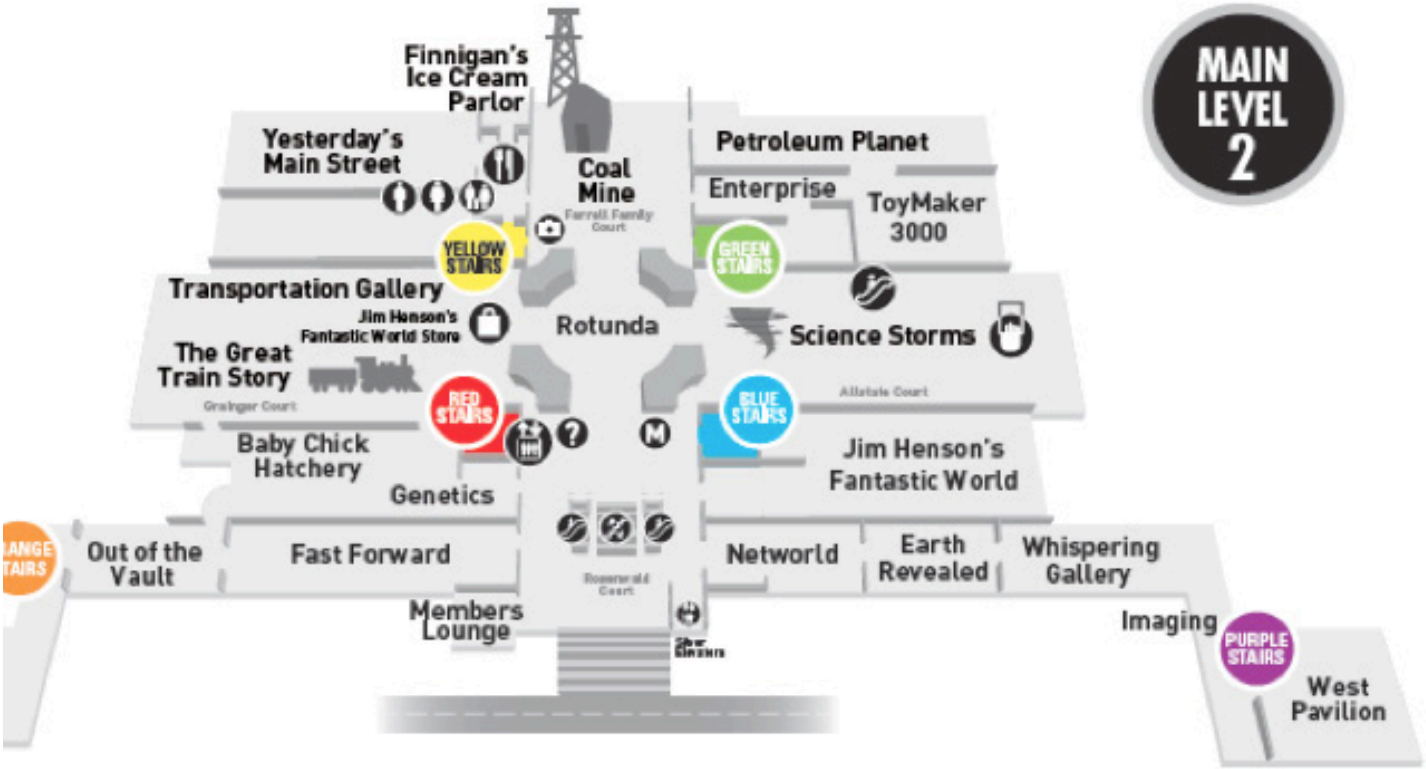
CHICAGO AREA UNDERGRADUATE RESEARCH SYMPOSIUM

April 02, 2011

11:30 a.m.	**Registration** *Ticketing Lobby, Museum of Science and Industry*
12:00 p.m.	**Opening Address** *Auditorium* *John W. Boyer, Ph.D.* *Dean, The College, The University of Chicago*
12:30 p.m.	**Poster Viewing** *West Pavilion*
1:00 p.m.	**Presentation Session I** Poster Presentations: *West Pavilion* *Oral Presentations: Auditorium*
3:00 p.m.	**Roundtable Discussions and Snacks** West Pavilion
4:00 p.m.	**Presentation Session II** Poster Presentations: *West Pavilion* *Oral Presentations: Auditorium*
6:00 p.m.	**Reception, Banquet Dinner, and Awards Ceremony** *Rotunda* *Keynote Address by John Cacioppo, Ph.D.* *The University of Chicago*

MAP

Museum of Science and Industry



Contents

To CAURS participants, faculty, and guests,

Welcome to the 7th annual Chicago Area Undergraduate Research Symposium! This symposium was created to celebrate the efforts of undergraduate researchers across the Chicago area who have worked extremely hard, devoting countless hours in the lab or in the field for the sake of discovery. This year's event promises to be an exciting one as we continue the tradition of collaboration between Chicago's fine research institutions.

This year we have experienced an exponential growth and have a record turnout of participants! More importantly, we are extremely impressed that this staggering increase in participation was accompanied by an increase in the quality of submissions. As you take a look at this program, you will notice the presentations cover a wide range of subjects, from Iranian politics to tissue engineering and bioethics. Our participants yield from all four years and all participating institutions, as well as numerous students from the City Colleges of Chicago and schools outside of the Chicago area! We extend a warm welcome to everybody taking part in this year's event and hope you will gain much from attending CAURS.

We would also like to take this opportunity to express our deep gratitude to those students who helped make this event a reality. CAURS is completely student-run and requires months of careful planning. The Inter-School Board is comprised of an incredibly talented group of students who have devoted countless hours orchestrating this event. Their commitment to CAURS ensures the continued growth and success of the event and they deserve a hearty recognition. It has been our pleasure for the last year to work with such an outstanding group of dedicated and bright individuals!

Finally, we wish to extend our appreciation to the faculty members and administration who supported this event. Numerous professors from each institution year after year participate in advising these research projects and as judges at CAURS as a testament to their strong support of undergraduate research. For this, we cannot thank them enough.

We sincerely hope you enjoy this year's event and that you will take the time to appreciate and learn from the projects of your peers from neighboring institutions!

Michael Heiferman and Stephanie Reeve
Directors, Chicago Area Undergraduate Research Symosium
Northwestern University
DePaul University

DEPAUL UNIVERSITY

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April 2, 2011

Dear CAURS students, faculty, and guests,

Welcome to the 7th Annual Chicago Area Undergraduate Research Symposium (CAURS). I am delighted DePaul University has again joined the Illinois Institute of Technology, Loyola University, the University of Illinois at Chicago, Northwestern University and the University of Chicago in sponsoring CAURS. As a university that places a premium on teaching and applied learning, DePaul is proud to be a supporting member of this innovative event, providing the opportunity for students to present and discuss their research projects in a professional environment.

It is my hope that today's interactions provide you not only greater insight into your fields of study, but also deeper appreciation for the research process and the ways that focused inquiry can serve to help address the vexing social problems of our day.

On behalf of DePaul, I would like to thank all of the student organizers whose time and dedication made today possible. Your efforts have succeeded in making this year's cross-university symposium the largest in CAURS history. I congratulate all of you and wish you continued success.

Sincerely,

Rev. Dennis H. Holtschneider, CM

Rev. Dennis H. Holtschneider, C.M.
President

THE UNIVERSITY OF
CHICAGO
THE COLLEGE

THE COLLEGE
1116 East 59th Street
Chicago, Illinois 60637

Office of the Dean

April 2, 2011

Dear CAURS Students, Faculty, and Guests,

On behalf of the University of Chicago I want to welcome you to the Seventh Annual Chicago Area Undergraduate Research Symposium.

We are pleased to join with DePaul University, the Illinois Institute of Technology, Loyola University, the University of Illinois at Chicago, and Northwestern University as sponsors of CAURS. It is a particular pleasure also to welcome the Symposium to the South Side of Chicago and to the Museum of Science and Industry.

Research is a demanding but also a rewarding calling. All of you have worked hard to achieve the results and the insights that will be presented today. The opportunity afforded by CAURS is on of the fruits of your effort—a chance to share your achievements but also to learn from the questions and the observations of others.

Congratulations to all of you, and a special thanks to those whose efforts have made today's event—the largest Chicago Area Undergraduate Research Symposium so far—a great success.

Sincerely,

John W. Boyer
Dean
Martin A. Ryerson
Distinguished Service Professor of History

Telephone: 773-702-8576 • Fax: 773-702-5846 • Web: college.uchicago.edu

Office of the President

Northwestern University
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NORTHWESTERN
UNIVERSITY

April 2, 2011

Dear CAURS Participants, Supporters and Guests:

On behalf of Northwestern University, I am delighted to welcome you to the 2011 Chicago Area Undergraduate Research Symposium. As a research university, Northwestern is pleased to help sponsor this symposium and the research activities of undergraduate students. It is gratifying to have so many students showcase their ideas and research through poster sessions and presentations.

Research is an integral part of higher education and is vital to the advancement of the new knowledge that will benefit mankind. I hope that your participation here will strengthen your appreciation of the research process and encourage you to invest yourself even further in it. By engaging in research projects, you gain valuable insight into a topic area, strengthen your critical thinking skills and integrate your learning more deeply. These skills will lead many of you to become accomplished researchers and contribute to the advancement of knowledge in your chosen field of endeavor.

I want to acknowledge the American Undergraduate Research Society for its efforts to promote excellence in undergraduate research. In addition, I want to recognize the symposium sponsors whose support made this event possible. Your support of undergraduate research will help to create the next generation of scholars and researchers. Finally, I thank all the student organizers of this symposium. Coordinating this cross-university program involves a great deal of time and effort; their dedication to this exceptional event is apparent and appreciated.

Best wishes for a successful symposium.

Sincerely,

Morton Schapiro
President and Professor

GUEST SPEAKERS

John W. Boyer, Ph.D., The University of Chicago

Dean, The College
Opening Address

John W. Boyer, the Martin A. Ryerson Distinguished Service Professor in History, was appointed to a fourth term as Dean of the College in 2007. He became Dean of the College in 1992. A specialist in the history of the Habsburg Empire and of Central Europe in the nineteenth and twentieth centuries, Boyer received his Ph.D. from the University of Chicago in 1975 and joined the faculty in the same year. Boyer has written three books, including Political Radicalism in Late Imperial Vienna: Origins of the Christian Social Movement, 1848-1897 (for which he was awarded the John Gilmary Shea Prize); and Culture and Political Crisis in Vienna: Christian Socialism in Power, 1897-1918 (for which he was awarded the Ludwig Jedlicka Prize), both of which were published by the University of Chicago Press. His most recent book is Karl Lueger (1844-1910). Christlichsoziale Politik als Beruf, published by the Böhlau Verlag in Vienna in 2010. Boyer was also co-general editor of the nine-volume University of Chicago Readings in Western Civilization. In 2004 Boyer was awarded the Cross of Honor for Science and Art, First Class, by the Republic of Austria, in recognition of his scholarly work on the history of the Habsburg Empire. He received the 2006 Austrian State Prize for Modern History.

John Cacioppo, Ph.D., The University of Chicago

Tiffany and Margaret Blake Distinguished Service Professor of Psychology
Keynote Speaker

This year's keynote address will be given by Dr. John Cacioppo. Dr. Cacioppo is a pioneer in the field of social neuroscience and an expert in social isolation, emotional contagion, and social behavior. He is the Tiffany and Margaret Blake Distinguished Service Professor of Psychology, Director of the Center for Cognitive and Social Neuroscience, and Past-Director of the Arete Initiative of the Office of the Vice President for Research and National Laboratories at The University of Chicago. Dr. Cacioppo completed his PhD at Ohio State University and served on the faculty at the University of Notre Dame (1977-1979), University of Iowa (1979-1989), Ohio State University (1989-1999), and University of Chicago (1999-present). He also served as the Bijzonder Hoogleraar Sociale Neurowetenschappen (External Professor Chair in Social Neurosciences) Free University Amsterdam (2003-2007), and a Guest Professor at State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University (2008-2010). He is a Past-President of the Association for Psychological Science (2007-2008), the Society for Psychophysiological Research (1992-1993), the Society for Consumer Psychology (1989-1990), the Society of Personality and Social Psychology (1995), and he is currently the Chair of the Psychology Section of the American Association for the Advancement of Science and the President-Elect of the Society for Social Neuroscience.

ORAL PRESENTATION SCHEDULE

Presentation Session I

Biological Sciences (1:00pm-2:00pm)

1:00pm- 1:15pm: Ashley Dickerson, DePaul University
1:15pm- 1:30pm: Desiree Dickerson, University of Chicago
1:30pm- 1:45pm: Rachel Kooistra, Loyola University Chicago
1:45pm- 2:00pm: Jay Patel, Northwestern University

Social Sciences (2:00pm- 3:00pm)

2:00pm- 2:15pm: Thomas Gilbert, Northwestern University
2:15pm- 2:30pm: Brandon Ng, Northwestern University
2:30pm- 2:45pm: David Showalter, University of Chicago
2:45pm- 3:00pm: Cindy Teng, Northwestern University

Presentation Session II

Chemistry (4:00pm- 5:00pm)

4:00pm- 4:15pm Forest Hynes, DePaul University
4:15pm- 4:30pm Daniel Kim, Illinois Institute of Technology
4:30pm- 4:45pm Jacob Parzen, University of Chicago
4:45pm- 5:00pm Lacy Simons, Loyola University Chicago

Physics and Engineering (5:00pm-6:00pm)

5:00pm- 5:15pm Aimee Bobko, University of Illinois at Chicago
5:15pm- 5:30pm Sun Kim, University of Chicago
5:30pm- 5:45pm Ahmad Qamar, University of Chicago
5:45pm- 6:00pm Tyler Hopkins, Loyola University Chicago

All oral presentations will be held in the Museum's Auditorium

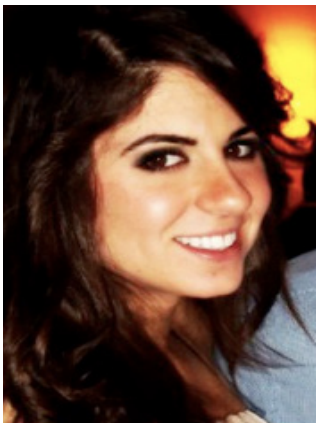
ORAL PRESENTERS

Biological Sciences: 1:00pm- 2:00pm

Ashley Dickerson, DePaul University
PALEOBIOLOGY OF THE LATE CRETACEOUS CARDABIODONTID LAMNIFORM SHARK FROM KANSAS
Abstract # 14

Ashley Dickerson is in her forth year at DePaul University where she is majoring in Environmental and Biological Sciences. Ashley is currently performing paleocology research with Dr. Kenshu Shimada, an associate professor of Biology at DePaul.

Desiree Dickerson, University of Chicago
Effects of Naturally Occurring Genetic Variation on the Severity of Mutation Phenotype in the Eye Development Pathway
Abstract # 16



Desiree A. Dickerson is a senior at the University of Chicago majoring in Biological Sciences and minoring in Visual Arts. She is currently working in the Martin Kreitman laboratory in the Ecology and Evolution Department. Presently, her studies in the lab are centered around the effects of naturally occurring genetic backgrounds on disease phenotypes. Outside of her work in the laboratory, she is a member of the Kappa Alpha Theta sorority and the Global Medical Brigades. After graduation, she plans on working towards a master's degree and eventually attending medical school.

Rachel Kooistra, Loyola University Chicago
Surviving transport: Oxidative stress response of early mosquito stage malaria parasite Plasmodium
Abstract # 36

Rachel Kooistra is a senior majoring in biology at Loyola University Chicago. She was first exposed to research during an internship at ThermoFisher Scientific and enjoyed being able to learn more about science in a research setting. She joined Dr. Stefan Kanzok's lab during her junior year and is now studying the oxidative stress responses of the early mosquito stages of the malaria parasite P. berghei. After graduation, Rachel plans to continue on to graduate school toward a career in the field of infectious diseases.

Jay Patel, Norhtwestern University
VEGF: A Novel Therapy for Spinocerebellar Ataxia Type 1
Abstract # 52

Jay Patel is a senior majoring in Biomedical Engineering at Northwestern University. He has always been interested in science and research, and after coming to Northwestern quickly immersed himself in translational neuroscience research at the Feinberg School of Medicine. Working in the lab of Dr. Puneet Opal, Jay has gained insight into translational research and his current interests include the use of VEGF as a possible treatment option or biomarker to track the progression of SCA1. In addition to research, Jay volunteers at a local community health clinic and has served as the High School Outreach Chair for Engineering World Health, an organization that repairs old medical equipment and for outreach travels to local high schools to build electrosurgery unit testers. After graduating, Jay plans on attending graduate/medical School to one day combine his research interests and its clinical implications in medicine into a career.

Presenters

Social Sciences and Humanities: 2:00pm- 3:00pm

Thomas Gilbert, Northwestern University
Kierkegaard and the Sociology of Ideas: Pseudonyms as a Network of Intellectual Selfhood
Abstract # 156

Thomas Gilbert is a senior majoring in philosophy and sociology at Northwestern University. He is excited to present research that shows the potential benefits of bringing these two disciplines closer together. Gilbert studied in Copenhagen, Denmark during winter-spring semester 2010, where he began to use network theory to understand the philosopher Søren Kierkegaard's use of pseudonyms. After graduating, he will spend this summer at the Hong Kierkegaard Library at St. Olaf College, MN in preparation for a Fulbright in Denmark. In his spare time, Gilbert enjoys creative writing, chatting with sociology professors, and participating in Northwestern's weekly undergraduate philosophy society meetings. After his Fulbright, Gilbert intends to expand his research by examining the social environments of other historical philosophers while enrolled in a graduate program, in preparation for postdoctoral work in complexity studies.

Brandon Ng, Northwestern University
The Effects of Cultural Priming on Emotional Memory Biases and Interpersonal Relations
Abstract # 167

Brandon W. Ng is a senior majoring in Psychology, English Literature, and Economics at Northwestern University. He is primarily interested in social, affective, and cultural neuroscience, as well as cultural psychology more broadly, and is incredibly grateful for the research opportunities he has attained so far in his career. At Northwestern, he works with Dr. Joan Chiao, investigating the effects of cultural priming on emotional memory biases and prosocial behavior, and has also assisted with studies exploring the role of cultural values on amygdala activity. Furthermore, he also works with Dr. Wendi Gardner, researching broader social psychological phenomena, such as identity formation and threat, as well as the role of promotion priming on facial mimicry and emotional contagion. Brandon has also remained involved in the Evanston community and beyond by participating in Campus Catalyst, an organization at Northwestern that offers consulting advice for non-profit companies in the Chicagoland area. Following graduation, Brandon will continue his studies in graduate school as a doctoral student in the fall to earn a PhD in psychology, focusing on social and cultural neuroscience. He intends to pursue a career in academia and professorship

David Showalter, University of Chicago
Drone Strikes and the Discourse of Ungovernability in Pakistan's Tribal Regions
Abstract # 180

David Showalter is a third-year at the University of Chicago, completing a course of study on crime and punishment under the direction of Professor Bernard Harcourt. Though much of his work and research focuses on drug policy and sex offender policy, he also has interests in sociology, political science, and international relations more generally. He has been heavily involved in syringe exchange work and advocacy, both in Chicago and in his home state of Oklahoma, and also volunteers in a prisoner reentry program in Chicago. A finalist for the Truman Scholarship, David intends to attend law school and pursue a career of public service after graduation.

Cindy Teng, Northwestern University
Priming Pathogens: Effects on Culture and Perception
Abstract # 189

Cindy Teng is a senior at Northwestern University majoring in Psychology with a minor in Business Institutions. Interested in cultural psychology, affective neurological disorders, and behavioral health, Cindy is currently working as an honors thesis student in Dr. Joan Chiao's Social Affective and Cultural Neuroscience Lab at Northwestern University. Inspired by how research could contribute to the improvement of healthcare, she seeks to engage in research to better understand health-related perceptions and behaviors in the context of culture. Cindy embraces global diversity and travels abroad to volunteer in countries such as El Salvador. She plans to further pursue her research interests at the National Institute of Mental Health following graduation.

Presenters

Chemistry: 4:00pm- 5:00pm

Forest Hynes, DePaul University
Bioanalytical Techniques to analyze a single point mutation of the E22Q Dutch Alzheimer's Disease peptide
Abstract # 90

Forest Hynes is a senior majoring in Allied Health Technologies with a concentration in Nuclear Medicine Technology at both DePaul and Northwestern Universities. Forest joined Dr. Sandra Chimon Peszek's research group as of January of 2010 and has since worked on the structural analysis of a shorter fragment of the Alzheimer's beta amyloid peptide along with various single point mutations. While working on the completion of his project for submission to a peer-reviewed journal and academia, Forest is a competitive cyclist and also participates in performing at various theaters in the Chicago region. Forests' passion for research will be furthered by working as a nuclear medical scientist.

Daniel Kim, Illinois Institute of Technology
Boronic Acid Functionalized Gold Nanoparticles for Determining Protein Glycation
Abstract # 120

Daniel Kim is a senior majoring in Chemical Engineering at the Illinois Institute of Technology. He has been working in Dr. Perez-luna's lab for the past two years. His primary research interest includes using gold nanoparticles and silver nanorods for the detection of heavy metals and as thermal indicators, respectively. After spending last summer working in the Diabetes REU program at IIT, he has been focusing on using the applications of functionalized gold nanoparticles to detect protein glycation. Following graduation, Daniel intends to enroll in graduate school to pursue a career in academia.

Jacob Parzen, University of Chicago
SAMDI generates optimized peptide libraries and elucidates networks of opposing enzymes
Abstract # 102

Jacob Parzen is currently a senior at the University of Chicago, pursuing a dual degree in biological chemistry and chemistry. Jacob has long been interested in disciplinary science, so it is fitting that his research interests lie at the intersection of biology, chemistry, and materials science. Currently, he is working with Dr. Milan Mrkisch at Chicago to characterize large peptide libraries using high-throughput acetyltransferase/deacetylase assays and mass spectrometry. Aside from his research, Jacob serves as an international executive for the Triple Helix, Inc., an international, student-run science publication. In this capacity, he works to bridge the divide between the scientific and non-scientific crowds of undergraduates across the globe with content that draws connections between science and society. Jacob also enjoys interviewing prospective undergraduates and working as a tutor for introductory college biology courses. In future years, he hopes to matriculate into medical school and pursue a career as a physician-scientist.

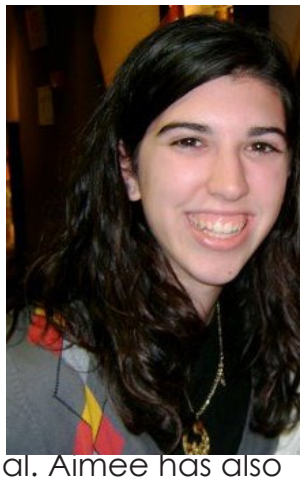
Lacy Simons, Loyola University Chicago
Elucidation of Select Divalent Metal Requirements for Growth of Bacillus anthracis and Expression of Protective Antigen

Lacy Simons is currently finishing her junior year ay Loyola University. She is majoring in Molecular Biology with minors in Chemistry and Physics. Her research experiences have been across-the-board from chemical ecology to biophysics. She enjoys a wide range of interests in chemistry, biology, mathematics, and nanotechnology. Lacy's freshman year yielded her first research publication in a major journal; since then she has not been able to escape the lab. Lacy plans on pursuing a MSTP program after her bachelor degree. She anticipates thriving in a fast-paced, continuously changing environment.Although she has a strong passion to practice medicine, her passion for research is just as strong. Lacy always knew she would pursue a career in the sciences and she plans on continuing her commitment to civic engagement with science students. As a freshman in college she started an undergraduate mentoring program (UNITE) for sixth through twelfth grade students that supplies them with interdisciplinary laboratory experiences. In her free time she enjoys spending time with her son, and taking photographs.

Presenters

Physics and Engineering: 4:00pm- 5:00pm

Aimee Bobko, University of Illinois at Chicago
Treating Lower Respiratory Infections in Developing Countries with Mechanically – Powered Nebulizers
Abstract # 117



Aimee Bobko is a junior majoring in Bioengineering with a concentration in Cell and Tissue Engineering at the University of Illinois at Chicago. Her studies have furthered her appreciation of the application of engineering principles to biological systems and the results which have the potential to improve the entire medical field as well as the lives of i ndividuals. The engineering curriculum at UIC has provided her with many opportunities to explore the improvement of medical device designs, and she is thankful for the opportunity to work with the members of her design team, Alex, Amber, and Amanda, and advisor, Dr. John Hetling, to expand this once theoretical idea into a functioning project. Aimee is a member of the Tau Beta Pi Engineering Honor Society and is an Associate Editor for the Undergraduate Bioengineering Student Journal. Aimee has also worked as a clerk and participated in research with the UIC Transplantation Department. She is also very involved on campus as a resident assistant (RA) in one of the residence halls and a participant in the intramural sports program. After she graduates, Aimee plans on attending medical school in hopes of becoming a surgeon.

Sun Kim, University of Chicago
Biomaterials: Therapeutic Micro/Nano Devices for Tissue Engineering and Drug Delivery
Abstract # 119

Sunny Kim is currently a sophomore majoring in Biochemistry at the University of Chicago. She has always possessed an avid passion the sciences, and over the years, she has been involved in various laboratories to further her research experience and passion. She has worked at the Polytechnic University in Brooklyn on diblock copolymers and their applications in biomedical technology. Additionally, she has worked at the Karp Lab at MIT on applicable nanodevices in drug delivery. Currently, she works at the neuroscience MacLean lab at the University to further pursue her dreams as a doctor and build her research experience as a scientist.

Ahmad Qamar, University of Chicago
Optimal integration of top-down and bottom-up uncertainty in humans, monkeys, and neural networks
Abstract # 124

Ahmad Qamar is a sophomore majoring in Mathematics and Physics at the University of Chicago. His recent summer research works have focused on the interdisciplinary intersection of mathematics, biology, and computer science. He has spent three summers at Baylor College of Medicine researching on projects in bioinformatics, protein imaging software, and most recently theoretical neuroscience. His most recent work was under Dr. Weiji Ma developing computational brain models and biologically plausible neural networks for a decision-making task under uncertainty. Besides his additional interest in statistics and machine learning, his extracurricular activities include working as an analyst for a partnership investment fund, and also for a separate humanitarian project investing in small microfinance institutions. Ahmad plans to pursue graduate studies in physics.

Tyler Hopkins, Loyola University Chicago
A Study of the Local Group of Galaxies Using Virial Theorem
Abstract # 131

Tyler Hopkins is a junior physics major at Loyola University. He has an intense interest in the fields of astrophysics and astronomy and his current research with Dr. John Dykla is focused on studying our local group of galaxies in order to make accurate measurements on the amount of dark matter in the system. He appreciates the opportunity to study with Dr. Dykla and plans on continuing this research through his senior year. He is also a math and physics peer tutor at Loyola's Center for Tutoring and Academic Excellence. After graduating, Tyler plans on going to graduate school to continue his studies in astrophysics.

BIOLOGICAL SCIENCES

1 **Cranial Musculature of the Crocodile Shark, and its Implications to Lamniform Phylogeny**

Ikechukwu Achebe, DePaul University Advisor: Kenshu Shimada, Ph.D.
Field: Paleobiology

The crocodile shark, Pseudocarcharias kamoharai, is a poorly-studied, open-ocean shark found nearly worldwide. It is the smallest species among the 15 living forms of the shark order Lamniform that includes more well-known species such as the great white, mako, and sand tiger sharks. Wilga (2005, J. Morphol., 265:102-119) examined the pattern of cranial muscles in selected lamniform species and proposed a simple successive evolution of jaw musculature through lamniform phylogeny. However, Wilga's study did not include the crocodile shark, and the cranial musculature of the species has remained unstudied.
The aim of my project is two-fold: to describe each cranial muscle in the crocodile shark; and to test Wilga's (2005) hypothesis about the evolutionary scenario of lamniform jaw musculature by adding my data. Tested specimens were scanned through a computed tomographic (CT) scanner in Chicago's Children's Memorial Hospital to analyze their internal anatomy. In addition, dissection of cranial musculature has also been performed on one of the specimens. Depending on the presence, and anatomical arrangement of jaw muscles in P. kamoharai, a phylogenetic repositioning may be necessary.

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2 **Construction of a piggyBac Transposon Vector**

Emmanuel Aryee, University of Chicago Advisor: Bruce Lahn Ph.D.
Field: Stem Cell Research

Current methods of introducing exogenous genes into cultured cells include the use of naked DNA and retroviruses. While the transfection of naked DNA is very efficient, the DNA does not into integrate into the host genome. The use of retroviral vectors solves this problem but also has the disadvantage of being able to carry only DNA of a limited size. The recent introduction of the piggyBac (PB) transposon system enables the introduction of large pieces of DNA which are able to stably integrate into the host genome. Furthermore, the PB transposon system has proved to be much more efficient than other transposons such as Sleeping Beauty (SB). The PB transposon system requires the transfection of a pBase expression plasmid and a piggyBac transposon vector carrying your genes of interest into cultured cells. Here, I have constructed a PB transposon vector to be used in a piggyBac transposon system. To accommodate the introduction of more than one piece of DNA, I have modified the PB transposon vector to be compatible with the Gateway recombination system to allow for the insertion of up to three pieces of DNA. I tested the PB transposon vector in cultured mammalian cells to show that it works.

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3 **Characterization of The Subtelomeric Region of HC21p**

Shamsa Baaj, Loyola University Chicago Advisor: Jeffrey Doering, Ph.D.
Field: Genetics

Telomeres are heterochromatic regions at the ends of all chromosomes composed of 6 base pair tandemly repeated units (TTAGGG)n. Proximal to the telomeric repeats are subtelomeric regions observed at the telomeres of many human chromosomes. Little is known about the organization of the telomeric and subtelomeric regions of the short arms of human acrocentric chromosomes. Current work in our lab aims to develop a detailed physical map of the short arm human chromosome 21 (HC 21p). Due to the repetitive nature of the p arm of HC 21 and its homology to

other acrocentric chromosomes, standard sequencing procedures used by the Human Genome Project cannot be employed. Previous studies have identified the presence of a 6.3kb repeat in the subtelomeric region of HC 21 which contains a 580bp sequence found in the subtelomeric regions of all human chromosomes. By using the technique of telomere anchored PCR previous work in our lab has yielded a 523bp sequence (E9A) on HC 21 which overlaps with the 580bp subtelomeric sequence. The HC 21 lambda phage library was screened using E9A as a probe; the positive plaques were extracted and used for purification. E. coli cells were infected with the purified phages and plated. The lambda DNA from the plate lysate was purified. Primers were designed in order to amplify the insert of the eluted phage DNA by polymerase chain reaction (PCR). The DNA was cloned in a plasmid vector and bacterial cells were transformed. Positive colonies were picked and the plasmids containing the insert were purified. The extracted vectors will be sent for sequencing and the data will be analyzed. The obtained data will broaden our understanding of the organization of the subtelomeric region on HC 21p.

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4 **KFC43 and the Short Arm of Human Chromosome 21**

Piotr Babinski, Loyola University Chicago Advisor: Jeffrey Doering, Ph.D.
Field: Genetics

The short arm of human chromosome 21 was omitted in the Human Genome Project because it is mainly composed of heterochromatic regions of DNA. These heterochromatic regions contain repetitive elements, making it difficult to clone and sequence. Our laboratory is focused on mapping the short arm of human chromosome 21 (HC21p). To close some gaps in the current map I screened for KFC 43, a low copy number repeat (LCNR) known to be on HC21p, using the phage lambda HC21-specific genomic library. KFC 43 was originally isolated and sequenced from human chromosome Y (HCY) and HC21 hybrid cell lines hybridized with KFC43 sequence obtained from HCY showed positive results. Using the sequence from HCY as a probe, initial screenings of the phage lambda library yielded no results. Possible explanations for this could be sequence variation of KFC43 between HC21 and HCY. Next I designed PCR primers for KFC43, again using the sequence from Y as a template, in an attempt to amplify a portion of the sequence on HC21. Results from the PCR showed amplification and those fragments were then inserted into bacterial plasmids to be cloned and sequenced. Currently, we are isolating the plasmids using the QIAGEN Lambda mini kit and sending them out for sequencing. With KFC43 sequence information on HC21 we would be able to determine the sequence similarity to HCY, as well as map more of HC21p.

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5 **Investigating the Role of BMP-2 Signaling in the Development of the Cardiac Conduction System**

Sylvia Badon, University of Chicago Advisor: Ivan Moskowitz, M.D., Ph.D.
Field: Developmental Biology

A limited number of genes have been identified as having roles in the development of the cardiac conduction system. Previous work has shown expression of various isoforms of Bone Morphogenic Protein (BMP) in the myocardium of the developing conduction system in mouse and in chick and the detrimental effects of removal of BMPs. Global removal of BMP-2 signaling in mouse embryos has been shown to cause malformation of the heart resulting in death. Specifically in the conduction system, the loss of BMPR1a in the atrioventricular canal causes conduction system disease, suggesting an important role for the BMP signaling pathway in the determination and development of the conduction system in cardiac development. Recent work in our lab suggests that SMAD4, which is required for transduction of canonical BMP signaling, is necessary for the development of the conduction system. The goal of this project was to test the hypothesis that BMP-2 is required for proper specification of the conduction system. Removal of the BMP-2 ligand in mouse from

conduction precursor cells was accomplished using the Cre-loxP recombination system. Embryos were evaluated for conduction system defects via slide in situ hybridization for Tbx3 and Id2, both targets of BMP signaling, and Cx-43 expression. Preliminary results show removal of BMP-2 has no effect on conduction system development in E13.5 embryos. Other compensatory pathways, including other BMP pathways such as BMP-4, may be active in ensuring normal conduction system development in the absence of BMP-2. Further research is required in defining the role for these signaling pathways in cardiac conduction system development.

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6 **Creating a Higher Resolution Map of the Juxtacentromeric Region of the Short Arm of Human Chromosome 21**

Roxanne Bavarian, Loyola University Chicago Advisor: Jeffrey Doering, Ph.D.
Field: Molecular Genetics

The Human Genome Project left heterochromatic areas unsequenced due to the difficulty of sequencing the highly repetitious DNA associated with these regions. We are studying the short arm of chromosome 21 (HC21p) as a model for characterizing heterochromatic domains. Juxtacentromeric heterochromatic regions play a crucial role in proper chromosome segregation and cell division, and we are physically mapping this area on HC21p. A series of detailed restriction digests were performed using YAC clones that span the region (YACs 831B6, 5A12, 3A8, 1F8) followed by hybridization to various types of satellite DNA known to be contained within the region (Y-specific satellite, satellite I, and alphoid DNA). This allowed construction of a high resolution physical YAC contiguous map of the juxtacentromeric region, eliminating a previously-existing gap in the map of HC21p. The order of the satellite DNAs is now known, with the satellite I DNA cluster located between Y-specific satellite I and the centromeric alphoid DNA cluster. Further mapping is ongoing to determine the sizes of each sequence cluster and the distances between them.

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7 **Caenorhabditis elegans**

Roberto Bonilla, Truman College Advisor: Aaron Putzke Ph.D.
Field: Developmental Biology, Biochemistry

In Caenorhabditis elegans the expression of Fer-Related-Kinase (frk-1) is required for enclosure of the embryo during morphogenesis, suggesting that frk-1 may act to stabilize adhesion complexes independent of its enzymatic activity. Deleting the frk-1 protein disrupts the migration of epidermal cells, preventing enclosure and elongation of the embryo. Using a wild type strain (N2) and a mutant strain (VC-558) we hypothesized that the mutant strain will produce arrested L1 larvae and will have the frk-1 gene deleted. Following PCR experiments coupled with gel electrophoresis, our results showed a 1500 base pair difference in genome size between N2 and VC558 strains, indicating the frk-1 gene had been successfully deleted. This confirmation supports the efforts of other lab personnel.

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8 **Microgeographical distribution of divergent threespine stickleback fish mtDNA haplotypes**

Ashley Brown, DePaul University Advisor: Windsor Aguirre, Ph.D.
Field: Ecology and Evolution

The microgeographical distribution and genetic variation of the threespine stickleback, Gasterosteus aculeatus, is studied to understand the post-glacial events in the upper Fish Creek drainage of Cook Inlet, Alaska. This drainage is small but ecologically diverse and contains populations of threespine stickleback that are highly divergent morphologically. Less is known about the distribution of genetic variation in stickleback populations occurring in this drainage. In this study, the distribution of two major mtDNA clades found in the Upper Fish Creek drainage of Cook Inlet, Alaska is examined. The

Trans-North Pacific Clade (TNPC), which likely evolved in stickleback isolated in the Sea of Japan, occurs at low frequencies along the Pacific Coast of North America. The Euro-North American clade (ENAC), is the more common clade in Europe and North America. To score the haplotypes, DNA of 24 specimens from 35 populations was extracted using standard phenol-chloroform based protocols. The polymerase chain reaction (PCR) was used to amplify a fragment of the Cytochrome b gene approximately 450 bp in length. The restriction enzyme, Nsi I, was used to score the haplotypes. It cuts DNA belonging to the ENAC but not the TNPC. Following PCR amplification, the DNA was run on 2% agarose gels. The samples that did not cut with Nsi I were confirmed as TNPC with the use of HincII restriction enzyme, which cuts TNPC but not ENAC. Of the 35 populations in the Alaskan drainage tested, 14 showed the presence of TNPC, with the highest frequency found in Bear Paw Lake. This study adds to our understanding of the microgeographical distribution of genetic diversity in Alaskan threespine stickleback fish.

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9 **Proximate causes of rapid evolution in rats & mice on the California Channel Islands**

David Byrn, K. Lee-Woodward, and R. Jackson, Olive Harvey College
Field: Evolutionary Biology Advisor: Oliver Pergams, Ph.D.

Rapid morphological evolution has been shown to exist and is often mediated by human activity and environmental changes. Examples of have been identified in rodent populations on islands, specifically deer mice (Peromyscus maniculatus) on the California Channel Islands . Over just 40 years, cranial and external measurements of the deer mice changed as much as 10% in some traits . Surprisingly, most of these changes were towards smaller size, and were not consistent with the Island Effect . There are several plausible explanations, including 1) the introduction of black rats (Rattus rattus) in the mid-19th century (black rats compete with deer mice for resources and prey on young deer mice), 2) changes in vegetation, especially invasive vegetation, 3) changes in climate (temperature & precipitation), and 4) changes in human population density. To assess changes in rats, we took eleven cranial and four standard external measurements from 57 Rattus rattus specimens collected 1940-2000. Measurement errors were minimized using an extensive and novel procedure. We found rat cranial measurements to have grown as much as 11% larger in 43 years, consistent with the Island Effect. These measurements were then compared with 97 Peromyscus maniculatus anacapae (from Anacapa Island), 42 P. m. elusus (Santa Barbara Island), and 38 P. m. santacruzae (Santa Cruz Island). By comparing significant changes in both rats and mice with 1) population density of competitors, 2) climate change, 3) vegetation changes, and 4) human population; we will build a multivariate model of proximate causes of rapid evolution in rats & mice on islands.

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10 **Isolation of microsatellites from Hoplias microlepis (Characiformes, Erythrinidae)**

Jane Chistman, DePaul University Advisor: Windsor Aguirre, Ph.D.
Field: Genetics

Microsatellites are important molecular markers for population level studies due to their high mutation rate and number of alleles. However, one drawback to the use of microsatellites is the necessity of species specific primers. This study focuses on the isolation of microsatellite loci for primer development for Hoplias microlepis, an ecologically and commercially important species of freshwater fish from western Ecuador, which is currently facing strong anthropogenic stressors. The microsatellite loci are isolated by extracting DNA with a standard phenol-chloroform method, followed by an enzyme digestion using RsaI restriction enzyme. Linkers are then ligated to the digested DNA to act as priming sties for subsequent PCR steps. The genomic DNA is enriched for microsatellites by applying a (CA)15 biotinylated probe that binds to microsatellites and separating the probe/microsatellite DNA with streptavidin-coated magnetic beads. The DNA is then inserted

into a vector and incorporated into E. coli using the pGEM-T Easy Vector kit . The plasmid DNA of positive colonies is extracted and sequenced, and primers are designed from regions flanking the microsatellite sequences. In addition, previous microsatellite primers from Hoplias malabaricus, a closely related species to H. microlepis, are being tested using an M13 universal fluorescent tagging system derived from Scheulke (2000). Preliminary results indicate that some of these unspecific primers may yield favorable products for H. microlepis. This study will provide a framework for future studies of genetic diversity and differentiation in H. microlepis.

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11 **Tumor suppression by Arf is oncogene-dependent and is not measurably influenced by Tgf-beta, an Arf regulator**

Patricia Chu, University of Chicago Advisor: Dr. Stephen X. Skapek, Ph.D.
Field: Cancer Biology

In normal cells, tumor suppressor genes, such as Arf, are induced by oncogenes to prevent cancer; however, the mechanisms by which various oncogenes induce Arf are largely unknown. Moreover, in some cancers caused by activated oncogenes, tumor suppressors may be repressed. In this study, I want to help elucidate how oncogenes signal to Arf for a tumor suppressor response. Recently, the Skapek lab found that in the context of eye development, the growth factor Tgf-beta plays an important role in inducing Arf. Thus, I hypothesized that oncogenes may induce Arf by different mechanisms and that Tgf-beta may cooperate with certain oncogenes to enhance tumor suppression by Arf. To test my hypothesis, I ectopically expressed Ras and Cyclin D1, oncogenes commonly associated with cancer, in wild type (WT) and Arf knockout mouse embryonic fibroblasts (MEFs). Then I measured Arf expression and did a cell proliferation assay comparing the growth rate of oncogene expressing cells with or without Tgf-beta. I found both Ras and Cyclin D1 increased expression of Arf but by different mechanisms. While a p38 MAPK inhibitor blocked induction of Arf by Ras, it had no effect on Cyclin D1infected cells. Somewhat surprisingly, ectopic Cyclin D1 increased cell accumulation by four fold over GFP whereas Ras decreased accumulation by two fold, despite their similar effects on Arf expression. Additionally, Arf played a more critical role in the initial tumor suppressor response in Ras-expressing MEFs compared Cyclin D1-expressing MEFs. Lastly, Tgf-beta blocked cell accumulation in WT and Arf null MEFs independently of whether an oncogene was expressed. Accordingly, the mechanisms for induction of Arf and the magnitude of the tumor suppressor effect of Arf in this model varied with the oncogene. Also, Tgf-beta does not seem to cooperate with oncogenes to induce Arf nor do its effects depend on Arf.

12

Hannah Dada, University of Chicago Advisor: Marsha Rosner, Ph.D.
Field: Cancer Biology

The details underlying the pathway tumor metastasis suppressors use to prevent cancer metastasis is unknown. Raf-1 Kinase Inhibitory Protein (RKIP) is a known tumor suppressor which inhibits breast cancer metastasis using the let-7 microRNAs. This project intends to discover the details in the RKIP cancer metastasis prevention pathway in breast cancer metastasis to the lungs. Through statistical analysis, several let-7 target genes relative to RKIP expression were determined: HMGA2 and BACH1. Analysis also determined several lung metastasis signature genes (LMS) whose expressions are induced by the let-7 target genes: MMP1, CXCR4. In performing in vitro experiments using breast cancer models, we have identified and confirmed the signaling cascade RKIP uses to function as an inhibitor of breast cancer metastasis to the lungs. We show that there is a direct correlation with RKIP and let-7g (a member of the let-7 microRNA family) expression: when RKIP is present in breast cancer cells, let-7g expression is high. In models with high let-7g expression, invasion is inhibited. Breast cancer cells subject to a knockdown of let-7g expression result to an increase in the number

of invading cells. Invasion is a process critical to metastasis. By inhibiting invasion, metastasis is also prevented. In the same models with high let-7g expression levels, the let-7g target genes and the LMS genes show low protein expression indicating that these four genes promote metastasis. These results suggest that RKIP prevents breast cancer metastasis via the let-7 microRNA. Let-7g inhibits invasion, and also metastasis promoters (HMGA2, BACH1, MMP1, and CXCR4). This novel signaling pathway serves clinical importance by providing useful information for the development of therapeutic drugs that treat breast cancer metastasis.

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13 **Defective nuclear architecture and gene expression during emerin-null murine myogenic differentiation.**

Justin T Demmerle, University of Chicago Advisor: James Holaska Ph.D.
Field: Molecular Biology and Epigenetics

The structural integrity of the human genome is highly dependant on the inner nuclear membrane of the nuclear envelope. Mutations in the nuclear membrane protein emerin cause muscular dystrophy (X-EDMD) and cardiomyopathy. Loss of nuclear envelope function affects nuclear architecture, gene expression, cell signaling, and mechanical durability. Recent evidence suggests the skeletal muscle phenotype is caused by impaired differentiation of resident adult muscle stem cells called satellite cells. Localization of genes to the inner nuclear membrane was shown to repress several developmentally regulated loci. While positioning of gene loci important for differentiation and stem-cell maintenance is known to be critical in other models, the nuclear architecture of emerin-mutant nuclei and the subnuclear positioning of myogenic regulatory genes throughout differentiation remain uncharacterized. Using 3D fluorescence in-situ hybridization of wildtype and emerin-null murine myogenic progenitors, we found that MyoD and Myf5 loci, which encode muscle-specific transcription factors critical for myogenic development, localize predominantly to the nuclear periphery (≤ 1 μm) in undifferentiated progenitors. Interestingly, over 60% of MyoD and Myf5 loci localize to the nuclear interior in emerin-null myogenic progenitors. We posit that expression of MyoD is repressed at the periphery and expect expression to be increased when MyoD is positioned at the nuclear interior in emerin-null myogenic progenitors. We further predict that increased MyoD expression upon differentiation correlates with movement of MyoD loci to the nuclear interior. We are currently analyzing the subnuclear positioning of the Pax3 and Pax7 loci, which are highly expressed in satellite cells, during differentiation. By quantifying distances between these loci and the inner nuclear membrane, and determining if their positioning correlates with changes in gene expression, these studies will test the relationship between nuclear architecture and gene expression during differentiation of wildtype and emerin-null myogenic progenitors. These studies will also test if changes in nuclear architecture in emerin-null myogenic progenitors result in impaired differentiation.

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14 **PALEOBIOLOGY OF THE LATE CRETACEOUS CARDABIODONTID LAMNIFORM SHARK FROM KANSAS**

Ashley A. Dickerson, DePaul University Advisor: Kenshu Shimada, Ph.D.
Field: Paleoecology

FHSM VP-425 is a fossil shark encased in a limestone slab that is housed in the Sternberg Museum of Natural History in Hays, Kansas. It is a 93-million-year-old (Late Cretaceous) specimen of an extinct lamniform shark, Cardabiodon venator (Cardabiodontidae), from Kansas. It is significant because it preserves a set of large sharp teeth, numerous placoid scales, and pieces of calcified cartilages from one individual. I examined the specimen through direct observation, microscopic analysis, and the use of a computer tomographic scanner (courtesy of the Children's Memorial Hospital in Chicago). My study shows that the specimen preserves upwards of 53 teeth, including many replacement teeth. The teeth vary in size and morphology, suggesting that the dentition of the shark showed heterodonty, where at least eight upper tooth rows and 10 lower tooth rows (likely as many

as about 15 tooth rows in each dentition) are identified. Based on the comparison with another Late Cretaceous lamniform shark, Cretoxyrhina mantelli, the Cardabiodon individual is estimated to have been about 2.5 m in total length. The placoid scales are small, each measuring 0.3-0.7 mm in maximum dimension, and exhibit 6-8 parallel grooves with keels on the crown. The grooved scales indicate that, like Cretoxyrhina mantelli, Cardabiodon was capable of fast swimming and was able to actively pursue lively prey. Such inferences are important to understanding the ecology and evolution of marine ecosystems.

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15 **Correspondence in GC nucleotide content between virus and host**

George Diab, Loyola University Chicago Advisor: Dr. Putonti Ph.D.
Field: Evolutionary Biology

Viruses and hosts have an intrinsic relationship that is continuously changing at a molecular level. Both the virus and the host have an evolutionary influence on each other, resulting in a unique propagation that further determines their co-evolution. The nucleic acid sequence fingerprints that result from this relationship are a result of the pressures the virus faces when crossing into a different host, and its attempt to replicate, adapt and survive. This can be observed through correspondences between viruses and hosts in their genome composition, i.e. GC-content, dinucleotide usage, codon usage, etc. This correspondence, however, is not perfect as viruses tend to have slightly lower GC-content than their host in addition as occasionally incorporating codons for which there are very few tRNAs. We are experimentally testing why this deviation exists. Mutant viral strains of the bacteriophage phiX174 were created aligning the GC-content of the virus with its E. coli C host and comparing the fitness of the mutant with the wild-type. Herein, we present our preliminary results.

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16 **Effects of Naturally Occurring Genetic Variation on the Severity of Mutation Phenotype in the Eye Development Pathway**

Desiree A. Dickerson, University of Chicago Advisor: Misha Ludwig and Martin Kreitman
Field: Ecology and Evolution

Neonatal diabetes is a human disease caused by a dominant mutation in the insulin gene. A transgenic model of this disease was introduced in the fruit fly, Drosophila melanogaster, wherein expression of the mutant insulin causes degeneration of the eye mimicking beta-cell death in the human form of the disease. In the fly, similar to diabetic humans, the severity of eye degeneration is sensitive to the genetic background in which the mutation is expressed. When crossed with different wild-derived fly strains, Akita insulin expression results in a wide range of eye phenotypes, extending from nearly complete eye loss to practically wild type eyes. Where does this genetic variation in severity of disease originate? More specifically, does this genetic polymorphism reside in genes regulating eye development, or alternatively does it inhabit non-developmental pathways? To distinguish between these possibilities, we investigated two classical dominant eye mutations, Drop and Lobe, both of which are transcription factor mutations disrupting eye development regulation, as well as the Akita insulin mutation. Each mutation was crossed into 38 fly lines carrying different genetic backgrounds. Three major findings were observed. First, all three traits were influenced by genetic background. Second, Drop and Lobe were less sensitive to genetic background than Akita insulin, producing only a narrow range of eye phenotypes. Third, specific wild genetic backgrounds were identified that produced either the most severe or the most suppressed phenotypes for each mutation, indicating a naturally occurring mutation in a shared pathway. The Akita mutation may effect downstream pathways and can greatly impact phenotype by unfolded protein response or negative feedback systems, while Lobe and Drop may lead more directly to apoptosis. The discovery that specific genetic backgrounds can similarly affect all three mutations, suggests naturally

occurring variation must at least partly reside in shared eye development pathways. D.melanogaster models of human disease may be useful for understanding not only the genetic basis of disease but also the premise for genetic variation in disease severity.

17

Joshua Eassa,and J. Lakhoo, Northwestern University Advisor: Robert A. Linsenmeier, Ph.D.
Field: Neurobiology and Physiology

Brain circulation is autoregulated to provide a constant supply of nutrients despite changes in blood pressure, cellular metabolism, or oxygenation. Cerebral blood flow is regulated less well during anesthesia; however, the impact of anesthesia on the autoregulation of brain tissue oxygen tension (PO2) has not been measured. To investigate the impact of isoflurane on cerebral autoregulation, we recorded PO2 with oxygen sensitive electrodes in the somatosensory (whisker barrel) cortex of rabbits before and during anesthesia with isoflurane. Animals were implanted with chambers over the cortex in a sterile surgery. At least ten days after recovery from the surgical procedure, rabbits were restrained for the measurements but showed no signs of distress. After a period of electrode stabilization, PO2 was recorded while the awake animal breathed air (baseline) followed by a 90 second episode of 100% oxygen (hyperoxia), during which time the brain PO2 stabilized. For each episode, ΔPO2, the hyperoxic PO2 minus the baseline PO2, was computed. Following several episodes of hyperoxia, the animal was anesthetized with 0.5% or 1.5% isoflurane, and the hyperoxic episodes were repeated. The anesthetic was then terminated and responses were again recorded in the awake animal. Brain PO2 increased during hyperoxia in both awake and anesthetized rabbits, but under 1.5% isoflurane, the hyperoxic ΔPO2 was significantly larger than during air breathing in all four rabbits studied. The responses during 1.5% isoflurane were 2.15 ± 0.6 (mean and SD) fold greater than when the rabbits were awake. The effect of 0.5% isoflurane was variable. These results indicate that the ability of the somatosensory cortex to regulate PO2 in response to hyperoxia is worse during anesthesia, which may have implications for respiratory management during anesthesia.

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18 **Interact With Collagen**

Aya Eid, Illinois Institute of Technology Advisor: Joseph Orgel, Ph.D.
Field: Computational Biology

The collagenous extracellular matrix (ECM) is the basis of all human connective tissues (bone, skin, tendon, blood vessels, organs), thus understanding its structure-function relationships has significant relevance to human health. Currently, however, this information is only readily accessible to the structural specialists, and the process of mentally processing the wealth of data can be an arduous and confusing task.

Interact With collagen is an intuitive website, built to provide an interactive tool to display the spatial and chemical relationships between ligand-binding sites and disease associated mutations on collagen and the ECM proteins that bind to it.

Interactive With Collagen utilizes Jmol, a powerful, open source, interactive java applet for molecular visualization and manipulation in 3D. Currently, over fifty ligand binding sites have been mapped onto one D-period of the type I collagen microfibril, and many of their references are provided.

The user can search and display amino acid sequences on collagen and highlight the fibrillar-banding pattern. Additionally, a color coded map can be superimposed on collagen, showing the accessible regions of the microfibril when in its mature packing structure. Finally, the user will be able to print a list of desired sites, including a screen shot of the displayed sites, the amino acids involved in interaction, the references from which the site was proposed and the techniques used to resolve the site. This web-accessible resource will continue its growth by including binding conformations, displaying protein homology, and by allowing others to post sequences of proposed interactions

onto the main database.
Interact With Collagen will deliver a powerful tool for hypothesis formation and testing, and will serve as a module for educational outreach.

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19 **Remarkable new turtle fossil from Niger offers insight into early evolution of side-necked turtles and Cretaceous fragmentation of southern continents**

Sara J. ElShafie, University of Chicago Advisor: Paul Sereno, Ph.D.
Field: Paleontology

Side-necked turtles (Pleurodires) comprise a very small percentage of both extant and fossil turtle groups. Well-preserved pleurodire fossils are rare, and very few primitive species have been described. A remarkably well-preserved and articulated skull and post-cranial skeleton of a small basal pleurodire was discovered recently beneath a skeleton of the spinosaurid dinosaur Suchomimus tenerensis in the Elrhaz Formation (Aptian-Albian, ca. 110 Ma) in the Gadoufaoua region of Niger. The specimen includes a nearly complete carapace and plastron with complete forelimb, hind limb, and cervical and caudal series.
The Nigerienne turtle appears to be closely related to the primitive and unusual pelomedusid Araripemys barretoi from similar age sediments in the Santana Formation of northeast Brazil. The Nigerienne turtle retains all synapomorphies that characterize the family Araripemydidae, of which A. barretoi is currently the only established taxon. Other features distinguish the Nigerienne turtle from A. barretoi as a new species and perhaps a new genus. Some of these features suggest synonymy with a poorly known taxon, Taquetochelys decorata, which was previously described from isolated shell fragments also recovered from the Gadoufaoua region. The paucity of the Taquetochelys material has led some scholars to question validity of this taxon. The author is currently examining the Taquetochelys material to assess its relationship to the Nigerienne turtle.
Phylogenetic analysis of the Nigerienne turtle requires a reevaluation of early pelomedusoid radiation, which remains poorly understood. Addition or modification of characters is needed to resolve these relationships. Preliminary cladistic analysis places the Nigerienne turtle as a new sister taxon to A. barretoi.
The presence of closely related species in Brazil and Niger in sediments of approximately 110 Ma provides additional evidence of prolonged faunal exchange between South America and Africa prior to the opening of the Atlantic Ocean.

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20 **Genetic differentiation and diversity of sympatric anadromous and lake resident threespine stickleback in Mud Lake and Jim Lake, Alaska**

Rosanna Falco, DePaul University Advisor: Windsor Aguirre, Ph.D.
Field: Evolutionary Biology

The threespine stickleback, Gasterosteus aculeatus, is a species of fish that is becoming a very important model system in evolutionary biology. This species has shown extremely rapid adaptation to new environments and is being studied throughout the world. Primitively, stickleback are oceanic but they have established resident freshwater populations in postglacial areas of the northern hemisphere. Mud Lake and Jim Lake are small lakes that form part of the Jim Creek drainage in the Cook Inlet region of Alaska. These lakes are among the few lakes in the world in which anadromous (ocean-run) and resident lake stickleback are known to breed sympatrically. Although morphological differences have been relatively well documented in this system, very little is known about the level of genetic differentiation. To look at the genetic differences between the anadromous-resident freshwater species pairs, specimens were collected from these lakes and neighboring lakes and streams. A total of 144 specimens from six different populations were sampled in this area, 24 specimens from each population. A fragment 433 bp in length of the mtDNA control region of

each specimen was PCR amplified and sequenced. The results were then analyzed for differences between the species pairs and populations and to measure levels of genetic diversity. By analyzing the mtDNA control region of G. aculeatus in this system, it will be possible to gain insight into the evolutionary origins of these sympatric anadromous-lake resident species pairs.

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21 **Characterizing L1 retroelements from the heterochromatic short arm of human chromosome 21**

Ninoshka Fernandes, Loyola University Chicago Advisor: Jeffrey Doering, Ph.D.
Field: Genetics

The human genome contains a large number of repetitive sequences whose functions are not completely understood. L1 elements are a major component of the interspersed repetitive elements, which constitute more than 42% of the genome. L1 elements are autonomous non-long terminal repeat retrotransposons that duplicate and insert themselves into the genome via an RNA intermediate. Most elements are truncated with only full length ones having the potential to actively transpose. A full length L1 sequence is approximately 6.0 kb long and contains two open reading frames. These open reading frames encode for an RNA binding protein and a protein with endonuclease and reverse transcriptase activities. Both these proteins are crucial for the transposition of L1 elements via reverse transcription of L1 RNA into cDNA by reverse transcriptase followed by integration into the host genome. L1 repetitive elements, while well-characterized in euchromatic regions of the genome, have not been studied in heterochromatic regions. The short arm of human chromosome 21 (HC21p) is a good model for studying the organization of L1 repetitive elements in the heterochromatic regions of the genome. Our previous studies showed that while L1 elements in general are underrepresented on HC21p those that are present are disproportionately full length. The full length active L1 copies could generate insertional mutations at many genomic sites. We previously cloned fragments from HC21p containing full length L1 elements from a phage library. I am using PCR to isolate these fragments and transfer them to plasmids for sequencing. My sequence data will then identify potentially active L1s on HC21p and allow testing for its retrotransposition activity in the genome. Having a detailed understanding of these L1 retrotransposons is necessary to fully characterize all elements that can contribute to genomic evolution.

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22 **Calpain Activity in the Brains of Mice and Naked Mole-Rats: A Comparative Analysis**

Anuhya Gampa, University of Illinois at Chicago Advisor: John Larson, Ph.D.
Field: Neuroscience

Naked mole-rats live up to ten times longer than other rodents of comparable body size. Numerous causes for variations in longevity have been suggested, ranging from reversible oxidative damage to endogenous telomerase activity. However, the mechanism responsible for the unusual maximum lifespan of naked mole-rats is uncertain. It has been noted that the activity of brain calpain, a calcium-dependent proteolytic enzyme, is negatively correlated with lifespan across diverse mammals; however calpain activity has not yet been measured in the naked mole-rat brain. Thus, this study aimed at comparing the levels of activity of m-calpain (which is activated with millimolar concentrations of calcium in the cell) in the mouse and mole-rat brain. The hypothesis was that because mole-rats tend to live longer, calpain activity would be lower in the mole-rats than in the mice. Various areas of brain tissue were extracted and homogenized from the subjects. After this, the protein concentrations of the samples were standardized and to measure total activity, a synthetic substrate was added which fluoresced upon cleavage by calpain. Calcium was added to activate the enzyme, and thus, activity levels were determined based on relative fluorescence from the substrate cleavage. Statistical analysis showed that across all samples, the mole-rat brain had significantly lower levels of calpain activity than the mouse brain, as expected from the relation between lifespan and calpain in other mammals. Why brain calpain activity is correlated

with maximum lifespan across mammal species is unknown. The present results strengthen this relationship by showing that a rodent with an unusually long lifespan has unusually low levels of brain calpain activity. Future studies should examine the participation of this proteolytic activity in neurodegenerative processes that contribute to brain aging, and possibly contribute to longevity.

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23 **Analysis of body shape and vertebral number for oceanic and benthic population of the threespine stickleback fish, Gasterosteus aculeatus**

Shawn Gideon, DePaul University Advisor: Windsor Aguirre, Ph.D.
Field: Evolutionary Biology

Body shape and vertebral number varies substantially among fishes. The threespine stickleback (Gasterosteus aculeatus) is a great model organism to study how changes in body shape can impact the axial skeleton. Ocean sticklebacks occur in temperate waters throughout the northern hemisphere and have established resident lake and stream populations since the retreat of glaciers approximately 15,000 years ago. These newly established resident populations have adapted, changing substantially in morphology from their oceanic ancestors. Resident populations have also diversified in freshwater in relation to environmental differences. Research has been conducted on the ancestral anadromous form and it is relatively well known. Since different threespine stickleback populations have evolved in different habitats, these populations vary broadly in body shape. How these changes in body shape affect vertebral morphology is unknown. Different resident freshwater populations might have evolved different numbers of abdominal and caudal vertebrae as deeper or more elongate body shapes evolve. Alternatively, it may be vertebral lengths that change. This study will use statistical methods to analyze data from populations collected from ancestral (oceanic) and deep bodied (benthic) populations to examine how changes in body shape and vertebral number and length relate. Body shape is examined using geometric morphometric methods while vertebral number and length is measured from digital images of x-rays taken from 30 male and 30 female sticklebacks from replicate oceanic and benthic populations.

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24 **Neutrophil Gelatinase-Associated Lipocalin as a Biomarker of Acute Kidney Injury Following Partial Nepherectomy**

Vanessa Gonzalez, University of Illinois at Chicago Advisor: W. Brian Reeves, M.D.
Field: Medicine

Acute kidney injury (AKI) can complicate partial nephrectomy due to renal ischemia induced by prolonged clamping of the renal artery during surgery. There is a need to improve on nephrectomy procedures in order to reduce renal damage. Research in this field is hampered by the lack of good indicators of kidney injury, especially in the setting of a functioning contralateral kidney. Neutrophil gelatinase-associated lipocalin (NGAL) is dramatically upregulated after kidney ischemia. Levels of NGAL in the blood and urine have been proposed to be sensitive and early indicators of AKI in several settings. The goal of this study is to investigate the value of neutrophil gelatinase-associated lipocalin (NGAL) as a urinary biomarker for the detection and quantitation of AKI in patients subjected to unilateral renal ischemia during partial nephrectomy. Eleven patients scheduled for a partial nephrectomy underwent pre and post surgery urine collections. Patients subjected to radical nephrectomy served as controls. NGAL concentrations in the urine samples were determined by ELISA. Clamp time of renal arteries during surgery was noted as well as the levels of the current kidney injury indicator: serum creatinine (SCr). Post-operative urine NGAL levels were increased in patients following partial nephrectomy but not radical nephrectomy. The urine NGAL was increased as early as 2 hours after surgery and preceded any visible increase in SCr levels. There was a correlation between the duration of renal artery clamping and the increase in urine NGAL levels. NGAL levels may be useful as an early diagnostic marker for AKI in post partial nephrectomy patients and might

be useful as a surrogate marker of kidney injury in intervention trials. Analysis of other promising urine biomarkers is in progress.

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25 **Co-treatment of ferric ammonium citrate (FAC) with ebselen decreased FAC induced PC-3 cell invasion**

Wenji Guo, University of Illinois at Chicago Advisor: Dr. Andre Kajdacsy-Balla, M.D., Ph.D.
Field: Molecular Pathalogy

Prostate cancer progression, invasion, and metastasis are complex processes involving the interplay between cancer cells and microenvironment with tight regulations to ensure the growth and survival of cancer cells. The studied hypothesis is that environmental iron exposure may trigger already established cancer cells to increase their invasive and metastatic behavior through a non-genotoxic mechanism.

PC-3 prostate cancer cell invasion with iron was investigated using Neuroprobe filter membrane transmigration assays. PC-3 cells were pre-incubated with 100 uM FAC for 6 hours. Excess iron was removed before the assay. The PC-3 cells were placed on an extracellular membrane preparation (Matrigel ®) in the upper wells of the chamber and allowed to migrate onto the underside of a porous membrane that allowed cell transmigration. The number of cells migrating to the underside of the membrane is a direct measure of cell invasion. Pre-treatment with 100 uM FAC caused a 4-fold increase in PC-3 cell invasion through the Neuroprobe porous membrane above control when measured at 24 hours ($P < 0.05$). The FAC concentrations that induced PC-3 invasion were significantly below that which interfered with cell viability or proliferation within the assay period of time. Furthermore, we discovered that co-treatment of FAC with antioxidant ebselen, a hydrogen peroxide inhibitor, decreased FAC-induced PC-3 cell invasion. We also examined the mRNA expression of invasion related genes using a cDNA array and found a positive correlation between the exposures to FAC and the invasion phenotype of prostate cancer cells. The data demonstrated the activation of genes associated with the notch and androgen receptor signaling pathways and up-regulation of fractalkine on PC-3 cells treated with FAC, which may be associated with iron-induced invasion of prostate cancer. Our data suggest iron overload may be detrimental to patients with prostate cancer and that the effect of iron on invasion may be inhibited by ebselen.

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26 **Mapping the Histone Modifications within the short arm of Human Chromosome 21**

Daniel Harris, Loyola University Chicago Advisor: Jeffrey Doering Ph.D.
Field: Molecular Biology

The Human Genome Project did not provide the entire human genome sequence, leaving out all the complex repetitive sequences in the heterochromatic regions of the genome. We are studying the detailed structure of the short arm of human chromosome 21 (HC21p), a region originally thought to be heterochromatic. Recent data, however, suggests that this region may be a mosaic of both euchromatic and heterochromatic domains. The goal of my project is to map the various histone modifications on the chromatin of HC21p to deduce whether a region is heterochromatic or euchromatic. Methylation of histones is a marker of heterochromatin while acetylation is a marker of euchromatin. To determine the particular histone modifications on various regions of HC21p I have used chromatin immunoprecipitation (ChIP). This technique uses antibodies to specifically precipitate chromatin regions containing only a particular type of histone modification. The ChIP fractions are then analyzed using real-time quantitative PCR (qPCR) to determine which sequences were precipitated with a given antibody. I have been examining histone modifications on the chAB4 duplicon, a 200 kb paralogous sequence present on HC21p as well as in heterochromatic regions on other chromosomes in the genome. I designed primers for 3 unique sequences within chAB4 (KFC 11, KFC 37 and KFC 52) to use in the qPCR assays. Our initial results show that many of the histone modifications in the chAB4 region are markers of euchromatin. Thus, a euchromatic

chromatin domain can exist in the midst of extensive heterochromatic regions. Further histone modification studies on other portions of HC21p will provide the most complete structural map of any heterochromatic genome region.

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27 The Grainyhead-Like 2 (Grhl2) Transcription Factor Is Essential For Normal And Malignant Mammary Ontogeny

Tsung Ming, University of Chicago Advisor: John M. Cunningham, M.D.
Field: Breast Cancer

The Drosophila transcription factor family grainy head (grh) is required for polarized epithelial cell migration. Our laboratory has implicated the mammalian homologues grainyhead like 1-3 (Grhl1, Grhl2 and Grhl3) in diverse developmental events including epidermal differentiation, migration, maintenance of epidermal integrity, epithelial apical junctional complex composition and wound healing. Interestingly, in silico studies suggest that Grhl2 may be involved in progression of mammary tumors. To test this possibility, MCF10A breast epithelial cells were transfected with a Grhl2-expressing construct and cultured in Matrigel (3D culture). With vector transduced cells, acinar-like structures with hollow lumens, reminiscent of the in vivo breast, are formed after 6-8 days in culture. In contrast, MCF10A cells transfected with Grhl2 developed ball like-structures, but failed to undergo clearing of lumen-filling cells. Grhl-2 over-expression resulted in increased cell proliferation and decreased apoptosis, as measured (respectively) by BrdU incorporation and activated caspase-3 expression. Interestingly, Grhl2–MCF10A breast cell lines showed reduction in epithelial markers including E-cadherin and B-catenin and increased levels of the mesenchymal markers N-cadherin, Laminin V, B6-integrin and GM130. These results suggest that increased Grhl2 expression alters tissue polarity. Consistent with this observation, we identified several targets of Grhl2 including scribble, whose function is critical in establishing epithelial cell polarity and modulating lamellapodia-mediated cell movement. Our results are consistent with a central role for Grhl2 in normal and malignant mammary development. Indeed, preliminary data implicating Grhl2 as a key factor in primary tumors with amplification of the 8q22 locus are consistent with a novel role for this factor in breast cancer progression. Our observations strengthen a focus on strategies targeted at identifying evolutionarily conserved developmental mechanisms co-opted during oncogenic transformation.

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28 Effects of Connexin 36 on Olfactory Perception

Aminah Hussaini, Illinois Institute of Technology Adviser: Chunbo Zhang, Ph.D.
Field: Neurobiology

Connexin 36 (Cx36) is one type of gap junction protein. Gap junctions formed by Cx36 are found in a variety of neurons including interneurons and have important physiological functions. In the olfactory system, Cx36 is expressed in neurons in the olfactory epithelium and olfactory bulb. This information raises a question of whether removal of Cx36 directly affects the ability to smell and to identify different odorants. Therefore in order to study the effect of Cx36 on the olfactory system, we compared behavioral responses to odorants between Cx36 knock out mice and their wildtype or heterozygous littermates to identify whether Cx36 knock out mice have distorted sense of smell. A total of 22 transgenic mice (knockout homozygous, heterozygous and wildtype mice) were used during this study. Approximately half of the mice were knockout mice yet information for which particular ones were was not disclosed to the researcher in order to avoid experimenter bias. A habituation/dishabituation behavior procedure was created which allowed a mouse to be timed for how long they sniff an odorant source offered to them with a 2-min period. Two positive controls were applied at the beginning and the end, respectively to ensure that mice were active during the trials. The middle sections include a negative control and two test odorants. Numerous tests were conducted, started at concentration of 0.01% (v:v in mineral oil) to determine the threshold

concentrations (the least amount of odorant concentration at which the mice could smell). The threshold concentration for various odorants is around 0.000001% . Different mice showed different sniffing time in the habituation/dishabituation tests. These mice were divided into two groups according to their behavioral tasks. The data was graphed and admitted for ANOVA analysis and Post Hoc tests. The data indicate that olfactory detection in Cx36 knockout might be different then other mice.

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29 **Molecular Study of Weed Herbicide Resistance Affecting Agriculture**

SoRi Jang, University of Chicago Advisor: Robert Haselkorn, Ph.D.
Field: Molecular Biology

Acetyl-coenzyme A carboxylases (ACCs) are essential rate-limiting enzymes of fatty acid metabolism, making them attractive targets for drugs and herbicides. For this reason, many commercially valuable herbicides targeting ACCs have been developed to control grassy weed populations. Due to the wide-usage of these herbicides, however, many spontaneous, herbicide-resistant weed populations have been identified in agricultural regions around the world. Target enzyme mutation is one source of resistance. Single-site mutations at eight amino acid residues in ACC confer various levels of resistance to different herbicides. These resistant mutations were identified in weeds in areas reported by farmers, where the effectiveness of these herbicides were lost. In my project, I studied the effects of these mutations causing resistance of grassy weeds towards herbicides from a molecular biology standpoint using yeast ACC-gene replacement strains as surrogate host. The transgenic system allows study of one mutation at a time, which cannot easily be done directly using the plant system. I measured resistant factors (IC50 of mutant/IC50 of WT) for all seven resistant-causing mutations and ten herbicides representing all three families of ACC herbicides (fops, dims, and pin). To interpret my results, I modeled interactions between herbicides and wild type (WT) and mutated ACCs using available crystal structures of yeast ACC. I expect my results to provide guidance for the herbicide use in agriculture in terms of selecting appropriate herbicides or discontinuing their use all together depending on the occurrence of resistant mutations in the affected area. The goal is to prevent excessive use of herbicides. Additionally, our studies will help develop new herbicides targeting ACC, whose action is not affected by pre-existing and already widespread resistant mutants.

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30 **Filling the Gaps in the HC21p Physical Map**

Akadia Kachaochana, Loyola University Chicago
Field: Genetics Advisor: Dr. Jeffrey L. Doering, Ph.D.

Our laboratory is working towards completing a map of the short arm of human chromosome 21 (HC21p), which is a heterochromatic genome region primarily composed of repetitive elements. These elements are unstable and difficult to clone and sequence, and so were not studied by the Human Genome Project. In order to eliminate gaps in our map, I screened a phage lambda HC21-specific genomic library with SSW9, a low copy number repeat (LCNR) known to be on HC21p. I was not able to identify any positive plaques with SSW9, possibly because not enough plaques were screened. I then screened the library with □2, a high copy number beta satellite sequence. Since our map also has a gap near this sequence, □2 is a good marker to use both for a positive control and to help fill gaps in our map. After screening with □2, I identified two positive phage plaques from the library, and went on to purify each plaque to 100% purity. I purified the DNA from these two plaques using the QIAGEN Lambda Midi kit. I designed PCR primers to amplify the inserts from lambda Charon 21A's HindIII site, and then did PCR reactions to isolate the □2 inserts. I obtained a total of three different fragments. I digested the fragments with HindIII, and am ligating them into the pUC18 plasmid vector. Transformation with blue-white colony screening will permit isolation of

the recombinant plasmids in bacterial cells. I will then purify the plasmids and send them out for sequencing. I will then analyse the sequences (using such programs as NCBI's BLAST and DNASTAR's Lasergene) in order to fill the gaps present in our map.

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31 **Avian Malarial Parasite Prevalence and Diversity in Phylloscopus warblers**

Melissa Kardish, University of Chicago Advisor: Jeffrey L. Doering, Ph.D.
Field: Genetics

Wild bird populations throughout the world are affected by multiple malarial pathogens. Parasitic strains exhibit geographic, temporal and interspecific variation and can have negative fitness consequences in infected individuals. The Hamilton-Zuk hypothesis predicts that species with stronger sexual selection should also experience greater parasite pressure. In this study, we examined the geographic and interspecific variation of the malarial strains Haemoproteus and Plasmodium in three populations of two sympatric warbler species, Phylloscopus humei and Phylloscopus trochilodes. We collected samples from both species at sites representing different habitat types and populations densities in India, Kyrgyzstan, and Russia. Based on the Hamilton-Zuk model, we predict that these three populations, which also differ in sexual selection pressure, will experience varying parasite pressure. To determine if there are differences in relative parasite prevalence, number of unique strains, and prevalence of different strains, across different habitats and/or species, we screened samples for parasite presence via nested PCR. We then sequenced the parasite mitochondrial cytochrome b gene from infected individuals. We will next construct phylogenetic trees using the cytochrome b sequence data to determine if parasite strains covary with species or habitat. Our results can ultimately be compared to behavioral data on individual birds to discover whether a correlation between fitness measures and parasite load exists and, if so, how it varies between regions and species.

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32 **Effect of commensal microflora on the outcome of a Yersinia infection**

Samira Khakpour, University of Chicago Advisor: William Depaolo, Ph.D.
Field: Immunology/Microbiology

Commensal microorganisms play a significant role in protecting a host from infection by modulating signals from the immune system and preventing pathogen colonization through competition. Segmented Filamentous Bacteria (SFB) is a commensal that inhabits the distal ileum and promotes Th17 immunity. Th17 cells promote a variety of immune responses, including the production of antimicrobials and neutralizing IgA. Importantly, differences in mucosal Th17 responses exist between mice of the same C57BL/6 strain from different animal facilities. Taconic mice, which possess SFB, have high levels of IL-17 compared to Jackson mice, which posses no SFB. Yersinia enterocolitica is an enteropathogenic, gram-negative bacterium that causes severe gastroenteritis through colonization of the distal ileum. Furthermore, we have recently shown that a Th17 response is critical for the elimination of Yersinia in a model of oral infection. Using this information, our purpose was to investigate the immune response in Jackson and Taconic mice infected with Yersinia. We hypothesized that Taconic mice would be more resistant to infection because of the increased IL-17 leading to increased production of antimicrobial peptides and IgA. We found that Taconic mice were, in fact, more protected from infection. However, antimicrobial peptide and cytokine production were not elevated in Taconic mice. Further, Taconic mice had higher levels of Yersinia bacteria in the lumen and a delay in penetration of the epithelial barrier, suggesting that SFB may compete with Yersinia for a niche in the distal ileum. These studies suggest that the presence of a specific commensal may have very important non-immune consequences during infection.

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33 **In Vivo Evidence For the GTPase Facilitated Mechanical Role of Dynamin in Vesicle Fission**

Syed Khalid, University of Illinois at Chicago Advsior: Liang-Wei Gong, Ph.D.
Field: Neuroscience

Exocytosis of synaptic vesicles is rapidly followed by compensatory plasma membrane endocytosis. The efficiency of endocytosis has been shown to vary with experimental conditions, but the molecular basis for its control remains poorly understood. The function of GTPase dynamin has been implicated in vesicle fission by means of electron microscopy, in vitro lipid tube imaging, FM dye, and postsynaptic electrophysiological experiments. Though these experiments provide an appreciation for dynamin's endocytic role, they do not implicate specific knowledge of dynamin's dynamic function in endocytosis. Here, by means of cell-attached capacitance electrophysiology, real-time illustrations of membranous area dynamics were utilized to functionally discern the role of dynamin in endocytosis. Dynasore, a well-known membrane permeable dynamin GTPase inhibitor, was used to disrupt dynamin GTPase activity. Thusly, a 73% increase in endocytic duration induced by dynasore treatment was observed of the already retarded number of endocytic events recorded—a near three- fold decrease. A 95% increase in the fission-pore conductance, which is determined by the fission-pore geometry, is observed in cells treated with dynasore. Our data provides the first piece of in vivo evidence for the mechanical role of dynamin in vesicle fission.

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34 **Screening for Hypoxia Susceptible Genes in the Fetal Rabbit Brain**

Syed Khalid, University of Illinois at Chicago Advisor: Sidhartha Tan, M.D.; Lei Yu, M.D., Ph.D.
Field: Neuroscience

Background: Cerebral palsy (CP) is one of the most severe consequences of prenatal hypoxia-ischemia (H-I). We have a unique rabbit model of CP that develops after acute placental insufficiency at preterm gestation, based on the clinical paradigm of abruptio placentae. This model is the first to reliably lead to a CP phenotype. It allows us to rigorously test not only putative therapies but also mechanistic pathways of CP in animals. A non-invasive MRI biomarker, using apparent diffusion coefficient (ADC), allows us to predict the phenotype (postnatal hypertonic or non-hypertonic) immediately after H-I and thus identify susceptible animals in the same litter.
Hypothesis: The individual susceptibility of rabbit fetuses to HI-induced motor deficits of cerebral palsy is underlined by differential expression of key susceptibility genes Method: Brain samples were collected from hypertonic (sick) and non-hypertonic (healthy) animal based on MRI facilitated predictions and subsequently RNA was extracted. Gene expression levels were compared between the two groups using differential display (DD) assay due to the lack of full sequencing information of rabbit genome. The resulting DD bands from PCR reaction were purified and sequenced. Then the full-length gene sequences were obtained by using Rapid Amplification of cDNA Ends (RACE) PCR. Homologous genes in human, mouse and rat were identified with NCBI BLAST.
Results: A brand new gene (Lei-2) and several other new genes that has homologous with human's were identified has significant diffident expression levels between sick and healthy animal brain. Their sequences were submitted to GenBank. The exact functions of those genes in brain were currently under investigation.

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35 **Tissue-Selective Regulation of Stress Response Networks in C. elegans**

Jonathan Kim, Northwestern University Advisor: Richard I. Morimoto, Ph.D.
Field: Systems Biology

Disruptions to protein conformation are associated with numerous protein misfolding diseases such as Alzheimer's, Parkinson's, and Huntington's disease. It is imperative that the cell is able to detect

damaged proteins and coordinate appropriate protective stress response pathways, such as the heat shock response (HSR). This highly conserved pathway is well characterized at the cellular level. Here, we present a comprehensive genetic analysis of the HSR in an intact multicellular organism, Caenorhabditis elegans. We utilized RNAi screening to identify and characterize genetic negative regulators (HSR Suppressors) of the HSR in the absence of stress. This approach revealed distinct tissue-selective regulation of the HSR. In addition, we developed a novel HSR reporter in order to examine alterations to HSR regulation in the presence of toxic polyglutamine repeat protein associated with Huntington's disease. While we unexpectedly discovered that this reporter may not be suitable for these experiments, we may have fortuitously developed a new folding sensor that might suggest that the RNAi knockdown of HSR Suppressors induces the HSR by disrupting the folding environment.

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36 **Surviving transport: Oxidative stress response of early mosquito stage malaria parasite Plasmodium**

Rachel Kooistra, Loyola University Chicago Advisor: Stefan Kanzok, Ph.D.
Field: Parasitology

The Malaria parasite Plasmodium transmitted by mosquitoes is the most successful vector borne pathogen, infecting more than 250 million people worldwide each year. The insect vector represents an environment dramatically different from the human blood and requires Plasmodium to adjust its biology accordingly. The parasite is taken up by a female mosquito as part of a blood meal which will be digested in order to supply the insect with nutrition for its eggs. To avoid the same fate Plasmodium converts into a motile form, the ookinete, which escapes the digesting blood meal across the epithelial cell barrier that lines the midgut of the mosquito. However, it takes about 18 hrs for the ookinete to mature into its motile form. To survive, the parasite has to be able to respond to environmental stresses, such as reactive oxygen species (ROS) and other cytotoxic compounds, which originate not only from blood meal digestion but also from the insects' immune response. Data from our lab indicates that the parasite upregulates antioxidant genes in response to the environmental stresses in the mosquito. To gain more insight into this oxidative stress response, we have challenged mosquito stage parasites in vitro with various ROS and detected that Plasmodium induces distinct sets of defense genes for each oxidant. We also show that the extent of the response is concentration dependent, indicating the environmental concentration of a given oxidant in the mosquito midgut. Our data provides new information about the adaptation capabilities of the malaria parasite to different environments. This may help to understand how Plasmodium is able to utilize different mosquito species as disease vectors. It will also help to identify key players in the antioxidant defense of the parasite which may be exploited for transmission intervention studies.

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37 **Quantifying the Variation in Bacterial Diversity between Lake Michigan Beaches using Next Generation Sequencing**

Gina Kuffel, Loyola University Chicago Advisor: Catherine Putonti, Ph.D.
Field: Bioinformatics

Advances in the amount of data which can be generated by next-generation sequencers provide us with a unique opportunity to assess not only the microbial members present within environmental samples, but also the genes being expressed. High-throughput sequencing was conducted using the Illumina Genome Analyzer System for 3 samples collected from near shore waters at different Lake Michigan beaches including 57th St. Beach, Montrose Beach, and Loyola Beach. Recently, we have developed a new software suite specifically for the mapping of short reads. Using this tool, we performed an extensive analysis of the different beach samples, identifying what species and genic regions were present. Comparisons of the results from each beach were conducted. In addition, we have compared these results to those obtained from culturing samples in the laboratory and 16S

sequencing of colonies. Herein, we present the preliminary results of our study.

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38 **Development of a new Paradigm for Antimicrobial Drug Delivery in Apicomplexan Toxoplasma gondii**

Bo-Shiun Lai, University of Chicago Advisor: Rima McLeod, M.D.
Field: Pathology

Toxoplasma gondii remains one of the most successful parasites in the world; it infects about one-third of the world's population. When a pregnant woman acquires this infection for the first time during gestation, it can be transmitted to the fetus, causing severe ophthalmological and neurological defects. T. gondii has two main stages of development – dormant bradyzoite in cysts and active tachyzoite. Prescribing pyrimethamine and sulfadiazine as a standard procedure for patients with toxoplasmosis may lead to toxicity and hypersensitivity. In addition, delivering antimicrobial drugs across tachyzoite membranes and cyst walls is currently ineffective. Therefore, novel drugs with less toxicity, more stability and better delivery mechanisms are needed. Phosphorodiamidate Morpholino Oligomers (PMO) are a sequence-specific antisense knockdown system that has a potential for medicine. Herein, PMO were employed to knockdown tachyzoites' gene expressions. Utilizing PMO to knockdown YFP fluorescence, luciferase luminescence and DHFR serves as the first proof of principle in T. gondii. PMO were further used to knockdown enoyl-acyl carrier protein reductase (ENR) and AP2 domain transcription factor XI-3 (AP2XI-3). Through such knockdown, all gene products tested were found to be essential to T. gondii, making them appropriate targets for new antimicrobial drugs. It would be of interests to increase PMO's therapeutic range and improve their delivery versatility by conjugating antisense oligomers to non-toxic and highly potent transductive peptides. Promising peptides, including oligocarbonate and arginine-rich transporters, have been identified. PMO conjugated to effective transductive peptides would establish such system as a paradigm for versatile and stable delivery system that is an effective medicine.

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39 **Differential fear learning and anxiety-like behavior mediated by quantitative trait loci (QTL) on chromosome 10**

Emily Leung, University of Chicago Advisor: Abraham A. Palmer, Ph.D.
Field: Genetics

C57BL/6J (B6) and A/J (AJ) inbred mice differ in freezing to context with AJ mice displaying a greater degree of freezing to context compared to B6 mice. Previously, we used a standard fear conditioning paradigm (FC) in a panel of chromosome substitution strains (CSS) where each strain is created by introgressing a single chromosome from the AJ strain on an otherwise uniform B6 genetic background. In that study, C57BL/6J-Chr10A/NaJ mice (CSS-10) showed higher freezing to context and to tone compared to B6 mice suggesting that pleiotropic alleles influencing both innate and learned fear may be present on chromosome 10. To determine the chromosomal region corresponding to these differences, a F2 cross was produced between B6 and CSS-10 mice. We identified a region on the distal portion of chromosome 10 that corresponded to both freezing to context and to tone with a Bayesian 95% confidence interval spanning approximately 17.43 Mb (110.23-127.66 Mb). To distinguish between learning and innate fear, we have bred and phenotyped two congenic lines spanning most of the confidence interval. One of the congenic lines spans from 122 to 127.63 Mb while the other line spans from 127 to 127.63 Mb. The larger congenic region captures both phenotypes of elevated freezing to context and tone while the smaller congenic region captures only elevated freezing to tone suggesting the presence of two loci affecting innate and learned fear. By sequencing boundaries and looking at polymorphisms in our congenic intervals, we can gain a better sense of a region that contains genes affecting anxiety-like behavior in mice that may also contribute to pathogenic anxiety in humans.

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Jeff Leya, Loyola University Chicago
Field Human Molecular Genetics
Advisor: Jeffrey Doering, Ph.D.

The location of heterochromatic DNA, or transcriptionally inactive DNA, makes its importance in chromosomal organization and replication clear. It plays a large role in chromosome structure and organization which affects the segregation and separation of chromosomes during mitosis and meiosis. The Human Genome Project did not include the heterochromatic regions.
One of the major areas of heterochromatic DNA is on the short arms of the acrocentric chromosomes, and the telomeres of these regions are uncharacterized. Tandemly repetitive sequences make up much of chromosome arms and they are quite similar on all the acrocentric chromosomes. The subtelomeric regions appear to be complex and highly variable. I used telomere-anchored PCR to isolate the subtelomeric repeat from different copies of human chromosome 21. The PCR products were cloned into a plasmid vector, which were purified and sequenced. Sequences were analyzed with Seqman and BioEdit programs. Comparisons between different individuals reveal a low level of sequence polymorphism in the subtelomeric sequence.
I am also studying the chromatin modifications in the telomere region of chromosome 21p (HC21p) which have not been previously examined. HC21p is a good model for characterizing the structure of heterochromatic genome regions because it contains the largest concentration of heterochromatin in the human genome. Analysis of histone modifications requires a reliable sequence for PCR primers to be made, since the amount of DNA associated with each type of histone protein is determined with quantitative PCR (qPCR). I am creating my own primers based on a consensus sequence of the subtelomere region established in my earlier work. This primer will then be used in chromatin immunoprecipitation (ChIP) and qPCR to quantify the types of modifications in the region.

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41 **Age and time-dependent expression of CD74 after kainic acid-induced status epilepticus**

Kevin Li, Northwestern University
Field: Neurobiology
Adviser: Sookyong Koh, M.D., Ph.D.

In order to identify time dependent physiological changes underlying epileptogenesis, we have previously investigated time-course of hippocampal gene expression profiles of postnatal day (P)15 and P30 rats after kainic acid-induced status epilepticus (KA-SE) using high-density oligonucleotide arrays and qRT- PCR. We selected for differentially regulated genes (P30/P15) by capitalizing on age-dependent physiological responses to KA. It was observed that KA-SE causes hippocampal neurodegeneration and development of a chronic epileptic state in mature rats (P30), while KA causes neither cell death nor chronic spontaneous seizures in younger animals prior to P21. Furthermore, through ontological databases, genes associated with the mitogen activated protein kinase (MAPK) pathways and inflammation related genes were among the most significantly regulated after KA-SE and gene expressions were more robust and sustained in P30 compared to P15. Specifically, one gene that belonged to both MAPK and inflammation pathway and that displayed a striking gene expression profile was CD74, a transmembrane receptor for macrophage migration inhibitory factor (MIF), a pro-inflammatory cytokine. In particular, CD74 upregulation exhibited an exponentially increasing trend near 240h only in P30 animals. Furthermore, microarray data from human hippocampal tissue from patients with mesial temporal lobe epilepsy (MTLE) also confirm an upregulation of CD74 compared to control.
In the present study, we performed immunohistochemistry to verify our microarray data and to localize CD74 expression in rat brains (P15 and P30) and in surgically resected cortices from patients with intractable epilepsy.

42 Structural-Functional Study of Asxl2: Generation of Recombinant Adenoviruses

D'Feau Jia Lieu, University of Illinois at Chicago Advisor: Q. Tian Wang, Ph.D.
Field: Molecular Biology

Asxl2 belongs to a family of proteins that regulate chromatin structure, thus affecting gene expression (Sinclair 1992, Milne 1999, Brock 2001, Baskind 2009, Fisher 2010). It is involved in the production of both repressive as well as activating histone marks (Brock 2001). In Asxl2-/- hearts, multiple genes are misregulated. Asxl2 is enriched around the promoters of some of the misregulated genes suggesting that Asxl2 is directly regulating their expression (Lai, unpublished). Our lab seeks to better understand the functions of the conserved regions of Asxl2. This will be accomplished by introducing various deletion/truncation forms of Asxl2 to primary cardiomyocytes harvested from Asxl2-/- mice. Restoration of Asxl2 function will be determined by observing increases in H3K27me3 levels, which are reduced in Asxl2-/- hearts (Baskind 2009). Cell fractionation will also be done to determine which conserved regions are required for chromatin association. Adenoviruses will be the vectors used to introduce the primary cardiomyocytes to the various forms of Asxl2. This project produced recombinant adenoviruses expressing full-length Asxl2 using the AdEasy system. The gene of interest, Asxl2, was first subcloned into the pAdTrack-CMV shuttle vector. The Asxl2 containing vector was then introduced into adenoviral backbone vector pAdEasy-1 via recombination. Correct recombinant adenoviral DNA were then used to transfect HEK-293 adenoviral packaging cells. Viral production was monitored by observing GFP expression. Viruses were harvested after 2 weeks. Infection of additional HEK-293 cells with the generated adenoviruses followed by protein extraction and western blot analysis for Asxl2 will confirm the ability of the adenoviruses to induce Asxl2 production. It is expected that introduction of full length Asxl2 to Asxl2-/- primary cardiomyocytes will restore Asxl2 function, and this will lay the foundation for the study of Asxl2 deletion/truncation forms.

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43 Screening Members of Brassicaceae for Hyperaccumulators of Lead and Zinc

Micah Lindley, Harold Washington College Advisor: Junoo Tuladhar, Ph.D.
Field: Phytoremediation

Phytoremediation is a process that uses different species of plants to remove, transfer, stabilize and destroy contaminants from soil. Contaminants could be heavy metals, PCBs, solvents, pesticides and crude oil. The plant can either render the pollutant harmless or simply accumulate the chemical for easier elimination. The plant roots absorb the contaminants and the contaminants become a part of the plant root or shoot. These can be discarded at a later time as hazardous waste or metal can be recovered from the plants. Several members of the mustard family (Brassicaceae), such as the Indian mustard plant or alpine pennycress, are known to be hyperaccumulators because they have proven to be very effective at collecting heavy metals from the soil. We believe other members of the Brassica family could be equally effective accumulators and we plan to screen for them.
We plan to screen 15-20 members of the Brassica family for their ability to uptake metals. The plants will be grown in soil contaminated by metal, either artificially or collected from different sites. We will monitor the plants and check for their ability to uptake metals from the soil. Plants will also be grown in plant growth medium to which metals have been added. Plants will be monitored periodically and at the end of the experiments, plants will be sampled, weighed and analyzed using atomic absorption spectroscopy.

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44 Single-chain variable fragment antibodies targeting Alzheimer's disease-relevant particular AB oligomers

Kevin Luo, Northwestern University Advisor: William L. Klein, Ph.D.
Field: Neurobiology

Toxic soluble AB oligomers (ADDLs) accumulation is now widely accepted as a primary and necessary event in Alzheimer's disease (AD) pathology. Antibody-based therapies targeting ADDLs have been shown to reduce AD pathology in both animal models and AD patients. In particular, usage of antibodies targeting conformational epitopes on ADDL molecule has emerged as a promising approach to effectively rescue neural function in AD. Starting from a synthetic library of human single chain antibodies (scFv), we used phage display to isolate a unique set of scFv's that efficiently distinguished AB oligomers from either monomeric or fibrillar AB, as well as transgenic mouse models of AD from wild type brain extracts. ADDLs bound to neuronal surface in primary cultures were readily detected by anti-ADDLs scFv's. In addition, a purified, phage free form of one of these scFv's, NUsc1, blocked ADDLs neuronal binding by neutralizing oligomeric ligands in solution. Importantly, NUsc1 also recognized endogenously-produced AB oligomers in human AD brain extracts and tissues, indicating that ADDLs prepared in vitro assume a disease-relevant conformation. NUsc1-reactive AB oligomers in AD human brain sections and cultured neurons are partially distinct from AB species detected by previously characterized anti-ADDLs full length IgG's obtained using animal vaccination. Size-exclusion chromatography conjugated with NUsc1-based detection analysis revealed a novel AB oligomeric species of 30 kDa abundant in both synthetic ADDLs and AD human brain extract. These novel anti-ADDLs scFv's may help to decipher the conformation of the actual pathological assemblies of AB, highlighting their potential as more efficient diagnostic and therapeutic reagents for facing AD.

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45 A Survey of the Huron River and Antibiotic Resistance in Acinetobacter spp

Laura Markey, Northwestern University Advisor: Chuanwu Xi, Ph.D.
Field: Environmental Microbiology

Due to the negative impact on the treatment of human disease, the spread of antibiotic resistant bacteria is a current public health concern. In this survey of the aquatic ecosystem of the Huron River (in and around Ann Arbor, MI) the level of antibiotic resistance and multidrug resistance in Acinetobacter spp was measured. A previous study indicated that wastewater treatment increased levels of antibiotic resistance (Zhang, Yongli et al 2009). The Huron River was sampled at four different sites; upstream of the plant, within the plant, and at two downstream sites. Acinetobacter spp were then cultured and isolated from each sample and tested for antibiotic susceptibility to seven antibiotics (colistin, ciprofloxacin, gentamicin, amoxicillin, trimethoprim, chloramphenicol and rifampin) using the disc diffusion method. At the site within the plant (taken from the final effluent) and at the second downstream site, there was a significant increase in multidrug antibiotic resistance (compared to the upstream site). Such an increase in resistance in the final effluent corresponds with the previous study; given the decrease in multidrug resistance at the first downstream site and drastic increase at the second downstream site, the survey indicates another factor influencing antibiotic resistance in the Huron River.

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46 Investigating genetic differentiation of the populations of the freshwater fish Hoplias microlepis from western Ecuador

Joelle Mbatchou, DePaul University Advisor: Windsor Aguirre, Ph.D.
Field: Ecology and Evolution

The ecology and evolution of the fauna in western Ecuador remains poorly understood. The area has been under severe anthromorphic pressure and most of the communities that have evolved are unique to the region; they occur nowhere else on Earth. In this study, we employed amplified fragment length polymorphism (AFLP) analysis as a neutral nuclear marker to analyze genetic differentiation of a species of freshwater fish in western Ecuador, the tahira Hoplias microlepis. We compare previous results obtained from sequencing a fragment of the mitochondrial loop with the samples of 32 specimens collected at four different sites (Quevedo River, Babahoyo River, Daule-Peripa Reservoir, Chongon Reservoir) in western Ecuador. By studying how populations in those sites vary, we hope to gain a better understanding of the evolutionary history of the neotropical fish fauna in the region. Furthermore, this study will improve our knowledge of how species respond to environmental stress, as the fauna in western Ecuador has been impacted by natural geological events and human development, including the creation of large artificial reservoirs.

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47 Growth Factor Release from a Chemically Modified Elastomeric Poly(diol citrate) Scaffold Promotes Angiogenesis in vivo

Jay Meisner, Northwestern University Advisor: Arun Sharma, Ph.D.
Field: BioNanotechnology in Medicine

Attempts to regenerate functional urinary bladder tissue have been hampered by obstacles including appropriate scaffold choice and poor vascularization of developing tissue. The elastomeric properties of poly(1,8-octanediol-co-citrate) (POC) scaffolds have recently been shown to aid in urinary bladder regeneration when seeded with epitope defined, human mesenchymal stem cells in the context of a nude rat urinary bladder augmentation model.1 In order to further promote increased tissue growth and development, we sought to create heparan sulfate binding POC (POC-HS) scaffolds that would allow for the binding and extended release of growth factors conducive to localized angiogenesis. POC scaffolds were prepared as previously described.1 POC-HS were created by activating the POC in MES buffer [2-(N-morpholino)ethanesulfonic acid], containing 1-ethyl-3-(3- dimethylaminopropyl) carbodiimide hydrochloride (EDC) and N-Hydroxysuccinimide. Scaffolds were incubated in MES buffer containing PEG-diamine. Heparan sulfate was activated. POC scaffolds were incubated in the activated heparan sulfate
solution. Scaffolds were stored in PBS. Subsequently, human growth factors (GF) vascular endothelial growth factor (VEGF), basic fibroblast growth factor (bFGF), and insulin-like growth factor (IGF-1) were individually mixed into a PBS solution containing BSA and added to POC-HS scaffolds. Scaffolds were removed, rinsed in PBS and underwent GF release and quantification with the appropriate enzyme-linked immunosorbent assay (ELISA) Assay. Control samples consisted of POC scaffolds without heparan sulfate that were loaded with GFs under identical incubation conditions and processed accordingly. Athymic nude rats underwent subcutaneous implantation with either Condition A) POC scaffold alone, B)POC-VEGF, or C)POC-HS-VEGF. Animals were sacrificed at 4 weeks post-implantation. In vitro cumulative GF release from POC- HS based scaffolds demonstrated an extended GF release profile compared to POC-GF control samples. Gross subcutaneous specimens of Conditions A-C demonstrated increased vascularity with POC-HS-VEGF. Data demonstrate that POC can be chemically modified to release pro-angiogenic GFs over time and promote localized angiogenesis.

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48 Antibacterial and Cholesterol-Lowering Effects of Tea Saponins

Merrell Misayah, D. Bohan, M, Misayah, W. Jones, and M, Ochoa, Richard J. Daley College
Field: Biochemistry Advisor: Catherine Han, Ph.D.; Rowena Misayah M.D.

Saponins are complex compounds widely distributed in the plant kingdom. Each saponin consists of one or more sugar chains attached to a steroid triterpene. Tea seeds contain about 13% by weight saponins, which is an abundant source of saponins. Despite the cultivation and processing of large quantities of tea plants, tea saponins are not a significant product of commerce at the present time, due to the difficulty of isolation and purification. Traditional methods of extracting and isolating saponins from dry vegetable materials consist of extraction with various alcohols (ethanol, propanol, and methanol). To increase purification of saponin, a defatting step using non-polar solvents such as ether or hexane may be performed prior to the extraction process or on the extraction itself. Crude saponins are then precipitated by washing with acetone or ether. Saponins have been demonstrated to have anti-microbial properties. One of the goals of this study is to determine the range of antimicrobial activities of saponin and compare its effects with known antibiotics. To date, the most powerful and potentially groundbreaking effect of eating saponins is the impact on blood cholesterol. Saponins have also been shown to bind with bile salts which results in inhibition of bile reabsorption from the small intestine. The lowered bile salts in the blood results in the liver synthesizing bile salts from blood cholesterol. Saponin also forms insoluble complexes with cholesterol, which leads to inhibition of cholesterol absorption from the digestive tract. This research aims to study these cholesterol-lowering effects of the saponins.

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49 When Prey Fight Back: An Analysis of Functional Variation in Passerine Mobbing Calls

Milan Neeley, University of Chicago Advisor: Trevor Price, Ph.D.
Field: Animal Behavior, Language Evolution

Mobbing is an interesting behavior in which vulnerable species that are generally preyed upon congregate and attack their predator instead of fleeing, and is usually accompanied by a distinct set of calls. The nature of these mobbing calls has been studied widely in various passerines, and there is evidence supporting their function as signals to other potential prey, including both conspecific and heterospecific individuals. Mobbing calls have been shown to convey information about the urgency, proximity, type or size of a predator or other threat. Studies have shown this information is encoded in the frequency of the calls, repetition of certain call elements, or by using specific calls for different types of threats. Through software analysis, I have studied the mobbing calls of the greenish warbler (Phylloscopus trochiloides trochiloides) across two distinct sites in the Himalayas. In this I have found approximately 30 call types in each site, significantly more than other trochiloides subspecies, which use a singular mobbing call type. Many of these include elements from other species (Ph. Pulcher) commonly found in the region, implying significant selection toward heterospecific communication. Despite the great variation in call types, P. t. trochiloides does not appear encode threat information using any of the modes mentioned above, but through the number and rate of switching between call types, a previously unstudied mode of communicating danger.

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50 A Novel MRI Contrast Agent for Use in Tumor Targeting

Nina Nosavan, Northwestern University Advisor: Thomas J. Meade Ph.D.
Field: Molecular Imaging

Magnetic resonance imaging (MRI), a non-invasive technique that generates detailed three-dimensional images of soft tissue, is a valuable diagnostic tool for cancer and other diseases. A significant portion of MR images are enhanced with contrast media. Contrast agents are small molecules which alter water proton relaxation times of tissue, improving the visibility of internal structures on the MR scan. Most agents are simple chelates of gadolinium. If designed to target cancer cells in vivo, they could greatly improve MRI sensitivity and increase the likelihood of early detection.
To target contrast agent to the tumor site, we proposed the use of an established tumor targeting protocol originally developed for radioimmunodetection and therapy. The targeting system utilizes sequential injections to obtain signal amplification with every step and exploits the enormously strong bond between avidin and biotin to ensure accumulation of the agent at the tumor. This dual amplifying and targeting strategy would increase the signal to noise ratio, allowing for small tumor detection.
The modular design of the contrast agent links multiple gadolinium moieties to a biotin molecule via a flexible carbon linker. I have successfully synthesized two versions of the agent with differing linker lengths. Each step of the synthetic route was purified via flash column chromatography and characterized by NMR. The agents were HPLC purified and characterized by MALDI mass spectroscopy. The relaxivities of the agents were determined using a bench top relaxometer and ICP-MS. We expect to see an increase in relaxivity upon binding to avidin due to an increase in rotational correlation time, or tumbling motion of the chelate. The next steps of the project will be to determine the binding constants of the agents to avidin and investigate the relaxivities of the bound agents.

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51 Oxidation Reactions Catalyzed by Horseradish Peroxidase

Grace S. Park, University of Chicago Advisor: Guilherme L. Indig, Ph.D.
Field: Oncology, Molecular Biology

The objective of this investigation was to characterize the number of peroxidase units per mg of solid in a commercially available sample of horseradish peroxidase, and initiate a systematic investigation involving four distinct HRP-catalyzed oxidation reactions that are of potential interest for use in antibody-directed enzyme prodrug therapy (ADEPT).1 In this study, indol-3-acetic acid2, acetylacetone3, acetaminophen4, and diethylstilbestrol5 were investigated as potential drug candidates for ADEPT. These oxidation reactions were investigated at 37oC in 0.1 M phosphate buffer, pH 7.3, and as a function of substrate, enzyme, and hydrogen peroxide concentration.

We have searched for and found experimental conditions that can be seen as appropriate for the study of four HRP-catalyzed reactions involving prodrug candidates for use in ADEPT. The oxidations of two of these candidates, diethylstilbestrol and acetaminophen, are clearly H2O2 dependent processes, while the respective reactions of two other candidates, acetylacetone and indole- 3-acetic acid apparently do not require H2O2 to occur. Although the presence of peroxide contaminants is always a possibility when HRP-catalyzed reactions are found to occur in the absence of H2O2, compelling evidences have previously described in the literature pointing to the somehow surprising fact that fact the reactions of oxidation of both acetylacetone3 and indole-3-acetic acid2,7,8 catalyzed by peroxidase are indeed independent of H2O2.

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52 VEGF: A Novel Therapy for Spinocerebellar Ataxia Type 1

Jay Patel, Northwestern University Advisor: Puneet Opal, M.D., Ph.D.
Field: Neurology

Spinocerebellar Ataxia type 1 (SCA1) is one of many neurodegenerative diseases linked by a common mechanism of glutamine-repeat induced pathology. In SCA1, a poly-glutamine repeat expansion in the protein ataxin-1 leads to progressive cerebellar and brainstem degeneration. Recent findings suggest that expanded ataxin-1 causes neurodegneration by altering transcription. In an attempt to identify specific transcriptional changes, our lab has discovered mutant ataxin-1 directly represses the expression of the angiogenic/trophic factor Vascular Endothelial Growth Factor (VEGF). We have also shown that replenishing VEGF in the SCA1 knock-in mouse model by mating with a VEGF overexpressing mouse line mitigates the SCA1 phenotype and improves cerebellar pathology brought on by lower levels of expressed VEGF. Particularly, the cerebellar blood vessel density is improved, indicating an interaction between the degenerating neurons and vascular system. In order to translate these findings to the bed-side we set-up a mouse clinical trial to replenish VEGF using intracerebroventriclar delivery of recombinant protein. Our initial findings suggest that replenishing VEGF via a pump appears to have beneficial effects on the SCA1 phenotype. We are now performing additional experiments to further determine the therapeutic potential of VEGF in this chronic debilitating and eventually fatal disease for which there is no current treatment.

53 Characterization of narrow abdomen Sleep Phenotype: spatial and temporal requirement for na during Drosophila sleep/wakefulness.

Neha Patel, Northwestern University Advisor: Ela Kula-Eversole, Ph.D.; Ravi Allada Ph.D.
Field: Neurobiology

Poor sleep quality and timing have been implicated as an emerging threat to public health. Studies performed on both humans and animals have demonstrated that inadequate sleep results in increased likelihood of obesity, cardiovascular disease, susceptibility to foreign pathogens, and premature death. With the increasing need to research these issues genetic model organisms, in this case fruit fly Drosophila melanogaster, have been used as tools to understand the function of sleep and its effects on the human body. Previous studies suggest that mutations in the gene narrow abdomen (na), which encodes a putative cation leak channel, disrupt locomotor rhythms, sleep amount, and arousal. My research sought to further refine the neuroanatomical and molecular requirements for na in Drosophila sleep by utilizing genetic tools that manipulate na function in vivo. Further studies of na function focusing on sleep in Drosophila can yield insight into how na functions in higher vertebrates, thus illuminating possible steps to understanding sleep's roles and effects on human physiology. A series of experiments were conducted to learn the basics of na in the Drosophila brain; the primary objective was to identify specific neural circuits where na functions to regulate Drosophila sleep-wake behavior both in a spatial and temporal manner, as well as further characterize na. Results showed that na possesses a sleep phenotype that is not due to an unhealthy background or a lack of efficient fat storage in the body, a major concern with the cation channel. In addition, through pore mutant overexpression studies we were able to find various regions of the brain where na functions to regulate sleep.

54 A phylogenetic analysis of Alouatta pigra inhabiting the Calakmul site of Campeche, Mexico

Lindsey G. Proctor, University of Illinois at Chicago Advisor: Sloan R. Williams, Ph.D.
Field: Biological Anthropology

Howler monkey, Alouatta, phylogeny is not well understood and researchers have recognized anywhere from six to ten species of Alouatta, and up to nineteen subspecies. We analyzed the mitochondrial cytochrome b gene sequence of four Yucatan Black Howler individuals (A. pigra) and compared them to published sequences from nine of the ten recognized howler species to better understand howler phylogenetic relationships. DNA was extracted from fecal samples collected from two troops of howler monkeys living at the Calakmul site in the Campeche state of southeastern Mexico. We sequenced the first 800 bases of the mitochondrial cytochrome b gene. A neighbor-joining tree was constructed to compare the Calakmul sequences with published Alouatta sequences, including A. pigra samples from two collection sites in Tabasco and Chiapas, Mexico. The Calakmul samples were identical to each other, but did not match the Tabasco and Chiapas samples. We identified four substitutions among the Calakmul howlers. Two substitutions were synonymous, but the other two changes were non-synonymous mutations that resulted in new amino acids. In all, three different sequences were found among the ten A. pigra samples collected from the three locations. Although the Calakmul sequences differed from published A. pigra sequences, they clustered with them on the neighbor-joining tree and support the identification of A. pigra as a separate species. The genetic relationship among the individuals in the two Calakmul howler troops is currently unknown, but these identical sequences suggest the possibility of close maternal relationships that will be further explored in future studies.

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55 Development of Computational Methods for DNA Regulatory Motif Prediction in Plasmodium Promoter Regions

Bryan Quach, Loyola University Chicago Advisor: Catherine Putonti, Ph.D.; Stefan Kanzok, Ph.D.
Field: Bioinformatics

Malaria is a disease caused by parasites belonging to the genus Plasmodium that affects 500 million people globally and causes over one million deaths annually. The parasite's successful transition from vertebrate host to insect vector requires significant adjustments in the expression of antioxidant genes that respond to the presence of cytotoxic reactive oxygen (ROS) and reactive nitrogen species (RNS). Despite research efforts on gene control mechanisms in Plasmodium species, little is known regarding its transcriptional regulation. Numerous regulatory element binding site prediction algorithms have been developed to aid in uncovering novel transcription factor binding sites (TFBS), but they have proven ill-suited for analyzing organisms with AT-skewed genomes such as Plasmodium.

We discuss the development of a new algorithm for DNA motif discovery. Our model suggests enhanced motif prediction power by incorporating structural properties from known protein-DNA interaction sites and improved expectation values for statistical pattern recognition using motif-occurrence analysis. The ability to recognize TFBS within Plasmodium would provide invaluable insight into the regulation and functionality of the parasite's genes within its two-host system. Knowledge of TFBS in Plasmodium would contribute to a deeper understanding of the parasite biology and could potentially lead to the discovery of new targets for controlling Malaria.

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56 T elomere Maintenance: Identification of Specific Ccq1 Mutants that Disrupt Ccq1-Tpz1 and/or Ccq1-Est1 or Ccq1-Clr3 Interactions in Fission Yeast

Olga N. Raguimova, University of Illinois at Chicago Advisor: Toru M. Nakamura, Ph.D.
Field: Molecular Genetics

The fission yeast telomere shelterin complex includes the interaction Tpz1-Ccq1. Tel1 and Rad3 kinases promote telomerase recruitment to telomeres, possibly by phosphorylation of Ccq1. Current findings suggest that Ccq1 phosphorylation is essential to directly bind and recruit Est1, the regulatory subunit of telomerase. Ccq1 also recruits a Snf2/histone deacetylase (HDAC)- containing repressor complex (SHREC) by interaction with the SHREC component Clr3. The present investigation is intended to identify specific Ccq1 separation of function mutants that either disrupt Ccq1-Tpz1 and/or Ccq1-Est1 or Ccq1-Clr3 interaction. We characterize the Ccq1- Clr3 interaction through a mutagenesis approach utilizing truncation and point mutants. To date, we have identified that the C-terminus of Ccq1 is sufficient for interaction with Clr3, but known to be inadequate for interaction with either Est1 or Tpz1. On the other hand, the N- terminus of Ccq1 is known to be sufficient for interaction with Est1 and Tpz1, and as we have identified with Clr3 as well. Currently, we are generating additional protein truncation and point mutants to position the specific Ccq1-Clr3 interaction sites. Since telomere maintenance is well conserved among fission yeast and mammalian cells, the current study might give insight on telomere maintenance in humans.

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57 Quantifying Genome Sequence Compatibility Between Viruses and Their Hosts

Patrick Schreiner, Loyola University Chicago Advisor: Catherine Putonti, Ph.D.
Field: Bioinformatics

Dinucleotide CpG under-representation is well known to occur in mammalian genomes. Previous studies have concluded that the leading hypothesis for this under- representation of CpG dinucleotide content can be explained by methylation of cytosine residues and the corresponding deamination that occurs in 5-metycytosine. Viruses that have infected humans for an extended period of time exhibit these same dinucleotide CpG deficiencies, although CpG dinucleotide content does not result in methylation throughout the viral genome. It is suggested that genomic signatures of viral genomes have a direct correlation with the content of the host DNA in which they infect, with few exceptions. This correlation is expressed significantly at both the dinucleotide and tetranucleotide level. The similarity of the viral genome to its specific host's genome allows the virus to more efficiently escape immune response. We have developed software for the analysis of di-, tri-, and tetra-nucleotide usage correspondences between a wide variety of viruses and their hosts. Examination was performed not only at overall genome compositional biases but using a sliding window approach.

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58 Transplantation of Neurospheres following Traumatic Brain Injury enhances behavioral function

Stacey Seidl, DePaul University Advisor: Dorothy Kozlowski, Ph.D.
Field: Neuroscience

Traumatic Brain Injury (TBI) affects 1.7 million people annually leaving them with neurological/ behavioral deficits and limited treatment options. A potential treatment for TBI is the use of adult stem cells. Stem cells are immature and undifferentiated cells that have the ability to divide and integrate into the central nervous system. Bone Marrow Stromal Cells (BMSC's) derived from adult rats can be made into immature brain cells called neurospheres. When transplanted into the injured rodent brain, neurospheres can survive and decrease initial behavioral impairments. The current study focuses on examining the long term effects of these transplants. Male rats received a cortical

contusion impact (CCI) over the forelimb sensory-motor cortex of one hemisphere. Seven days after the injury, neurospheres were transplanted into either cortex (location of the injury) or the striatum (brain area connected to the injury). Control transplants (vehicle; fluid without the neurospheres), were also injected in the striatum or cortex. Forelimb deficits were assessed with behavioral tests that examined motor coordination. One behavioral test, footfault, analyzed how often the animal's injured forelimb completely fell into the space between an elevated grid. Preliminary data suggests that rats with neurosphere transplants showed smaller deficits and the greatest improvement in the footfault test when compared to injured rats without transplants. Vehicle transplants in the striatum showed similar results to the neurosphere transplants. In addition, vehicle transplants in the cortex showed the least improvement, but still showed greater improvement than the rats receiving only the CCI. Our findings suggest that neurosphere and vehicle transplantation may be effective in enhancing behavioral deficits following TBI.

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59 **Species-limits and Phylogeography of Pomatorhinus ruficollis in Southern China**

Sarah Sharief, Loyola University Chicago Advisor: Sushma Reddy, Ph.D.
Field: Species-Limits & Phylogenetics

While there has been much interest in Asian avifauna in the past, the diversity of species present today is still unknown despite its profound implications for preserving the integrity of long-standing ecosystems. The aim of this project was to study the species-limits and diversification of birds in tropical Asia in order to increase our knowledge of the avian biodiversity of this region. The family Timaliidae or babblers is a large and diverse group with many species only found in southeast Asia. Species-limits in many taxa within this family still need to be resolved in order to be able to conduct biogeographic analyses. We examined the genetic divergence within several populations of the species Pomatorhinus ruficollis. We examined both mitochondrial and nuclear genes for over 50 individuals of this species. By using modern techniques such as polymerase chain reaction, electrophoresis and DNA sequencing technology, we obtained information about the genetic makeup of these organisms and then used this information to assess species-limits and the phylogenetics relationships between these bird populations. Since mitochondrial genes evolve at a faster rate than nuclear genes, we tested whether the signal from both these sources are in agreement as to the diversification patterns within this species. Our analyses of the ND3, ND2, cytochrome b, TGF, MUSK and FIB-5 gene sequences indicated distinct populations of the birds on either side of the Pearl River (Ji Xiang) in China.

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60 **FYN Affects Cellular Motility and Morphology in Advanced Prostate Cancer Metastasis**

Alan Sit, University of Chicago Advisor: Edwin Posadas, M.D.
Field: Cancer Biology

In 2010, prostate cancer will affect more American men than any other cancer, with almost 220,000 new cases expected, and has the second highest mortality rate of any cancer1. In addition, African American men are 60% more likely to develop prostate cancer than Caucasian men and are 2.5 times more likely to die from the cancer2. While the early forms of prostate cancer are relatively treatable using hormonal therapy and radiation, progression of prostate cancer to an advanced metastatic form usually leads to mortality.
The effects of FYN over expression, a protein in the Src family of kinases, on prostate cancer metastasis were investigated. Advanced prostate cancer cells were stimulated by HGF, shown to be upregulated in advanced prostate cancer tissue, in a chemotactic gradient via Dunn Chamber Assay, tracked using time lapse video microscopy, and analyzed. FYN overexpression was shown to increase directed haptotaxis toward an HGF gradient, increasing cellular velocities, linearity of movement, and directionality toward the chemoattractant. Under HGF stimulation, FYN over

expression induces morphological changes such as increased cell area, circularity, and length – precursors to cellular motility. Thus, FYN could be a potential therapeutic target in the future for fighting prostate cancer progression.

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61 **Retrotransposon-associated minisatellites in the soybean genome**

Kamil Slowikowski and Lauren Mogil, Loyola University Chicago Advisor: Howard Laten, Ph.D.
Field: Bioinformatics

The soybean genome contains several thousand copies of the GmOgre (Gmr9) retrotransposon. A ~20,000 bp consensus sequence was previously constructed and found to contain a minisatellite repeat region between the end of the coding region and the 3' Long Terminal Repeat (LTR). The region contains five distinct minisatellite families with monomers ranging in length from 26 to 164 bp. The monomers are interspersed and repeated three to sixteen times within this region of GmOgre. The origin of this minisatellite region is not yet known. We developed a computational method to characterize other loci where these minisatellites might be present. We found a total of 77,265 monomer copies of the five minisatellites in assembled chromosomes from Genbank. In addition to those found in members of the GmOgre family, we found 486 copies of these minisatellites in 176 retrotransposons representing 21 additional retrotransposon families. Also, an additional 23,413 monomers are located in regions of the soybean genome that are currently unannotated. However, the majority of these minisatellites are contained in GmOgre. PCR analysis suggested and the computational analysis confirms that the total lengths of some of the minisatellite clusters may be far longer than that found in the GmOgre consensus sequence.

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62 **Effects of Multiple Mychorrizal Fungi on a Perennial Prairie Plant**

Erika Spencer, DePaul University Advisor: Sarah Richardson, Ph.D.
Field: Ecology

Many species of plants and some species of mycorrhizal fungi are known to have mutualistic relationships; this is a relationship in which both partners benefit. Mycorrhizal fungi are a type of soil fungus that infects and lives within the roots of plants; the plant gets the benefit of more water or nutrients and the fungus receives carbon. The focus of this research is determining the effects of multiple mycorrhizal fungi infecting one perennial prairie plant. The question being investigating is there an effect of multiple mychorrizal fungi on plant fitness, and is this effect a benefit or a cost; if there is a benefit for the plant are the effects additive or only as beneficial as the better mutualist; does one fungus give the plant more or do the fungi compete and hinder the plant. These questions were addressed by growing one species of plant Coreopsis palmata, with four different treatments: Scutellospora fulgida, Glomus claroideum, both fungi, and one sterile treatment, in a sterile greenhouse. Growth and survival of the plants were measured to compare effects of a single species of fungi to both species or neither. Plants experienced a high early mortality rate just after being transplanted. Early in the experiment plants inoculated with fungi tended have a lower rate of survival than plants without fungi. However, by day 75, plants infected with Glomus had highest survivorship. Treatment was found to have a significant effect on survival of the plants. This shows that treatment had an effect on the survivorship, and that initially sterile treatment had the lowest death rate, but in the end more of the sterile treatment had died throughout the experiment. These results would suggest that this mutualistic relationship has a cost on the plant before having a benefit.

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63 Dynamics of motion adaptation in the smooth pursuit system of monkeys

Patrick Stinson, University of Chicago Advisor: Leslie Osborne, Ph.D.
Field: Computational Neuroscience

In order to maintain sensitivity in changing environmental conditions, a sensory system must adapt, changing the responsiveness of its neurons to best represent the current range of stimuli. Adaptation to visual contrast has been observed in the retina, visual thalamus and primary visual cortex, but it is not known whether cortical areas sensitive to features of visual signals also adapt and how that adaptation would affect behavior. Our current project studies the impact of visual adaptation to motion stimuli in the primate smooth pursuit system. In pursuit, the eyes smoothly track a moving object in order to keep its image on the fovea. Perturbations in the target's motion drive perturbations in pursuit, and the scale of the behavioral perturbations is affected by the scale of target motion perturbations (Osborne and Lisberger, 2009), since the neural stimulus-response function must adapt to maintain an efficient representation of the stimulus. In order to test the dynamics of pursuit adaptation to visual motion signals, we are making sensitive measures of eye movement in non-human primates tracking stochastic target motion. We compute the correlation between eye and target trajectories to find the temporal function (a linear filter) that best predicts the pursuit response. With increasing perturbation variance, the amplitude of the filter decreases and its width narrows. Changes in the level of target motion fluctuations cause the system to switch from one filter (high noise) to another (low noise). By measuring the dynamics of adaptation, we wish to understand the nature of the neural mechanisms that drive it, whether rapid intrinsic spike-rate adaptation or slower cortical population driven adaptation mechanisms appear to dominate.

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64 ROCKing Upstream: Rho-Associated Kinase 1 Mediates RhoA Activity through a Novel Feedback Loop

Alan Tang, University of Illinois at Chicago Advisor: Donald A. Chambers, Ph.D.
Field: Cytoskeleton Dynamics

Actin cytoskeleton reorganization induces morphological changes in mammalian cells. This remodeling process directly affects cell motility, which is a prerequisite for cancer metastasis. The Rho family of small GTPases has been shown to tightly regulate actin cytoskeleton organization and stability. In prostate cancer cells, RhoA is a critical regulator that promotes cell invasion and migration. The inhibition of RhoA and its major downstream effector, Rho-Associated Kinase 1 (ROCK1), has been demonstrated to inhibit prostate cancer cell motility. We previously found that Y-27632 and Fasudil (HA-1077), selective ROCK1 inhibitors, diminished RhoA activity (GTP-RhoA) in prostate cancer (PC3) cells. Based on these results, we hypothesized that ROCK1 participates in a feedback mechanism to regulate upstream RhoA activity. In this study, we used genetic manipulation (siRNA knockdown) in conjunction with a pharmacological approach in order to elucidate that the ROCK1 mediation of RhoA occurs through the inhibitory effect of ROCK1 upon a Rac1 guanine nucleotide exchange factor (GEF), TIAM1. Inhibition of ROCK1 markedly increased Rac1 activity but reduced RhoA activity. Previous studies have demonstrated that Rac1 is able to antagonize RhoA activity through a redox-dependent mechanism. Accordingly, the increased levels of active Rac1 would explain the decreased levels of active RhoA. Additional experiments showed that direct inhibition of Rac1 increased RhoA activity. Furthermore, the siRNA knockdown of Rac1 severely diminished the inhibitory effect of Fasudil on RhoA activity. Upon knockdown of TIAM1, the ability of Fasudil to increase Rac1 activity and decrease RhoA activity was abolished. Taken together, these findings indicate for the first time that ROCK1 regulates upstream RhoA activity by mediating levels of active Rac1. The ability of ROCK1 to regulate upstream Rho GTPases through signaling pathway crosstalk introduces novel approaches to drug development for the treatment of metastatic prostate cancers and various other pathological conditions.

65 Lipid-Protein Interactions in Hepatitis C Virus Replication

Michael Tartell, University of Chicago Advisors: Glenn Randall, Ph.D.
Field: Virology

Phosphatidylinositol 4-kinase III alpha (PIK4A) has previously been shown to be an essential cellular cofactor for replication of hepatitis C virus (HCV). It co-localizes with viral replication complexes and is required for their proper formation. However, the mechanism through which PIK4A and its products, PI lipids phosphorylated on the fourth carbon (PI4P), act in viral replication has not yet been characterized. We examined whether viral proteins interact with PI4KA or its product, PI4P, to better understand the function of PI4K in HCV replication. PIK4A co-immunoprecipitates with the HCV non-structural protein 5A (NS5A) both in vivo and in vitro. The expression of NS5A enhances PI4P production, suggesting that NS5A may stimulate PI4KA activity. Both NS5A and the HCV RNA-dependent RNA polymerase, NS5B, were found to specifically bind certain PI lipids. NS5A binds both mono- and bi-phosphorylated PI lipids, while NS5B preferentially binds mono-phosphorylated PI lipids, including PI4P. These data suggest that HCV NS5A may recruit PIK4 to generate PI lipids at sites of replication. These PI lipids are then bound by a subset of HCV proteins to mediate membrane interactions and replication complex formation. Currently, we are focusing on identifying the domains of NS5A and NS5B responsible for lipid binding, as neither one contains a canonical lipid binding domain, as well as the biochemical nature of this interaction.

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66 Effects of electrical stimulation and testosterone on functional recovery following a recurrent laryngeal nerve injury

Piotr T. Tekiela, Loyola University Chicago Advisor: Keith N. Fargo, Ph.D.
Field: Neurobiology

Nerve damage is a significant contributor to serious sensory and motor disability. Although peripheral nerves are known for their regenerative capacity, recovery from peripheral nerve injury is often unpredictable and may be quite prolonged. It is therefore important to gain a better understanding of the recovery process and the kinds of treatments that can enhance it. In the present experiment, we used a nerve crush injury in rats to study the effectiveness of testosterone and electrical stimulation in promoting recovery. All animals received a unilateral crush injury of the recurrent laryngeal nerve, which controls movement of the vocal folds. Animals were then treated with either testosterone, electrical stimulation, or a combination of both. A group of untreated animals served as controls. Animals were allowed to survive between 1 to 6 weeks. Just prior to sacrifice, an endoscopic camera was used to record vocal fold movements. All recordings were viewed by a blind observer, and vocal fold mobility scores were assigned by comparing movement between the injured and uninjured sides. Untreated animals reached complete functional recovery in approximately 6 weeks. Treatment significantly reduced recovery time, with treated animals reaching complete functional recovery within 4 weeks. In addition, untreated animals did not display appreciable recovery until 2 weeks after injury, but treated animals showed significant recovery of vocal fold function by 1 week post-injury. Both in terms of recovery time and initial delay, all treatments were significantly better than control, and were approximately equal to one another in efficacy. Thus, both testosterone and electrical stimulation (and combined treatment) led to more rapid recovery from peripheral nerve injury. Future studies should focus on determining the biological mechanisms underlying the ability of these treatments to enhance recovery from nerve injury.

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67 **Characterization of Telomeric and Subtelomeric Regions of Human Acrocentric Chromosomes**

Pankti Thakkar, A. Kachochana, D. Harris, P. Babinsky, S. Baaj, R. Bavarian, Loyola University
Field: Human Genetics Advisor: Jeffrey Doering, Ph.D.

The human genome project didn't sequence the heterochromatin regions of the human genome, although they account for 10-15% of the total genome. The short arms of all the human acrocentric chromosomes are primarily made up of heterochromatic DNA. Heterochromatin DNA is highly compact DNA that is tightly packed with histones and is transcriptionally inactive. Telomeres are tandemly repeated DNA and ribonucleoprotein complexes present at the ends of all the chromosomes. Telomeres play an important role in genome stability, prevention of end to end joining of chromosomes, end replication, replicative senescence, and cancer biology. Little is known about the organization of the repetitive sequences in the telomeric regions of the human acrocentric p-arms. Subtelomeric sequences are telomere-associated or telomere-adjacent sequences and are complex and highly variable with high sequence divergence. Subtelomeric sequences are estimated to comprise about 5 % of the human genome and are believed to play a role in regulation of telomere tract length and stability. My work aims to compare the telomere region within the acrocentric short arms of chromosomes 13 and 21. This work will help identify DNA sequences that are critical for human telomere function. A subtelomeric tandemly repetitive sequence of 6.3 kb was found on acrocentric chromosome p arms in previous studies. A 580bp sequence within the repeat was used to create a subtelomeric primer that served as the basis for a telomere-anchored polymerase chain reaction (PCR). DNA fragments amplified by this approach were isolated from chromosomes 13 and 21, cloned and sequenced. The analysis so far shows significant differences in subtelomeric structure between the p arms of chromosomes 13 and 21.

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68 **Gonadal steroid treatment reduces recovery time in a murine model of nerve injury: Effects of testosterone and its metabolites estradiol and dihydrotestosterone**

Yesha Thakkar, Loyola University Chicago Advisor: Keith N. Fargo, Ph.D.
Field: Neuroscience

Steroids enhance the regeneration of both axons and dendrites after motoneuron injury. The Syrian hamster facial nerve crush model has been particularly fruitful in studying these effects. We have learned from this model that steroids reduce recovery times, and that this is due in large part to increased axon regeneration rates. A growing catalog of knockout mice makes it increasingly critical to study these effects in a murine model as well. Adult male mice were subjected to unilateral facial nerve crush injury, resulting in facial paralysis. Some were also treated with either testosterone, dihydrotestosterone, or estradiol. Animals were observed daily for the return of facial nerve functions, including vibrissae orientation & movement, eye blink reflex, and orolabial symmetry. All three steroids significantly reduced the time to full recovery, with approximately equal efficacy. However, they were differentially effective in reducing recovery time for some of the specific measures, with estradiol being most effective. For example, for both orolabial symmetry and vibrissae movement, estradiol was the only steroid that significantly reduced recovery time. These data extend our knowledge of steroid-enhanced facial nerve recovery to a murine model. Moreover, the fact that estradiol was the most effective raises interesting questions about the mechanism of action of gonadal steroid treatments.

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69 Determining the effect of a Gene Recruitment Sequence on Gene Localization

Abbey Thompson, Northwestern University Advisor: Jason Brickner, Ph.D.
Field: Molecular Biology

The genome is spatially organized within the nucleus so that individual chromosomes are not randomly positioned, but instead adopt preferred conformations. Furthermore, the position of specific genes can be influenced by their expression. Although the nuclear periphery is traditionally associated with repression and heterochromatin, several genes are targeted to the periphery upon induction. This is dependent on interaction with the nuclear pore complex (NPC) and may help facilitate the rapid export of mRNA transcripts from the nucleus. A short cis-acting DNA element discovered in the promoter of the INO1 gene acts as a DNA zip code that is sufficient to target the gene to the nuclear periphery. A perfect match of this 8 base pair gene recruitment sequence (GRS I) can be found in the promoters of many other genes that are upregulated by stress conditions, including the gene TSA2. Like INO1, TSA2 is targeted to the nuclear periphery upon transcriptional activation. This led to the question of whether the GRS I targets genes to the nuclear periphery in general, or if it sends genes to a specific NPC or subset of NPCs. By tagging these two genes with a LacO or TetO array and coexpressing LacI-RFP and TetR-GFP, the location of the genes was visualized by confocal microscopy as a red and green dot and the distance between them was measured. INO1 and TSA2 conditionally colocalized upon activation in a GRS I-dependent manner. This suggests that the GRS I is a specific targeting sequence that may help coordinate the regulation of genes that are activated under stress conditions.

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70 A screen for a suppressor of a conditional dmc1 mutant reveals a new yeast meiotic protein

Lucas Tian, University of Chicago Advisor: Douglas K. Bishop, Ph.D.
Field: Molecular Genetics and Cell Biology

The eukaryotically conserved protein Dmc1 is necessary for proper meiotic recombination. Meiotic recombination is mediated by other accessory factor proteins, which interact with Dmc1 to form the "recombinosome." To characterize novel proteins that are part of the recombinosome of the budding yeast Saccharomyces cerevisiae we first utilized a mutagenesis screen to discover a temperature sensitive dmc1 mutant (dmc1-ts10). A second mutagenesis screen, in a dmc1 dmc1-ts10 background, revealed a repressive suppressor (sup12) of dmc1-ts10 that rescued the temperature sensitive phenotype. That finding indicated that the protein expressed by the wild-type allele of sup12 might interact with Dmc1 during recombination. Using a specific chromosome loss technique we narrowed down the location of sup12 to chromosome XV. Positional cloning of a 20 kb region of chromosome XV, which linkage analysis indicated that sup12 was located in, revealed a stop codon mutation of SOG2 that caused a C-terminal truncation of 65 amino acids. We showed that a sog2 haploid did not complement a sup12 haploid, which indicated that sup12 is in fact an allele of SOG2. A novel finding is that sog2 knockouts have meiotic progeny with drastically lowered viability, further suggesting a role for Sog2 in meiotic recombination. This study indicates that Sog2 might interact with Dmc1 and have a role in meiotic recombination, novel discoveries that we must confirm with future experiments.

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71 Carbon dioxide induced quiescence as a possible tool for investigating lethargus in C. elegans

James Townsend, University of Chicago Advisor: David Biron, Ph.D.
Field: Neuroethology

Sleep is an evolutionarily conserved, chemically regulated and biologically important process that remains, nonetheless, poorly understood. Its near universality in animals from higher order

vertebrates to the nematode, Ceanorhabditis elegans is proof of its basic evolutionary importance. The nematode, with its relatively simple neuroanatomy, tractability to various modes of genetic manipulation, and, most importantly for our discussion and investigation, its sleep-like state—termed lethargus—serves as an ideal platform from which to begin characterizing this complex process. Lethargus bears a distinct resemblance to sleeping states in other animals, such as a depressed arousal threshold, prolonged quiescence, homeostatic mechanisms, as well as a species-specific posture. In addition, several molecular pathways and their associated genes in C. elegans have been identified as being involved in the tight regulation of sleeping behavior, such as the cAMP and cGMP pathways which suppress and promote lethargus in nematodes, respectively.
This project is based first on the observation that carbon dioxide gas has an immobilization effect on C. elegans and that furthermore, this immobilized state is similar to lethargus on a behavioral level. The question that we seek to investigate is one of if there are any underlying mechanistic similarities between CO2 immobilization and lethargus, and if present, examine the genetic basis for these similarities. To this end, I designed and machined a specialized chamber for creating a controlled environment of carbon dioxide gas. I then went on to test and calibrate the device and its sensor as well as doing various proof-of-concept tests to roughly replicate previous studies on CO2 as a nematode anesthetic, as well as to determine a rough threshold concentration of carbon dioxide required for worm immobilization.

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72 **Pressure Overload Induces Activation in SSEA-1+ Cells and Differentiation in Hematopoietic Stem Cells**

Benjamin Turturice, Loyola University Chicago Advisor: Marc S. Penn, M.D., Ph.D.
Field: Cardiovascular Stem Cell Biology

Cardiac pressure overload (PO) occurs in several disease states such as hypertension and aortic stenosis. Previous work in our lab has shown that there is stem cell signaling in the heart in response to PO and that bone marrow stem cells (BMSC) aid in cardiac repair. The aim of this project is to define populations of BMSC that responds to PO. Trans-aortic constriction (TAC) was used to create PO in the murine LV. 8 week old C57Bl/6J underwent TAC and sham operations. Tissue was collected 2 weeks post-surgery and 3 days prior to harvest, mice were pulsed with BrdU to label proliferating cells. Bone marrow populations were analyzed using flow cytometry to quantify percentage of cells expressing known stem cell antigens SSEA-1 and c-kit, hematopoietic lineage markers (Lin), and BrdU + cells. TAC animals demonstrate a 2.00 (87.6% vs. 43.8% $p < 0.001$) fold increase over sham animals in Lin+ cells, a 4.14 (0.45% vs. 1.87% $p < 0.001$) fold decrease in Lin- c-kit+ cells(hematopoietic stem cells), and a 3.42 (10.1% vs. 2.95% $p < 0.001$) fold increase in Lin+ ckit+ cells. Additionally, TAC animals had a 3.36 (3.53% vs. 1.05% $p < 0.05$) fold increase in SSEA-1+ cells. 90% of the SSEA-1+ cells were BrdU+ in TAC mice. These results suggest that in TAC there is activation and differentiation of hematopoietic stem cells represented by the increase c-kit+ Lin+ cells and decrease in c-kit+ Lin- cells. They also suggest SSEA-1+ cells are activated in PO and further studies are in progress to determine the role of SSEA-1+ cells in BMSC mediated repair of the heart.

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73 **Correlation Between Body Shape and Vertebral Column Variation in Oceanic and Limnetic Threespine Stickleback Fish**

Kendal Walker, DePaul University Advisor: Windsor Aguirre, Ph.D.
Field: Evolutionary Biology

Fish species vary broadly in body shape and size. The threespine stickleback (Gasterosteus aculeatus) is a fish species that exhibits substantial body shape diversity as a result of environmental selection pressures. Primitively stickleback lived in oceanic environments. The retreat of glaciers approximately 15,000 years ago allowed stickleback in the Cook Inlet region of Alaska to colonize

the newly formed postglacial fresh water environments. Presently, stickleback fish in this region have adapted to shallow, close to shore, benthic environments by evolving deep bodies, or deep-water limnetic environments by evolving elongate bodies. The evolution of benthic and limnetic stickleback populations has occurred repeatedly in the region. This study explores the relationship between body shape differences and vertebral number and length variation in limnetic threespine stickleback populations. The vertebral column can change in number, length of the vertebral centra, or both. These differences could occur in either abdominal or caudal regions, and the pattern of differentiation may vary between males and females. Thirty male and thirty female stickleback from ancestral oceanic and derived limnetic populations in Cook Inlet, Alaska were photographed and the coordinates of sixteen landmarks, which outlined the body, were recorded. The body shape data were analyzed through geometric morphometrics and principal component analysis (PCA) to find the major axes of body shape variation. X-rays of the same specimens were taken at the Field Museum of Natural History to examine vertebral number and length variation. Examining the relationship between body shape and vertebral column variation in closely related but morphologically divergent fish can provide insight into the early stages of diversification of the vertebrate axial column.

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74 A Central Nervous System Link to the Endocrine Pancreas

Arnaud Wautlet, University of Chicago Advisor: Christopher J. Rhodes, PhD
Field: Metabolism and Diabetes

Beta cells in the pancreas are the site of the body's insulin secretion. Insulin plays a critical role in the take up of glucose from the blood and in its storage as glycogen in the liver, muscle cells, and fat cells. As over 200 years of historical data has shown, certain hypothalamic and brainstem injuries in humans have led to development of obesity and diabetes in affected individuals. While such observations have been made, the precise neuronal pathway involved in regulating insulin secretion from pancreatic beta cells remains largely unknown. In this study, we are beginning to unveil a three dimensional map of the brain that traces this pathway and indicates which anatomical parts of the brain connect to pancreatic endocrine cells and are likely involved in regulating their function. By infecting the pancreas of mice with a retrograde neuronal tracer, attenuated pseudorabies virus expressing the LacZ gene reporter (PRV-BaBlu) and immunostaining brain sections cut from these mice for beta-galactosidase detection, we were able to detect the specific areas of the brain reached by the virus. Our experiment reveals strong PRV-BaBlu tracing to the brainstem and to certain hypothalamic nuclei, especially the dorsal medial nucleus, the ventral medial nucleus, the lateral hypothalamus, and the arcuate nucleus, clearly indicating their central role in endocrine metabolic homeostasis areas of the brain. While PRV-BaBlu tracing mostly ends in the hypothalamus, that indicates the major link of the CNS to the endocrine pancreas, to a lesser extent the virus was also detected in limited extrahypothalamic sites that include the habenula in the thalamus and the hippocampus, suggesting the "fight or flight" process may utilize the hypothalamic nuclei to relay its regulatory effects on endocrine pancreas. While the precise central nervous system (CNS)-endocrine pancreas map is currently being refined, these extrahypothalamic sites could regulate insulin secretion via the hypothalamus or eventually join the autonomic pathways that exit the CNS at the brainstem. Also, some restricted PRV-BaBlu staining was found in parts of thecerebellum, indicating the possibility of a motor neuron-regulated process in control of metabolic homeostasis. In summary, the data obtained to this point have generated the first map of the CNS link to the endocrine pancreas that is mostly directed at the hypothalamus, a central regulator of metabolic homeostasis and, now, likely also of endocrine pancreas physiology.

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75 **The coding of natural textures at the somatosensory periphery**

Alison Weber, University of Chicago Advisor: Sliman Bensmaia, Ph.D.
Field: Neuroscience

Though textural information can be obtained both visually and auditorily, touch yields much finer and more complex textural information than do the other sensory modalities . When we run our fingers across a surface, we may perceive the surface as being rough, like sandpaper, or smooth, like glass; the surface may also vary along other sensory continua, such as hardness (e.g., stone) vs. softness (e.g., moist sponge), or stickiness (e.g., tape) vs. slipperiness (e.g., soap). Also, whether a texture is thermally isolating (e.g., leather) or thermally conductive (like metal) contributes to the textural percept. Texture is represented at the somatosensory periphery in the spatio-temporal pattern of activity in populations of receptors embedded in the skin. Different aspects of texture are encoded by different populations of receptors. Previous studies have explored texture representation using highly artificial surfaces, including gratings and embossed dot patterns, but do not address how more natural textures are represented at the periphery. To fill this gap, we conducted paired psychophysical and neurophysiological experiments in which we presented various textures (e.g., fabrics, plastics, sandpaper) to the fingertips of humans and non-human primates. In the psychophysical experiments, human subjects were asked to provide magnitude estimates along each of three textural dimensions, namely roughness, softness, or stickiness. In the paired neurophysiological experiments, the same textures were presented to the fingertips of anaesthetized Rhesus macaques while we recorded from individual afferents dissected away from the median and ulnar nerves. Our results show that perceptual ratings obtained from humans can be successfully predicted from the firing patterns elicited in the afferents of macaques. Different aspect of the neural responses can account for different aspects of perception.

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76 **Evolution and Mechanics of the Jaw of Tiktaalik roseae**

Alexandra Weill, University of Chicago Advisor: Neil Shubin, Ph.D.
Field: Paleobiology and Evolution

Tiktaalik roseae, a Late Devonian fossil fish uncovered in the Canadian Arctic in 2006, is a prime example of a transitional species in the fish-tetrapod progression. This project seeks to understand the jaw morphology of the holotype of T. roseae in order to make about its feeding habits and lifestyle based on and determine whether phylogenetic analysis based on jaw morphology is consistent with Tiktaalik's current placement as the sister group to tetrapods. By addressing these questions, I hope to contribute to the understanding of the evolution of early tetrapods and the vertebrate transition to life on land. To observe and measure the structure of the lower jaw and separate it out from the rest of the skull, I have made use of the digital image software Amira, which enables a 3D analysis of CT scans and observation of the internal structure of the specimen. This technology has allowed me to segment the jaw into its constituent bones and sutures to create a three-dimensional model with clear features that may be studied in isolation or along with the rest of the skull. The last stage of the project will involve taking measurements on the jaw to calculate mechanical advantage and muscle volume. These measurements will be used comparatively to answer the question of whether T. roseae was a "biter" or a "gulper."

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77 Alterations in global gene expression in abnormally myelinating mice

Yuwen Wu, University of Chicago Advisor: Brian Popko, Ph.D.
Field: Neurobiology

The myelin sheath that is wrapped around axons is necessary for neuronal function and survival. Myelin is synthesized and secreted by glial cells and is made up of various glycolipids and proteins, many of which are specific to the myelin sheath. Myelin basic protein (MBP) is the second most common component of central nervous system (CNS) myelin and allows the cytoplasmic surfaces of multilamellar myelin to adhere to one another. Natural MBP mutant mice, called shiverer mice, display a tremoring phenotype, difficulty walking, premature death, and an almost complete loss of CNS myelin. Interestingly, mutations in other myelin structural proteins lead to much milder phenotypes, thus MBP seems to be the main constituent necessary for proper CNS myelin formation. However, it is unclear why MBP should have this specialized role. We hypothesize that MBP may regulate expression of other myelin genes, either directly or indirectly. We will thus analyze changes in global gene expression in response to MBP loss using RNA-Seq.
A second spontaneous mouse mutant carrying a nucleotide insertion in the zinc finger protein 191 (Zfp191) gene displays a similar phenotype to shiverer mice. Zfp191 knockouts tremor, experience tonic seizures, and are hypomyelinated in spite of the presence of mature oligodendrocytes, which are the myelinating cells of the CNS. Zfp191 is a nuclear protein with both DNA-binding and protein-protein interaction domains and seems to have a regulatory function in oligodendrocytes, as many myelin related genes are downregulated when Zfp191 is mutated. We plan to use RNA-Seq to compare Zfp191-/- global transcript levels to those of shiverer mice, as it will be interesting to see if there are any overlapping effects of the two mutations.

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78 The Great Phosphorous Mystery at Prairie Wolf Slough Wetlands Demonstration Project

Miki Yoshimura, C. Gregory, and M. Vernon, DePaul University
Field: Environmental Restoration Advisor: James Montgomery, Ph.D.

In 1998, a systematic water quality monitoring project was begun at Prairie Wolf Slough Wetland Demonstration Project (PWS), a restored palustrine emergent marsh wetland located on an abandoned farm field located in a northern suburb of Chicago. Long-term sampling indicates that the wetland acts as a point source of phosphorous to the adjacent Chicago River. In summer 2010 a project was conducted by students in DePaul's CIRRUS Program to identify the potential sources of excess phosphorous to the wetland. The working hypothesis tested was that the excess phosphorous emanated from the soil, perhaps due to the dissolution of residual rock phosphorous fertilizer that had been added when the site was in row crops. Soil samples were collected from upland areas adjacent to the marsh and from an abandoned farm field located on the east side of the river. This site serves as a baseline analog from which to gauge the effects of restoration on water quality in PWS. Mean concentrations of soluble reactive and total phosphorous were significantly higher ($p < 0.05$) in the analog field compared to PWS. Net export of phosphorous from the wetland was likely due to its mobilization as a result anoxic conditions produced during inundation events. Release of phosphorous from soil does appear to be a contributing factor to the excess phosphorous being discharged from PWS; however, other sources of phosphorous including fecal contributions from water fowl, could also be significant sources of excess phosphorous.

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79 P19Arf Transcriptionally Represses PdgfrB in the Developing Mouse Eye

Anna Zelivianskaia, University of Chicago Advisor: Stephen Skapek, MD
Field: Oncology

The tumor suppressor p19Arf regulates cell-cycle arrest and apoptosis either dependently or independently of the p53 transcription factor. In addition to the tumor suppressor function, Arf is required for normal eye development. Mice lacking Arf are born blind due to failed vascular regression within the primary vitreous. This phenotype resembles a severe pediatric eye disease known as Persistent Hyperplastic Primary Vitreous (PHPV). The exact mechanism by which Arf controls vascular regression in the eye is unclear but involves repression of platelet-derived growth factor receptor B (PdgfrB). Mice lacking both Arf and PdgfrB undergo normal vascular regression and have normal eyes. In this study, we examined the mechanism of Arf mediated repression of PdgfrB during eye development. We used fluorescence microscopy to assess the amount of proliferation, apoptosis, and cell migration in the embryonic vitreous. Our results show that without Arf, PdgfrB enhances cell proliferation in vivo by promoting DNA synthesis but does not affect apoptosis or cell migration into the vitreous. In cultured cells, p19Arf represses PdgfrB transcription. Arf-dependent transcriptional repression also occurs in vivo. These findings demonstrate that p19Arf transcriptionally represses PdgfrB during embryonic eye development and prevents excess cell proliferation caused by the receptor, which would otherwise result in a PHPV-like phenotype. The critical role that PdgfrB plays in the PHPV-like mouse phenotype opens up possibilities for a greater understanding of the disease and potential treatment options using Pdgfr inhibitors.

80

Sara Zufan, DePaul University Advisor: Corrie Moreau, Ph.D.
Field: Systematic and Evolutionary Biology

Bacterial endosymbionts are widespread across many ant species. Recent studies suggest that bacterial gut symbionts may play an important role in the evolution of herbivorous ants. To describe the evolution of the symbioses between bacteria and their ant hosts, we reconstructed phylogenetic histories of herbivorous Polyrhachis ants and their associated bacteria. Using specific primers (rpsBgene), we screened for the intracellular endosymbionts of the genus Blochmannia. In addition, we used 454 pyrosequencing targeting the 16S rRNA region of bacteria. We reconstructed phylogenies of the hosts and bacterial endosymbionts to test for coevolution. We found congruent evolutionary histories of ants and bacteria in all datasets analyzed at the ant subgenus level. Our findings indicate that the Polyrhachis– Blochmannia symbiosis has been stable evolutionarily leading to the hypothesis that the bacteria play a key role in their hosts' ecology.

Chemistry

81 **Escape Pathways of Ethylene Isocyanide from Sperm Whale Myoglobin**

Jamal Adas, Loyola University Chicago Advisor: Ken Olsen, Ph.D.
Field: Theoretical and Computational Biophysics

We are studying the mechanism for the movement of ethylene isocyanide (EtN) into and out of the distal heme pocket of sperm whale myoglobin (Mb). Obtaining this mechanism will help us understand the importance of the orientations of residues surrounding the distal heme pocket (His-E7, Val-E11, and Arg-CD3), and how these residues contribute to the overall function of myglobin. By mutating specific residues surrounding the distal heme pocket, we will form predictions about which residues are responsible for the movement of the EtN out of the distal heme pocket and then propose point mutations that can be used to study the EtN in sperm whale Mb.
The geometry of the bonds formed by ethyl-isocyanide to the Mb are similar to those of oxygen or carbon monoxide. Certain changes in the structure of the protein may be seen in the structure of the EtN complexed with Mb relative to that of MbO2; specifically, the His-E7 appears to swing out of the heme pocket toward the solvent phase. This movement is believed to be the source of the EtNís escape from the heme pocket. Understanding this mechanism will also shed light on the binding and escaping mechanisms of other large molecules that can bind to the heme pocket of Mb.
This proposal will examine the pathway of the EtNís escape from the heme pocket by simulating its movement with mutated His-E7 residue on the distal end of the heme pocket. The movement will be simulated using the approach of Target Molecular Dynamics (TMD), which will use steering forces to guide the EtN toward a target structure. We will use TMD, as implemented in the molecular dynamics program NAMD, to calculate the specific mechanism by which the EtN is able to escape the distal side of the heme pocket in sperm whale Mb.

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82 **Comparison of The Antioxidant of Caffeinated and Decaffeinated Coffee**

Brandon Alba and Brittany Borden , Northwestern University Advisor: Shelby Hatch, Ph.D.
Field: Antioxidants

To avoid the negative side effects of caffeine, many consumers choose to drink decaffeinated coffee; however, some of these consumers wonder if decaffeinated coffee provides the same antioxidant benefits of regular caffeinated coffee. The objective of this study was to test the hypothesis that decaffeinated coffee contained the same quantity and strength of antioxidants as caffeinated coffee. A Trolox equivalent antioxidant capacity (TEAC) assay was performed to test the strength of the antioxidants contained in caffeinated and decaffeinated coffee and a total polyphenolics measurement to quantify the amount of antioxidants in each type of coffee. Our results showed that caffeinated and decaffeinated coffee contained nearly the same strengths of antioxidants with TEAC values of 2105.27 for caffeinated coffee and 2141.02 for decaffeinated.

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83 **NOVEL FUNCTIONAL COPOLYMERS OF TRISUBSTITUTED ETHYLENES WITH STYRENE**

Sonia Chavez, DePaul University Advisor: Greg B. Kharas, Ph.D.
Field: Organic and Polymer Chemistry

Copolymers of styrene and 2-[(R-phenyl)methylene]-propanedinitrile (where R is 2-ethyl, 4-isopropyl, 4-butyl, 4-tert-butyl, 2-ethoxy, 4-hexyloxy, and 4-isobutyl) were prepared in solution with radical initiation. The composition of the copolymers was calculated from nitrogen analysis and the structure was analyzed by IR, 1H and 13C NMR. The copolymers were characterized by GPC, DSC, and TGA.

Higher glass transition temperature of the copolymers in comparison with that of homopolymers indicates a decrease in chain mobility of the copolymer due to the high dipolar character of the trisubstituted ethylene monomer unit.

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84 **Coffee Brewed With Previously Ground Beans Expresses Higher Total Antioxidant Capacity Than Coffee Brewed With Freshly Ground Beans**

Alysa Cortes, A. Guerrero, and D. Lee, Northwestern University Advisor: Shelby Hatch, Ph.D.
Field: Analytical Chemistry

Coffee is one of the most widely consumed beverages in the world, and is known to be a notable source of antioxidants. In this study, differences in antioxidant levels in coffee brewed with pre-ground coffee and coffee brewed with freshly ground coffee were investigated. Total antioxidant capacity (TAC) of each type of coffee was calculated through the Trolox Equivalent Antioxidant Capacity (TEAC) assay and the total polyphenolics measurement (Folin-Ciocalteau reagent assay). Pre-ground coffee was hypothesized to express lower antioxidant levels due to a greater surface area of the coffee bean being exposed to the atmosphere for a longer time. However, results from the TEAC assay indicate 1.59% higher TAC in pre-ground coffee, which is consistent with higher TAC in pre-ground coffee from the Folin-Ciocalteau assay. A possible explanation is that prolonged exposure to oxygen oxidizes the antioxidants further, which increases their reducing capacity. Because these data suggest that pre-ground coffee expresses higher TAC, consumers should be recommended to consume coffee brewed from pre- ground coffee for its increased antioxidant benefits

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86 **Exploring the potential of marine actinomycetes to inhibit the growth of Pseudomonas aeruginosa.**

Maryam Elfeki, University of Illinois at Chicago Advisor: Brian T. Murphy, Ph.D.
Field: Chemistry

Gram-negative pathogenic bacteria are an imminent threat of infection among humans. Their deadly persistence has highlighted the need for structurally and mechanistically new antibiotics on the market. Actinomycete bacteria have been an enduring source of antibiotics since the discovery of actinomycin in 1940. Since then, terrestrial actinomycetes have supplied greater than half of the antibiotics in clinical use. However, novel antibiotic discovery is currently stalled by the continuous re-isolation of known antibacterial agents. To address the problem of Gram- negative infections, we are exploring the potential of marine actinomycete secondary metabolites to inhibit the growth of the pathogen Pseudomonas aeruginosa. We paired each actinomycete from our strain library with P. aeruginosa in agar competition assays. Upon observation of a distinct zone of inhibition between the two microorganisms, we selected the actinomycete for large-scale liquid culture studies. Using standard chromatographic and spectroscopic techniques we are extracting, isolating, and identifying the antibacterial metabolites that were responsible for the observed bioactivity. Using nuclear magnetic resonance spectroscopy (NMR) and mass spectrometry (MS), we are elucidating the structure(s) of antibacterial metabolites and further exploring their potential as drug leads to treat Gram-negative bacterial infections.

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87 **Synthesis and Structure of Metal-Organic Frameworks**

Adrian Garcia, A. Gabriel, and O. Ogunnubi, Harry S. Truman College
Field: Chemistry/ Drug discovery Advisor: Raymund C. Torralba, Ph.D.

Metal Organic Frameworks (MOFs) consist of metal ions or clusters connected by organic linkers. These compounds, when formed, contain empty cavities within it. There is a growing interest in these compounds due to their possible applications in gas storage, purification, and chemical sensing. However, the ability to synthesize MOFs from nontoxic, biorenewable starting materials may benefit the environment and save money on production costs. Also, they may have possible pharmaceutical and food science applications like drug delivery.
Possible MOFs will be synthesized using benign natural starting materials; combining salts of various metals (Ca^{2+}, Fe^{2+}, Zn^{2+}, Co^{2+}, Ni^{2+}) with cyclic polysaccharides through simple one pot reactions and reflux reactions, respectively. Aqueous solutions of the combined starting materials will be allowed to crystallize by vapor diffusion with methanol in order to produce crystals. The products formed will be analyzed using single crystal or powder x-ray diffraction and 1H NMR spectroscopy.

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88 **Investigation of Trinuclear Ruthenium Clusters as Probes of Weak Interactions of Ligand-Receptor Binding**

Hsiao-Tieh Hsu, Northwestern University Advisor: Thomas J. Meade, Ph.D.
Field: Inorganic Chemistry

Weak interactions between small molecules and proteins, such as van der Waals forces and hydrogen bonding, are important in living systems but are difficult to measure directly. Marcus theory of electron transfer relates these weak interactions to reorganization energy and electron transfer rate. Therefore, information on weak interactions can be obtained through electrochemical experiments to measure the rate of electron transfer and reorganization energy. Initial studies were performed using the biotin/avidin system. Utilizing two different avidin binding ligands, 4-DMP and 4- BMP, monovalent and bivalent trinuclear ruthenium clusters were synthesized. Experiments were performed to investigate the strength of binding of these clusters to avidin. The clusters were incorporated into self-assembled monolayers to facilitate electrochemical experiments.

Cyclic voltammetry (CV) and alternating current voltammetry (ACV) were performed on these monolayer systems before and after protein binding. The redox potential, current, and amount of charge transferred upon oxidation and reduction of the clusters were measured. The data before avidin binding and after avidin binding were compared. In the 4-DMP and monovalent 4-BMP systems, changes in CV and ACV data were negligible. This means there is no measureable change in electron transfer rate and reorganization energy upon protein binding for these systems. For the bivalent 4-BMP system, a shift in redox potential of -43 mV was observed upon avidin binding. In the future, trinuclear ruthenium clusters with different binding ligands will be synthesized to maximize electrochemical changes upon protein binding. This research has potential applications in the development of protein biosensors.

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89 **Analysis of Omega-3 Polyunsaturated Fatty Acid Oxidation**

Lynn Huynh and Matthew Sienna, Wilbur Wright College
Field: Biochemistry Advisors: Matthew Siena, Doris Joy Espiritu, Ph.D.

Omega-3 fatty acids are essential polyunsaturated fatty acids that help prevent diseases such as coronary heart disease, osteoporosis, cancers, asthma, and depression. Omega-3 can be obtained from eating fresh marine fish but the potency of Omega-3 from the diet is difficult to maintain because Omega-3 is subject to rapid oxidation. Omega-3 fatty acids are available in either capsulated or bottled preparation. The liquid contains antioxidants but most Omega-3 in

capsules does not. The capsule is more convenient to take than bottled fish oil but the capsule is not completely impervious to air. Exposure of Omega-3 to air will cause oxidation. The aim of this study is to evaluate the integrity of commercial capsulated Omega-3 and commercial bottled fish oil after it was opened. We hypothesize that extended exposure to air will oxidize Omega-3 fatty acids in capsule form faster than the bottled Omega-3. We tested fatty acid oxidation by analyzing the Peroxide value of freshly opened and Omega-3 already exposed to air for 2, 4, 8 and16 weeks. Our results show that Omega-3 fatty acids is oxidized, whether in capsules or in liquid form, upon extended exposure to air. After eight weeks of air exposure, Omega 3 in capsules has a peroxide value 20 fold higher than fresh omega 3 and the liquid form has a peroxide value nine fold higher than freshly opened fish oil. Although, both the capsule form and the liquid for oxidized, our results supported our hypothesis that bottled fish oil will oxidize slower due to the presence of antioxidant. We then further analyze the effect of temperature on the integrity of Omega 3 capsules stored at 25°C or 4°C after opening using the previous method. We hypothesize that Omega-3 capsules stored at 4°C will oxidize slower than Omega-3 capsules stored at 25°C.

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90 **Bioanalytical Techniques to analyze a single point mutation of the E22Q Dutch Alzheimer's Disease peptide**

Forest Hynes, DePaul University Advisor: Sandra Chimon Peszek, Ph.D.
Field: Neurological Disorders

The amyloid beta (AB) peptides associated with Alzheimer's disease (AD) form complexes in vivo as well as in vitro which result in the formation amyloid plaques found in the extracellular region of the brain. Although the AB(1-40) and AB(1-42) are the predominant forms, the AB(22-35) fragment is both neurotoxic in vitro and assembles into straight fibrils as seen previously in other studies. Attenuated Total Reflectance Infrared Spectroscopy (ATR/IR) and Ultraviolet-visible Spectroscopy (UV/Vis) was used to study the conformational characteristics of amyloid plaques formed in Alzheimer's disease, and the affect of a single point mutation resulting in a E22Q amino acid substitution at position 22 of the AB(22-35) fragment. Our ATR/IR study showed the point mutation can affect the fibrillization, structure, and characteristics of the peptide relative to that of the wild type. Our kinetic measurements of B-sheet formation for E22Q Congo Red UV/Vis showed the point mutation can affect kinetics of the peptide relative to that of the wild type. These results experimentally proved a significant differences in aggregation time compared to the Wild Type (WT) AB(22-35) as well as both the AB(1-40) and AB(1-42) WT peptide chains. Our data was consistent with previous studies by D. J Watson, D. J Selkoe, and D. B Teplow were the disease process in which the Dutch mutation results in the production of AB peptides with enhanced propensities for fibrillogenesis, leading to accelerated vascular deposition and disease.

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91 **Measurement of the Inhibition Potential of Melatonin on Beta-Amyloid Peptide Aggregation and its Mutations Using Congo Red**

Jared Isaacs, DePaul University Advisor: Sandra Chimon Peszek, Ph.D.
Field: Bioanalytical Chemistry

Victims of the neurodegenerative Alzheimer's disease show the formation of amyloid plaques in the brain's extracellular region caused by the folding of beta-amyloid peptides (Aß). Beginning as monomers, these proteins fibrilize into increasingly complex and toxic intermediates, ending with the aggregation of amyloid proteins. As demonstrated by Cheng (2005), melatonin may function as an inhibitor of Aß aggregation based on tests involving the Aß (1-40) strand. Because point mutations at the hair-pin turn (Aß 22-35) affect the solubility of intermediates as well as their rate of fibrilization, this area became our focus. Ultraviolet-visible spectroscopy (UV-Vis) will be used in combination with Congo Red to quantitatively measure the inhibition capabilities of melatonin on Aß

proteins and its mutations. The measured effects of melatonin on the 22-35 fragment may help pave the way for future preventive treatment of Alzheimer's disease.

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92 CONFORMATIONAL STUDIES AND BIOANALYTICAL TECNHIQUES USED TO ANALYZE A SINGLE POINT ITALIAN MUTATION OF ALZHEIMER'S DISEASE

Luvleen Kaur, DePaul University Advisor: Sandra Chimon Peszek, Ph.D.
Field: Bioanalytical Chemistry

Alzheimer's disease (AD) is characterized by an onset progressive neurodegeneration linked to an aggregation of fibrillized beta amyloid (AB) peptides that result in the formation of amyloid plaques found in the extracellular region of the brain. Clusters of fibril misfolded proteins are associated with Alzheimer plaques, which can cause a toxic buildup that may lead to death of the nerve cell. In multiple studies for both AB(1-40) and AB(1-42), a trend of fibril formation have been identified to begin in a nontoxic monomer self-assembling state that progresses to an alpha helical, to spherical beta-sheet intermediates, and into a fibrillar state.1 Amyloid beta-sheet intermediate structures display a much higher toxicity than fibrils due to the neurotoxic intermediate species. A shorter 14 sequence (22-35) is of interest due to the hair-pin turn and the effect of fibril formation without the KLVFFA region of amino acids suggesting that the hair-pin turn is possibly an intermolecular hydrophobic core. About five percent of all AD is caused by a missense mutation in one of three inherited genes, such as the Italian mutation,(E22K) in the Presenilin 2 gene.2 A single point Italian mutation and the wild type, AB 1-40, are both capable of forming intramolecular and intermolecular beta-sheets but the Italian mutation demonstrates a different rate of beta sheet formation compared to the Wild type. Attenuated Total Reflectance Infrared Spectroscopy (ATR/IR) allows us to characterize the secondary structure. Data gathered verifies that the Italian A□ (22-35) fragment polymerizes into B-sheets and demonstrates time intervals in which intermediate structures can be captured for further analysis such with circular dichroism (CD), transmission electron microscopy (TEM) and nuclear magnetic resonance (NMR).

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93 Attenuated Total Reflectance – Infrared Examination of the Conformational Rate and Speciation of the Alzheimer's Disease Dutch Mutant Amyloid Beta 22-35 Region

Ryan Kravetz, DePaul University Advisor: Sandra Chimon Peszek, Ph.D.
Field: Bioanalytical Chemistry

Alzheimer's patients suffer from a buildup of neurodegenerative amyloid plaque in the brain's extracellular regions. This is commonly attributed to toxic B-sheet conformations formed with the self-fibrilization of amyloid beta (AB) peptides of the AB1-40/42 fragment. Our in vitro research focuses on AB 22-35, a unique segment of the peptide containing a salt bridge and hairpin turn. Study of the Dutch mutant strain (point mutation from the wild type at the 22nd residue replacing glutamic acid with glutamine – E22Q) indicates fibrilization in an area where previously it had been ruled out due to the lack of the KLVFFA region found in the 1-40/42 segment. In vitro incubation of the Dutch strain is analyzed in solution via attenuated total reflectance – infrared (ATR-IR) spectroscopy, a technique superior for peptide analysis to solid-state IR as it avoids the accelerated fibrilization commonly observed with use of salt plates. While other techniques such as ultraviolet/visual spectroscopy focus primarily on identifying B-sheet development, ATR-IR spectroscopy also allows for the detection of the presence of multiple intermediate species with potentially neurotoxic properties. These intermediate species (including random coil and B-helical conformations) are indicated by an observed shift and increase in intensity of peaks at the amide I and amide II regions of the ATR-IR spectrum, and the rate of aggregation then compared to the wild type.

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94 **Reaction rates of atmospheric constituent in Chicago Air**

Katarzyna Majewska, Loyola University Chicago Advisor: Martina Schmeling, Ph.D.
Field: Atmospheric Chemistry

The undergraduate research project at Loyola University of Chicago titled Reaction rates of atmospheric constituent in Chicago Air is based on analyzing the chemical constituents and the calculation of the reaction rates occurring in the Chicago air. During the summer months of the previous two years, air samples from a 42C and a 49C Thermo Analyzer were continuously collected. During the two academic school years, all the summer data has been graphed, carefully analyzed for errors and the reaction pathways have been gathered. The graphs have further been compared and the possible pollution occurrence was on the outlook. An Ion Chromatographer was used to see the exact compound compositions and their amount and analyzed to see any correlations with the data taken ten years ago and earlier. Interesting correlations of different variants such as the temperature, wind speed, relative humidity and the wind direction have been graphed and compared for concentrations of the nitrogen oxides and ozone. The calculations of the rates of the atmospheric reactions are being solved by looking at various articles mainly from the years from 1970 to 1980 where similar but far away from this actual research have occurred.

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95 **NITRENIUM IONS: DEVELOPING RESEARCH IN LARGER MEMBERED CYCLIZATION PRODUCTS**

Jenny Martinez, University of Illinois at Chicago Advisor: Duncan J. Wardrop, Ph.D.
Field: Organic Chemistry

In the field of organic chemistry, little attention has been paid to the behavior and reactivity of nitrenium ions. However, Dr. Duncan J. Wardrop's research group has not neglected such species. That being the case, this project proposes to examine the behavior of nitrenium ions. The project consists of the synthesis of eight organic compounds, a methodological study of larger membered cyclization products achieved via PIFA-mediated conditions. Each substrate is to be achieved through a similar reaction scheme. As of now, two substances have been achieved and the others are under development. All substrates undergo the same reaction scheme due to their similar chemical structures. The first reaction is an alkylation reaction with the substrate's corresponding bromide substituent. The following reaction is a second alkylation. Once the dialkylated compound is achieved, Grubbs catalyst is used to produce the metathesis product. The product then undergoes a hydrolysis followed by a decarboxylation. The acid is then converted to its amide by EDC coupling. At last, the final product is achieved via PIFA-mediated conditions. Although this methodology provides a reasonable reaction path for all substrates, modifications have been employed to achieve them, and thus, such variations are the focus of this presentation.

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96 **Plasma membrane receptor protein response to calcium and vitamin D**

Ilysha Minor, DePaul University
Field: Cell signaling Advisor: Sandra Chimon Peszek, Ph.D.

Type 1 and type 2 diabetes are characterized by the body's inability to metabolize glucose due to a dysfunctional glucose transporter, GLUT 4. Recent research has shown that excess calcium produced during exercise may provide another metabolic pathway for the absorption of glucose into cells. During exercise, excess calcium is released into the blood stream. The presence of calcium in the blood stream may signal an alternative glucose carrier protein to surface the plasma membrane and take in glucose from the blood stream and metabolize within the cell. The glucose carrier protein acts in the same way as the glucose transporter, GLUT 4 to metabolize glucose in the absence of insulin and insulin receptors. The challenge is to establish if calcium in combination with vitamin D can be

used as an equal and alternative method to metabolize glucose and if so, in what amounts and with what method can calcium in combination with vitamin D be administered into the body to provide the same results.

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97 **Isolating Ailanthone From Plant Extract**

Adil Mohyuddin, DePaul University Advisor: Justin Maresh, Ph.D.
Field: Biochemistry

The Ailanthus altissima plant is an invasive species that is hypothesized to generate an allelopathic toxin, ailanthone. Ailanthone is chemically unstable, thus further understanding of its ecological role requires study of its decomposition. We report the use of dry column vacuum chromatography to isolate pure ailanthone from the bark of A. altissima plant in good yield. We then utilized the pure ailanthone to characterize its decomposition.

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98 **Progress Toward Cell-Assisted Synthesis of Novel Alkaloids**

Michael Mullowney, DePaul University Advisor: Justin Maresh, Ph.D.
Field: Biochemistry

Plants synthesize chemical compounds of various complexities that may often be beneficial to society, often as medicine. In lieu of total synthesis, analogues of known intermediates found in the biochemical pathway of a plant may be synthesized and introduced to the cell culture of a plant. The novel products that form from these introduced intermediates reveal information about the enzymes involved. These products may also have potential benefit, which could be similar to, or better than that of the known compounds created by the plant. The plant cultures used for this experiment are Berberis stenophylla (barberry) , Narcissus (Daffodil), and Eschscholzia californica (California poppy). In preparation for the cell-assisted synthesis of novel alkaloids, a ChemFinder database was created of all known Narcissus, Berberis stenophylla , and Eschscholzia californica alkaloids, including their IUPAC names, structures, and other attributes. Berberis stenophylla cell culture and the media in which it was growing was extracted and analyzed on HPLC to determine which color cell culture produced the highest yield of desired alkaloids and whether these alkaloids resided in the cells or if they were released into the media. The extracts were compared to HPLC standards of known Berberis stenophylla alkaloids Berberine, Hydrastine, and Palmatine. Yellow Berberis stenophylla cell culture was found to contain the most alkaloid content within the cells, where brown cell culture and media from cells of either color had little to no alkaloid content. The medium light, pH, and ingredient (i.e. vitamin content) conditions for the Berberis stenophylla cell cultures were then optimized for maximum cell reproduction and minimum maintenance, resulting in a B-30 buffered Linsmaier & Skoog (LS) Medium as the most promising media. Narcissus bulbs of varieties Ice Follies, Mt. Hood, Yellow Cheerfulness, and Tete-a-Tete were also propagated using the 'twin scaling' technique with the aim of creating Narcissus cell cultures from shoots.

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99 **Bioanalytical Techniques to analyze a single point mutation of the E22Q Dutch Alzheimer's Disease peptide**

Nora O'Byrne, DePaul University Advisor: Sandra Chimon Peszek, Ph.D.
Field: Protein Structure Analysis

Amyloid beta peptide (AB) form fibrils which are found in extracellular brain plaques of Alzheimer 's disease (AD) patients.1 Studies of AB(1-40) and AB(1-42) have shown that fibril formation starts with monomers that change conformation to form various intermediates, and finally aggregate into beta sheet fibrils. This research is focused on the 22-35 fragment of the AB Dutch mutant (E22Q). This

fragment contains the hairpin region of the peptide which contributes to secondary and tertiary structure, and it displays neurotoxicity in vitro. Previous work has shown that the point substitution at residue 22 causes a change in time of fibril formation compared to that of the wildtype (WT). Ultraviolet-visible spectroscopy (UV-Vis) was used to study conformations of intermediate species and fibrils of the Dutch mutant (22-35).

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100 **Mechanical and Analytical Techniques Used to Analyze Beta Sheet Formation of a Single Point Mutation for Alzheimer's Beta Amyloid Peptide**

Nadrine Omar, DePaul University
Field: Alzeimer's Disease Advisor: Sandra Chimon-Peszek, Ph.D.

Amyloid diseases, such as Alzheimer's disease, are neurodegenerative disorders that have been introduced by protein misfolding into amyloid fibrils. Other similar diseases include Parkinson's, Huntington's, and Creutzfeldt-Jakob disease, which have yet to be cured effectively, are recurrently distinguished by fibrillar depositions of specific amyloid proteins. Alzheimer's B-amyloid (AB) peptides and B-synuclein (B-Syn) are distinctive traits of Alzheimer's disease (AD). In the extracellular region of the brain of Alzheimer's patients, the formation of amyloid plaques are formed. In multiple studies for both AB(1-40) and AB(1-42), a tendency of fibril formation has been found to start from a non-toxic monomer state that has self- assembled into a lethal fibrillar state. Additionally, the beta-amyloid peptide 1-40 and beta- amyloid 1-42, associated with the cause of Alzheimer's disease, undergoes several transformation processes resulting in structural changes in the protein shape; shifting from random coil, to alpha helical, to beta-sheet, with a range of intermediate structures in between. It is important to also examine the hair-pin region without the presence of residues 16-21. In order to study the effect on fibril formation without the "KLVFFA" region, or the sequence in the AB 1-40, the 22-35 sequence was chosen. Previous research conducted by Dr. Chimon Peszek has found diffusible beta sheet intermediate structures. These, in turn, could present a similar toxicity as fibrils, consequently the cause of neurodegeneration in Alzheimer's.
There are several missense mutations in the B amyloid precursor protein (APP). Among these, the Italian (E22K) point mutation lead to changes in time of fibril formation as well as solubility and toxicity of fibrils. It is believed to promote early onset of AD, prematurely producing clinical and neuropath logical features which are unchanged from those of late onset AD. The Italian mutant also has an increased level of neural toxicity. The Italian mutant is also associated with cerebral amyloid angiopathy and hemorrhagic stroke. The use of Attenuated Total Reflection Infrared Spectroscopy, ATR-IR, and Ultraviolet Visible Spectroscopy, UV-Vis, on the 22-35 sequence confirmed the formation of structures synonymous with toxic beta sheets. Discovery of more knowledge on these mutations could have a significant impact on therapeutic medicines and treatments in the near future.

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101 **Rate performance of 3-DOM ordered macroporous carbon based electrodes in aqueous K3Fe(CN)6**

Ana Ortega, Harold Washington College Advisor: Kenneth Brown, Ph.D.
Field: Electrochemistry

For the improvement of rate performance of carbon electrodes, new electrode surfaces, such as Three Dimensionally Ordered Macroporous (3DOM) carbon electrodes, are being studied in order to understand their electrochemical properties. The 3DOM carbon electrodes have a greater surface area that allows more charge transfer reactions to take place, and have high energy density. These characteristics should be useful in the development of sensors/biosensors with enhanced rates of electron transfer. In order to use the electrodes for aqueous solutions, an acid pretreatment was used to help create more "oxide defects" on the surface, therefore making the surface more hydrophilic to allow metal complexes to have better contact with the surface. This results in better

electron transfer between the electrode surface and 3DOM electrode. Based on the Randles Sevcik equation (derived from the Nernst Plank equation), the 3DOM electrodes have shown results similar to that of results with glassy carbon electrodes, but with enhanced electron transfer rates.

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102 **SAMDI generates optimized peptide libraries and elucidates networks of opposing enzymes**

Jacob Parzen, University of Chicago
Field: Biochemistry/Material Science Advisor: Milan Mrksich, Ph.D.

Acetylation of lysines is a common post-translational modification that is essential to many cellular processes, including gene expression, differentiation, and cell-cycle regulation. The acetylation state is controlled in vivo by the opposing activities of two enzyme families, lysine acetyltransferases (KATs) and lysine deacetylases (KDACs). In this research, we present the use of SAMDI (self-assembled monolayers for matrix assisted laser desorption/ionization mass spectrometry) both to develop peptide libraries that are active substrates for each family and to determine the specificities of isozymes within the families on the libraries. Novel libraries were optimized from the Ac-GXKZGC-NH2 library (where X and Z are all amino acids except cysteine), which has shown low acetyltransferase activity but whose acetylated analog has proved a viable substrate for deacetylase assays. It was determined that by inserting an N-terminal arginine residue and replacing the C-terminal glycine with proline, the resulting library, Ac-RGXKZPC-NH2, and its acetylated analog serve as viable sets of substrates for members of the acetyltransferase and deacetylase families, respectively. High-throughput assays of KAT2B and KDAC8 were performed to generate individual specificity profiles and then compared to an assay of the combined enzymes to demonstrate the potential of spatio-temporal co-localization on acetylation states.

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103 **A study on the Ligand-binding Pathways of the Heme-containing PAS Protein, EcDOS, of Escherichia coli**

Bhavik Patel, Loyola University Chicago Advisor: Kenneth W. Olsen, Ph.D.
Field: Computational Biochemistry

The PAS domain is an important structural motif that is found in proteins from all kingdoms of life (Saskura et al, 2006). Recent studies have shown the Escherichia coli direct oxygen sensor (EcDOS) to sense and bind oxygen at the heme within its PAS domain, amongst other diatomic gases. Ligand binding and exiting pathways for oxygen and subsequent conformational changes which govern the cognate phosphodiesterase activity, however, still remain unknown. Using Locally Enhanced Sampling Molecular Dynamics (LESMD), we find trajectory pathways for diatomic oxygen in both the native EcDOS and several mutations (Glu93Ile, Met95Ala, Arg97Ile, Arg97Ala, Arg97Glu, Phe113Leu, and Phe113Thr). The MD simulations suggest interactions amongst Arg97, the ligated oxygen and Phe 113, consistent with previous Raman spectroscopy studies (El-Moshtoly et al, 2008). On the basis of our results, we propose a model which suggests three pathways by which the exogenous ligand, oxygen, exits the heme-PAS domain EcDOS as well as distinct residue functionalities, in terms of ligand interactions. We compare our findings with previous mutational and kinetic studies on EcDOS and the PAS domain. By understanding how ligands, like oxygen, enter and exit the protein and the importance of specific residues involved within the process, we have a better understanding of how the specific signal transduction of EcDOS occurs within Escherichia coli and the PAS-domain family as whole.

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104 Amygdalin as an Alternative Treatment and Preventative for Behavioral and Cognitive Symptoms of Alzheimer's Disease and Various Neurodegenerative Diseases

Veronica Perez, DePaul University Advisor: Sandra Chimon Peszek, Ph.D.
Field: Chemistry, Alzheimer's Research

With life expectancy increasing, treatment and prevention of neurodegenerative diseases is becoming greater of importance. A highly controversial yet popular alternative treatment is known as amygdalin or more commonly "laetrile" or inaccurately "B17". Amygdalin (D-mandelonitrile-□-D-gentiobioside) is the cyanide-containing glycoside first isolated in 1830 and found in the seeds and cores of several members of the Rosaceae family (P. persica- peach; P.armeniaca- apricot, P. amygdalus var. amara –bitter almond and in the bark of prunus Africana- pygeum.) Chemists Liebig and Wohler discovered that in the presence of certain enzymes, amygdalin underwent hydrolysis with the evolution of benzaldehyde and hydrogen cyanide. The decomposition brought about by enzymes may occur in two ways. Emulsin, an enzyme mixture that is prepared from bitter almonds which includes (among others) enzymes beta-D-glucosidase and beta-oxynitrilase specifically hydrolyzes the beta-D-glucoside linkage. Emulsin decomposes amygdalin into benzaldehyde, cyanide, and two molecules of glucose. Another enzyme, maltase, partially decomposes amygdalin, giving D-glucose and mandelic nitrile glucoside, $C_6H_5CH(CN)O \cdot C_6H_{11}O_5$. Amygdalin is often mistaken with laevomandelonitrile, also identified as laetrile for short. However, amygdalin and laetrile are different chemical compounds. Since very few clinical trials have actually studied the effect we will choose to conduct an experiment that analyzes the impact amygdalin has on the Alzheimer's beta amyloid peptide and in the near future we will examine its impact on neural cells.

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105 Morphological and Kinetic studies of the Alzheimer's B-amyloid, residues 22-35, uncovered the secondary structural transformation of soluble B-sheet intermediate species.

Sean Reinsalu, DePaul University
Field: Biochemistry Advisor: Sandra Chimon Peszek, Ph.D.

Synaptic malfunctions and neural death resulting from accumulations of misfolding amyloid proteins is characteristic of neurodegenerative diseases. The beta-amyloid peptide 1-40 and 1-42, associated with the cause of Alzheimer's disease, undergoes various transformation processes resulting in structural changes. Although, the cause of neurodegeneration in Alzheimer's is often attributed to toxic beta-sheet filaments, research conducted by Dr. Chimon Peszek found diffusible beta-sheet intermediates presenting toxicity comparable to fibrils. These highly unstable morphologies may play an important role in neurodegeneration. Moreover, they provide potential information about the irregular folding process and rate of fibril formation. Many studies contribute neurotoxicity to the "KLVFFA" region, from residues 16-21; however, we chose to concentrate on a shorter sequence, 22-35, in order to study the effect on fibril formation without "KLVFFA". Instead, our research focuses on the role of the hair-pin turn and the salt-bridge attraction between Asp-23 and Lsy-28 to the rate of beta-sheet formation.
Our research utilizes Attenuated Total Reflectance Infrared Spectroscopy (ATR-IR) to identify beta-sheet formation and the secondary conformations of beta-sheet intermediates. Ultraviolet Visible Spectroscopy (UV-Vis) and Transmission Electron Microscopy (TEM) also provided data on the kinetics and morphology of these intermediate forms.
ATR-IR, UV-Vis, and TEM of the beta-amyloid 22-35 confirmed the formation of toxic beta- sheets from within the hair-pin region of the peptide. Nuclear Magnetic Resonance Spectroscopy (NMR) may help to identify intermediate variants and the structural contribution of these soluble sub-fibrilar species to the rate of beta-sheet formation. Discovering more knowledge about the transition of soluble intermediates to insoluble beta- sheet fibrils will provide an important baseline for comparison to the various mutations of beta-amyloid 1-40. These new discoveries could significantly impact future therapeutic treatments.

106 CO2 Concentrations through the Troposphere

Kathleen Roberts, DePaul University Advisor: Mark Potosnak, Ph.D.
Field: Environmental Science/Atmospheric Science

This experiment focused on creating a vertical profile of carbon dioxide (CO2) concentrations through the troposphere using a high-altitude balloon flight. The flight was conducted out of Kankakee, IL on October 10, 2010 with a payload containing a CO2 analyzer. The payload travelled to a maximum altitude of 22746 meters. These data showed an increase in CO2 concentration as altitude increased. Three hypotheses are considered to explain the trend in the data. (1) These results show the impact of an urban center, in this case Chicago, IL, on CO2 levels because as altitude increases the surface area that would affect the concentrations becomes larger. (2) These data show an instrument bias due to the impact of pressure on the instrument and thus CO2 concentration measurements were not accurate. (3) Ground-level concentrations of CO2 reflect the surface of the Earth as a sink for CO2 at the time the flight was conducted and the higher altitudes represent a source of CO2 at the time the flight was conducted. Hypotheses (1) and (2) are eliminated as explanations, but further research needs to be conducted to determine if hypothesis (3) is the main factor reflecting the trends found.

107 Examination of the Inhibitory Chemical Ailanthone in Ailanthus altissima

Samantha Sasnow, DePaul University Advisor: Judith Bramble, Ph.D.
Field: Environmental Science/ Chemistry

Ailanthone is a known inhibitory chemical produced by Ailanthus altissima. The objective of this project was to show the inhibitory effects of ailanthone in Ailanthus leaves with biological and chemical assays; this required creating a method to assay plant material. A successful bioassay that used minimum plant material was created along with a corresponding chemical assay. Ailanthone was then tested for allelopathic properties with a density experiment measuring radish growth at varying densities with different soil treatments. The results show the growth of the radish plants in soil treated with ailanthone was most likely influenced by inhibitory chemicals.

108 Milk Thistle, can it be a preventative for Alzheimer's disease?

Jennifer Sepe, DePaul University Advisor: Sandra Chimon-Peszek, Ph.D.
Field: Neuroscience

Alzheimer's disease (AD) is characterized by the excessive production of amyloid protein and deposition in senile plaques, which are mainly composed of 40- and 42-mer amyloid b-proteins (Ab40 and Ab42). Ab42 has a more powerful aggregative ability and neurotoxicity than Ab40 and therefore is more responsible in the pathogenesis of AD. Silymarin, a mixture of flavonolignans extracted from the seeds, fruits, and leaves of Milk Thistle, has long been used for the treatment of hepatic disorders, most commonly for liver diseases. Many studies have investigated the inhibitory effects of various flavonoids on Ab aggregation and neurotoxicity. As a result, silymarin, being a mixture of flavonolignane diastereomers and having already been proven safe for human consumption, might be capable of having a preventative effect against the Ab-dependent phenotypes of AD.
To identify silymarin as a potential therapeutic agent for the treatment of Alzheimer's disease, various Attenuated Total Reflection Infrared Spectroscopy, ATR- IR, and Ultraviolet Visible Spectroscopy, UV-Vis, assays will be developed to identify and rank whether or not the mixture of flavonolignane diastereomers could inhibit aggregation of Ab. To carry out this test, Ab will be incubated with the test compound silymarin at a controlled temperature for a set amount of hours followed by ultrafiltration in order to separate the monomeric Ab from its aggregates. Aliquots of the ultrafiltrate will be analyzed for monomeric Ab.

109 **Determination of Oxygen Pathways in R-State Hemoglobin Bound to 2,3- Bisphosphoglycerate**

Shaan Setia and Shreya Kora, Loyola University Chicago Advisor: Kenneth Olsen, Ph.D.
Field: Biochemistry

2,3- Bisphosphoglycerate (BPG) is an allosteric effector of human hemoglobin. Presence of will BPG will decrease hemoglobin's affinity to oxygen. This is because BPG is highly anionic and it tends to bind into a specific site in deoxygenated hemoglobin that is highly cationic. Strong binding of BPG to this site will stabilize the deoxygenated form of hemoglobin (T-state). Our research investigates the interaction between BPG and hemoglobin and refutes claims that BPG does not bind to R-state hemoglobin. We have already investigated the interaction energies between different states of hemoglobin and BPG using computer-simulated programs such as NAMD and VMD. As expected, the interaction energies between BPG and hemoglobin were much higher in the T-state conformer. This is further evidence proving that BPG does not disassociate with R-State hemoglobin but merely weakens its interactions. Additionally, our research determined the effect of BPG on oxygen binding pathways of human hemoglobin. During simulations, oxygen was able to find its way into the binding pockets of R-state hemoglobin within 10 nanoseconds which contrasted T-state simulations. These results show that the presence of BPG in different conformers effectively changed the entry and exit pathways of oxygen.

110 **Fruit Fly Hemolymph Amino Acid and Protein Study by CE and MS.**

David Smith, University of Illinois at Chicago Advisor: Scott A. Shippy, Ph.D.
Field: Analytical Chemistry

The fruit fly, Drosophila melanogaster, is a useful transgenic model because over evolutionary time the fruit fly has maintained many genes expressed in Homo sapiens. As a result, they can be studied and used as a model for advanced physiological systems. One particular chemical of interest is the amino acid and neurotransmitter glutamate. It has implications in the circadian rhythm which is the innate sleep-wake cycle animals experience. So to disturb the sleep-wake cycle of the animal would cause a change in the levels of glutamate. Two studies were done using single fruit fly sampling, which employed a method of using a capillary probe to take nanoliter samples of hemolymph from the abdomen of the fruit fly. For the first study fruit flies were raised in all darkness and at constant temperature. Samples were collected at "daytime" and "nighttime" corresponding to the light cycle. The samples were diluted and fluorescamine added to fluorescently tag amino acids. Then the concentration of glutamate was determined from samples by capillary electrophoresis. In a second study collected nanoliter volumes of hemolymph were digested and run through a chip cube-nanoESI-LTQ-FTMS instrument to scan for protein content. In the first study the concentration of glutamate was significantly higher during the day cycle than the night. Thus, they maintain their circadian rhythm independent of their environment. In the second study, proteins involved in transport, for neurological implications, and for clotting were observed with high sequence coverage. This demonstrates the ability to perform proteomic analyses of hemolymph from a single fruit fly.

111 **Site Directed Mutagenesis of ADP Glucose Pyrophosphorylase**

Milot Thaqi, Loyola University Chicago Advisor: Miguel Ballicora, Ph.D.
Field: Protein Biochemistry

ADP-glucose pyrophosphorylase (ADP-Glc PPase) is the enzyme responsible for the regulation of bacterial glycogen synthesis. The precise role that glycogen may play in bacterial is still not clear; however, it was suggested that the accumulation of glycogen by bacteria may give advantages during starvation periods, providing a stored source of energy and carbon surplus. ADP-Glc PPase has been found to be positively and negatively regulated by key metabolites and intermediates, of low metabolic energy levels, respectively. To determine the allosteric regulation of the Escherichia coli ADP-Glc PPase, we performed site-directed mutagenesis on key residues determined from the crystal structure of the protein. This research has major implication in the production of starch in potato tubers and other plants.

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112 **Progress Towards the Total Synthesis of Maoecrystal Z**

Liuchuan Tong, Northwestern University Advisor: Regan J. Thomson, Ph.D.
Field: Organic Chemistry

Historically, many natural products, like Taxol, Penicillin, Morphine, etc, have proven to show anti-cancer, anti-bacterial activities and greatly improved the human health condition. Maoecrystal Z, a natural product recently isolated, showed anti-cancer activity towards several cell lines such as K562 (leukemia), MCF7 (breast), and A2780 (ovarian) cell. Despite the enormous potential use of this molecule, the limited amount available from the natural source severely restricts further investigation. At best, 1.1 kg of dried, powdered Isodon eriocalyx leaves yield only 8 mg of Maoecrystal Z (0.00073% by mass). The inefficiency of natural acquisition demands an innovative synthetic method to produce this molecule and the designing a scalable synthesis is difficult because of its strained carbocyclic core and its 7 stereogenic centers. The short term goal of this research is to develop a concise, efficient total synthesis of maoecrystal Z and the strategy should be applicable to its structurally related diterpenes such as macrocalyxoformin E. Here, we report a convergent, enantioselective synthesis route to the common precursor of both maoecrystal Z and macrocalyxoformin E, employing a Nozaki-Hiyama-Kishi coupling reaction followed by Nazarov cyclization as key stereogenic and ring forming steps.

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113 **Lewis Base-Promoted Carbon sp3–sp3 Coupling Reactions of Silyl Silylethers**

Kolby White, Northwestern University Advisor: Karl A. Scheidt, Ph.D.
Field: Organic Chemistry

Fluoride ions are used as Lewis Bases for the generation of reactive benzyl and alkyl anions. These anions are subjected to a variety of electrophiles furnishing secondary alcohols in good to excellent yields. The reaction proceeds through a deprotection-1,2-Brook rearrangement of the corresponding bis-silylcarbinols. This reactivity represents an umpolung approach to the generation of secondary alcohols and alleviates the need for harsh alkyllithium or Grignard reagents.

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114 **Method optimization for non-equilibrium solid phase microextraction sampling of HAPs for GC/MS analysis**

Maria Zawadowicz, Lake Forest College Advisor: Lori A. Del Negro, Ph.D.
Field: Analytical chemistry

Hazardous air pollutants (HAPs) are usually present in the atmosphere at the pptv-level, requiring measurements with high sensitivity and minimal contamination. Commonly used evacuated canister methods require an overhead in space, money and time that often is prohibitive to primarily-undergraduate institutions. This study optimized an analytical method based on solid-phase microextraction (SPME) of ambient gaseous matrix, which is a cost-effective technique of selective VOC extraction. Several approaches to SPME extraction and sample analysis were characterized

and several extraction parameters optimized. Extraction time, temperature and laminar airflow velocity around the fiber were optimized to give highest signal and efficiency. Direct, dynamic extraction of benzene from a moving air stream produced better precision (±10%) than sampling of stagnant air collected in a polymeric bag (±24%). Using a low-polarity chromatographic column in place of a standard nonpolar (5%-Phenyl)-methylpolysiloxane phase decreased the benzene detection limit from 2 ppbv to 100 pptv. The developed method is simple and fast, requiring 15-20 minutes per extraction and analysis.

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115 **Analysis of the Beta-Sheet Aggregation Rates and Mechanics of the Italian Mutant (E22K) Using Attentuated Total Reflectance Infrared Spectroscopy and Ultraviolet Visible Spectroscopy Instrumentation**

Sarah Zawadski, DePaul University
Field: Biochemistry/Neurology Advisor: Sandra Chimon-Peszek, Ph.D.

Neurodegenerative disorders such as Alzheimer's disease (AD) are perpetuated by the neurotoxicity created by amyloid formation and protein misfolding. The accumulation of amyloid plaque demonstrated in AD-afflicted brains is caused by the neurotoxicity of beta-amyloid fibril aggregation. The intermediates that form during these aggregations have resulted in the impaired synaptic function of neurons, particularly in the hippocampus region, resulting in cognitive dysfunction. Our research focused on the identification of secondary structures, primarily beta-sheets, and their rate of formation in the 1-40 and 1-42 peptides. Previous studies of the Italian mutant (E22K), a single-point mutation that substitutes glutamic acid with lysine at codon 22, reveal that the peptide is similar to the Wild Type peptide (beta-amyloid 23-35) in structure and kinetics. Using Attentuated Total Reflectance Infrared Spectroscopy (ATR-IR) and Ultraviolet Visible Spectroscopy (UV-Vis), we monitored the peptides' structural changes from random coil to beta-sheet. Because the nature of the Congo Red dye used in the UV-Vis trials relies upon pentimirical binding to the aggregated fibrils, we confirmed that the secondary structures present in the peptide are beta-sheets and have been able to monitor their accumulation to determine their peak hours of fibrillization. Our methods for fibril formation in the WT (beta-amyloid 22-35) and Italian mutant (E22K) have enabled our work to focus on amyloid plaque using a highly effective yet rarely used technical approach. Our findings on both the WT and Italian fragments' beta-sheet aggregation rates offer reference points for various single-point mutations of the peptide. Similarly, the UV-Vis results show the importance of analyzing the soluble species intermediates that arise prior to beta-sheet formation, as these intermediates' high levels of neurotoxicity directly impact neurodegeneration.

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116 **Mutagenesis of Catalytic Residues in Escherichia coli ADP-glucose pyrophosphorylase**

Madison Zuverink, Loyola University Chicago Advisor: Miguel Ballicora, Ph.D.
Field: Biochemistry

ADP-glucose pyrophosphorylase, an enzyme present as a homotetramer in Escherichia coli, plays a vital regulatory role within the metabolic pathway of glycogen synthesis. Previous investigations into the evolutionary divergence of this enzyme's role in plants have shown that the Lys42 residue present in the binding domain is important in order for the enzyme to function properly. Therefore, the creation of mutations by site-directed mutagenesis can lead to understanding of which characteristics make this residue integral to the process of catalyzing reactions. By comparison of the pETECK42A mutant's kinetics with the wildtype enzyme, we can begin to characterize this enzyme further.
Malachite Green assays provide a direct means of measuring the specific activity of our enzymes by taking a product of the reaction pyrophosphate, cleaving it into single phosphates, and using a spectrophotometer to make an absorbance reading. By creating curves with the enzyme's

substrates adenosine triphosphate and glucose 1-phosphate, as well as effector molecules such as magnesium and fructose 1,6 bisphosphate, we can confirm conditions necessary for optimum catalysis and compare the magnitude of difference in specific activities.
The creation of mutants in protein engineering is nothing new but it reveals important differences within the functionality of an enzyme. By analyzing the data obtained, it can be shown which residues increase or inhibit this metabolic pathway. This will shed light on the evolutionary distinctions between various ADP-Glc Ppases and may prove important when working with plants to alter starch production and produce more calorie-rich foods in order to meet an ever-demanding world population.

Engineering

117 Treating Lower Respiratory Infections in Developing Countries with Mechanically-Powered Nebulizers

Aimee Bobko, Amber Langston, Alexandra Rybczynska, and Amanda Vicich
University of Illinois at Chicago Advisor: John Hetling, Ph.D.
Field: Bioengineering

Nebulizers are important for the treatment of respiratory diseases, primarily lower respiratory infections. Since lower respiratory infections are the second leading cause of death in low income countries, the availability of these devices in third world countries is crucial. Barriers that hinder the distribution include economic, technological, and geographical factors. The initiative for this proposal is the improvement of the accessibility, appropriateness, and affordability of a nebulizer device within developing nations. The nebulizers on the market are too costly for low-income nations obstructing patients from treatment. Nebulizers are powered by a constant supply of electricity during use. This is unlikely due to the unavailability and/or unreliability of electricity in many underdeveloped countries. Battery-powered nebulizers are too expensive to consider as an option. To create an efficient yet accessible nebulizer, the device must be able to function without electrical power, be durable in various climates, and have minimum manufacturing costs. It must meet the target performance requirements of a constant air flow rate of 5 L/min. This is the average flow rate necessary for the vaporization of the medicine. The design is composed of four parts: a bike pump, a hollow polycarbonate container, a connector cap, and the mouth piece unit. The bike pump and container replace the electric air compressor, eliminating the need for a power source. This nebulizer can then be powered mechanically.

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118 Synthesis of multilayered alginate microcapsules for the sustained release of fibroblast growth factor-1

Omaditya Khanna, Illinois Institute of Technology Advisor: Eric M. Brey, Ph.D.
Field: Biomedical Engineering

Alginate microcapsules coated with a permselective poly-L-ornithine (PLO) membrane have been investigated for the encapsulation and transplantation of islets as a treatment for type 1 diabetes. The therapeutic potential of this approach could be improved through local stimulation of microvascular networks in order to meet mass transport demands of the encapsulated cells. Fibroblast growth factor-1 (FGF-1) is a potent angiogenic factor with optimal effect occurring when it is delivered in a sustained manner.

Our lab has developed a novel technique is described for the generation of multilayered alginate microcapsules with an outer alginate layer that can be used for the delivery of FGF-1, while islets can be contained in the inner core. The local release of FGF-1 would serve to stimulate blood vessel formation directly towards the islets, thereby providing the cells with essential nutrients (O2, glucose etc.) required for survival. The long-term functionality of transplanted islets would obviate the need for type 1 diabetics to frequently dose themselves with exogenous insulin.

The influence of alginate concentration and composition on outer layer size and stability, protein encapsulation efficiency, and release kinetics was investigated. The technique results in a stable outer layer of alginate with a mean thickness between 113-164 μm, distinctly large enough for FGF-1 protein encapsulation. The outer layer was able to encapsulate and release FGF-1 for up to thirty days, with 1.25% of high G alginate displaying the most sustained release. The released FGF-1 retained its biologic activity in the presence of heparin, and the addition of the outer layer did not alter the permselectivity of the PLO coat.

Moreover, studies performed in vivo using a rat model resulted in a greater vessel density ($p<0.05$; n=5) for animals treated with FGF-1 release using the microcapsules (198.8+/-59.2vessels/mm2), compared to the control group (128.9+/-10.9) after 2 weeks of implantation.

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119 **Biomaterials: Therapeutic Micro/Nano Devices for Tissue Engineering and Drug Delivery**

Sun Kim, University of Chicago Advisor: Debanjan Sarker, Ph.D.
Field: Nanotechnology

Biomaterials engineering is a novel technique, which has the potential to heal chronic wounds, deliver medicine, and create organs through the use of micro devices, nanoparticles, and stem-cell engineering. In this study, we seek to fabricate biodegradable scaffolds through the techniques of nano-patterning and nano-structuring that allow human cells to migrate, proliferate, and secrete the extra-cellular matrix components required to create tissue. Additionally, we devised a drug delivery system that can selectively deliver nano-medicine to achieve a therapeutic effect in vivo. Through the techniques of micro patterning and micro structuring, we developed a PGSA scaffold with micro pillars to direct the organization of the extra-cellular matrix. Furthermore, we engineered a polybutadien substrate to mimic the extra-cellular matrix by varying the thickness, and thereby using stem-cell differentiation. In addition, we constructed a PGLA nano device drug delivery system to optimize drug delivery and drug release rate to treat more infectious diseases and cancer. Together, we propose that these biomaterials have many applications ranging from tissue engineering, drug delivery, and cancer therapy.

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120 **Boronic Acid Functionalized Gold Nanoparticles for Determining Protein Glycation**

Daniel Kim, Illinois Institute of Technology Advisor: Victor Perez-Luna, Ph.D.
Field: Biosensors

The Diabetes Control and Complications Trial (DCCT), a landmark study on the long term complications of diabetes, showed that tight control over blood glucose levels decreased the long term complications associated with this disease. Because of this, determining the effectiveness of controlling blood glucose levels over the long term is important in diabetes management. Determination of hemoglobin glycation is often used to determine long term control over blood glucose levels. Protein glycation has also been associated with complications of diabetes and aging. Because of this, the present work focus on developing probes to determine advanced glycation end products (AGEs), specifically glycated proteins. For this purpose, gold nanoparticles bearing boronic acid groups are created such that they can be used to differentiate between different extents of protein glycation in aggregation based assays. The boronic functionalized nanoparticles can be employed to cause aggregation that is mediated by glycated proteins such that this aggregation can be related to the extent of protein glycation. These novel nanomaterials could make possible the facile and fast determination of protein glycation. This research was funded by the NSF.

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121 **Investigation of the degradation rate of porous PEG-PLLA-DA copolymer for tissue engineering applications**

Sevi Kocagoz, Illinois Institute of Technology Advisor: Eric Brey, Ph.D.
Field: Biomaterials/Tissue Engineering

Poly(ethylene glycol) (PEG) is a hydrophilic and biocompatible polymer that is readily cleared by the body. It is a polymer that has been widely investigated for biomedical applications. PEG becomes photopolymerizable by replacing the end-capped hydroxyl groups with acrylate and forming

PEG-DA. Hydrogels formed by the photoinitiated cross-linking of PEG-DA are versatile and can be customized by modifying chain length and adding degradable linkages. Poly(L-lactide) (PLLA) is a hydrophobic and biodegradable polymer that has been studied extensively for biomaterial applications and introducing units of PLLA into acrylated PEG-PLLA creates a copolymer that is degradable under physiological conditions. In this study porous PEG-PLLA copolymer hydrogel has been investigated in degradation studies and mechanical testing. Gels of concentrations 12.5%, 25% and 50% with same size porosity and 25% gels with varying size porosity are prepared. Porosity is obtained by a salt-leaching method. The gels are made porous to improve cell migration, tissue invasion, molecular transport and cell adhesion by introducing increased surface area. Such cell behavior is important for tissue engineering applications for good cell adhesion and proliferation. After the synthesis of the porous hydrogels their degradation rate in vitro has been quantified by confocal microscopy and mechanical properties using compression testing. Variations in degradation rate according to the different gel concentrations have been recorded.

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122 **Modeling Systems based on Marching Cubes Algorithm**

Jiang Lan, Illinois Institute of Technology Advisor: Gady Agam, Ph.D.
Field: Computer Graphics

The traditional modeling systems based on surface representations require a complex mechanism for enabling topological changes. Furthermore, it is hard to provide physical features such as interaction with constant volume deformation in real-time. This research focuses on modeling system in volumetric representations. It permits easy modeling of topological change. It is defined by scalar field, which describes the shape of clay by voxel data (grid). The surface of clay is implemented in an isosurface of this filed data.

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123 **Glutaraldehyde (GA)-induced Crosslinking of Tissue-Derived Extracellular Matrix (ECM) Hydrogels**

Sophia Pilipchuk, Illinois Institute of Technology Advisor: Eric Brey, Ph.D.
Field: Cell and Tissue Engineering

Hydrogels have been investigated extensively as biomaterials for three-dimensional tissue reconstruction and regeneration. It is difficult, however, to incorporate tissue-specific features into synthetic materials. Our lab previously developed a novel method for generating extracellular matrix (ECM)-rich, tissue-derived hydrogels from soft tissues. These natural materials have composition and structure specific to the ECM source and are able to induce cell differentiation and vascularized tissue formation in vivo. However, low stiffness and rapid degradation in vivo hinder their potential clinical application. Crosslinking of these materials could improve mechanical properties, delay degradation, and prolong in vivo lifetime. The present study investigates the effect of glutaraldehyde (GA) as a crosslinking agent to increase resistance to degradation and improve mechanical properties of tissue-derived hydrogels. Dermis samples were harvested from rats and the ECM extracted based on a previously published protocol. Extracts were assembled into hydrogels through pH-induced gelation, and hydrogels were crosslinked with GA in intervals of 0.5hr, 1hr, 12hrs, and 24hrs. Compression testing results indicate significant increase in elastic modulus and yield stress with increasing GA exposure time ($p<0.05$), corresponding to an increase in durability under mechanical stress. Crosslinked hydrogels showed resistance to pepsin-based degradation compared to non-crosslinked gels. Cytotoxicity assay (MTS) data also indicated a significant increase in cellviability with post-crosslinking washes in PBS to reduce toxicity of residual GA ($p<0.05$). Preliminary results with fibroblast seeding suggest that crosslinked gels support cell adhesion. These results indicate the potential of dermal gels to obtain a more mechanically durable structure through GA-induced crosslinking while retaining the unique biological properties of tissue-derived hydrogels.

Abstracts - Engineering

124 Optimal integration of top-down and bottom-up uncertainty in humans, monkeys, and neural networks

Ahmad Qamar, University of Chicago Advisor: Wei Ji Ma, Ph.D.
Field: Computational Neuroscience

Hearing the sound of rustling leaves in the forest might indicate the presence of a predator or just be the effect of the wind. There are two difficulties in determining the source of the sound. First, both sources can cause similar sounds, and second, the sound is corrupted by sensory noise. In this common decision paradigm, uncertainty associated with previous knowledge (top-down uncertainty) is combined with uncertainty associated with sensory information from the environment (bottom-up uncertainty). The capability of the brain to make decisions under both types of uncertainty is key for survival. We studied this kind of decision-making in both humans and macaque monkeys using an orientation classification task. Stimuli were oriented patterns whose orientations were drawn from either a narrow or a wide normal distribution, with the same means. Each distribution defined a class. Top-down uncertainty stemmed from the overlap of the two distributions. Bottom-up uncertainty was manipulated through the contrast of the stimulus. The Bayes-optimal observer in this task chooses, on each trial, the class with the highest posterior probability. Computing the posterior is nontrivial because marginalization over stimulus orientation is required. The optimal strategy amounts to using a decision criterion that varies according to the trial-by-trial bottom-up uncertainty. Bayesian model comparison revealed that this model describes human and monkey data better than models with non-optimal criteria. Our next goal was to construct a neural network that behaves like the optimal observer under biologically plausible forms of neural variability. Within the framework of Poisson-like population codes, we trained neural networks with different types of operations to approximate the optimal posterior over class. A network with linear, quadratic and divisive normalization operations was sufficient to perform well. Our results demonstrate that humans, monkeys, and neural networks can optimally integrate top-down and bottom-up uncertainty.

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125 Biomechanical Remodeling During Stem Cell Differentiation

Sumaira Yahya and Amit Paul, University of Illinois at Chicago Advisor: Michael Cho, Ph.D.
Field: Computational Modeling

Cellular mechanics plays a crucial role in the fundamental cellular functions such as adhesion and migration, proliferation, and differentiation. Recent evidence suggests that stem cell differentiation could be regulated by modulation of the cell's biomechanics. The cytoskeletal structures and arrangements in the mesenchymal stem cells (MSCs) undergoing differentiation are dramatically altered, and that such altered mechanics is lineage-dependent. As a specific example, during adipogenic differentiation of human MSCs, the actin stress fibers are reorganized rapidly to support the round cell morphology of adipocytes, resulting in a lower Young's moduli. The complexity of events associated with transformation of these precursor cells leaves many questions unanswered about morphological, structural, proteomic, and functional changes in differentiating stem cells. A thorough understanding of stem cells' behavior, both experimentally and computationally, would allow development of more effective approaches to expansion of stem cells in vitro and regulation of their commitment to a specific phenotype. We have therefore investigated the lineage-dependent mechanical changes in stem cells using quantitative fluorescence microscopy, atomic force microscopy (AFM), and laser optical tweezers (LOT). With the abundance of quantitative experimental data, we also developed a sophisticated model utilizing the computational cellular modeling software Virtual Cell (VCell) that can predict critical changes in the stem cells and simulate experimental results.

Physics

126 The LHC is cool, but what comes next?

Summer Blot, University of Chicago
Advisor: Young Kee Kim, Ph.D.
Field: Particle Physics

The LHC experiment is undoubtedly an amazing accomplishment for scientists and non-scientists alike. The publicity that CERN has received due to black hole rumors and the search for the Higgs boson have put accelerator and particle physics in the public spotlight, and almost anyone you ask knows that there is "some really big experiment in Switzerland that might blow up the planet". But what most people don't know is what comes next. Physics doesn't end if or when we find the Higgs, and we need to develop new tools and ways of understanding if we are to continue to probe into the mysteries of the universe. Some of the ideas on the table at the moment are the Neutrino Factory and Muon Collider, and there is now a worldwide effort in research and development for new techniques that can be implemented in order to construct these future accelerators. The international Muon Ionization and Cooling Experiment (MICE) is working to demonstrate one such technique called ionization cooling, which is the first crucial step towards building either a Neutrino Factory or Muon Collider. This poster presents the motivation behind building these accelerators, the theory behind ionization cooling, and how MICE will actually demonstrate it in practice. In addition, the MICE
experiment took data over the summer of 2010, and I will show the results of a data quality study that confirms both the stability and purity of the MICE muon beamline.

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127 Dry Friction Tribology: Science or Art?

Candice Choo-Kang, B Payan, Q. Ascenzo, P. Patel, Loyola University Chicago
Field: Tribiology
Advisor: Aleksandr Goltsiker, Ph.D.

Several centuries after the first insights of Leonardo daVinci regarding the behavior of sliding blocks, Amonton reported his experimental results on the dry friction force, which he found to be both independent of interaction and contact area and proportional to normal force, in the late 17th century. These two laws were checked and proven almost a century later by Coulomb, who complemented them with a third law regarding the difference between static and kinetic friction coefficients (the latter usually smaller than the former and independent of speed).The status of the third law, in spite of its popularity in mass educational and scientific literature, is questionable due to the lack of reliable experiments concerning kinetic friction coefficients and of acceptable theories (most of which refer to some "adhesion") explaining the difference in static and kinetic dry friction. In addition, almost every physics textbook provides unique-and uncited- values for the coefficients of friction between any two given materials. Especially notable in all micro- and macroscopic explanations involving "adhesion" is the elimination of time (i.e. how long a body should be at rest to provide the higher value of the coefficient of static friction).We have designed two sets of experiments regarding dry friction. First, a traditional one, involves the use of a simple tribometer, with a plane or inclined surface, and the measurement of the coefficient of static friction with load and tension measured by a dynamometer; as well as the effects on kinetic friction of uniform and accelerated sliding. Second, an experiment never before practiced to our knowledge, involves repetitious movement in both a uniform and accelerated manner, delaying the object in rest for different lengths of time in order to find out whether the difference between static and kinetic coefficients will be reproducible and dependent on time of contact.

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128 Simulation and Modeling of the Anode of the Proposed Large-Area Picosecond Photo-Detector

Zhongtian Dai and Guilherme Nettsheim, University of Chicago Advisor: Henry Frisch, Ph.D.
Field: Instrumentation

Large-Area Picosecond Photo-Detector is a working collaboration between The University of Chicago, Argonne and Fermilab. We have worked on simulating the geometry of the proposed anode structure with HFSS and we compared it with the measurement of impedance over a range of frequencies. The simulation result is consistent with the measurement. We also came up with several models to explore different features of some proposed designs and tried to determine factors that affects the generation of signals in the device. Our work is relevant to the overall project because signal integrity at high frequency is crucial for the detector to achieve the proposed precision.

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129 On the Origin of "Fermi Energy" Conception

Jeff Duggan, Loyola University Chicago Advisor: Aleksandr Goltsiker, Ph.D.
Field: Fermi Energy

Fermi energy is the cornerstone fundamental conception in solid state physics. Its development is traced from Fermi-Dirac statistics (1926) of electrons as particles obeying the Pauli Exclusion Principle; to an electron gas in metals by the conception of Sommerfeld (1928). The value was first calculated by Fermi and the name was coined by Wigner and Seitz (1934). At the time this idea was not considered to be consistent with the current understanding of metals and the early stages of quantum theory. After the discovery and identification of the electron in 1897 by J. J. Thompson et al; the classical theory of electron gas and metals which explained Weideman-Frantz Laws, but also generated unexpected impact of electron gas to solid state specific heat capacitance (Dulong-Petit Rule). To eliminate this inconsistency, and encouraged by discovery of low temperature and superconductivity, Willy Wien (Jan 1913) introduced the idea of non-thermal origin of the electrons energy. It was immediately and furiously attacked by Lorentz (1913-1925) and his influential followers as unacceptable heresy and as well as break apart the scientific community. World War I stagnated the problems solution with the exception of J. Frenkel's (1924-1925) efforts. At the Como Congress (1927), Sommerfeld reported on Quantum Statistical progress in the problem and also a full-scale paper in 1928 to which he gave tribute to W. Wien. But later, most authors in textbooks and in history of physics research, rarely referred to W. Wien's suggestion as a "bold speculation". After Fermi's death, in the memorial tribute article, F. Seitz noticed that with the exception of an exact calculation, all physical meaning and practical consequences of Fermi Energy level could be traced from W. Wein's original work.

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130 Bridging the Gap

David Haberkorn, Andre Bonifacio, and Stefanie Boxel, Loyola University Chicago
Field: Physics Advisor: Aleksandr Goltsiker, Ph.D.

Published in 1960, C. P. Snow's The Affair serves as an example of his proposition put forward in his 1959 lecture, The Two Cultures. C.P. Snow, in The Two Cultures, comments on the ever-growing gap between the scientific society and the humanities. The concept metastasized in his novel, The Affair, where the major conflict arises due to a lack of scientific literacy. The core of the narrative is scientific fraud in a neutron diffraction experiment. Misinterpretations of the physical analysis lead to complications within the academic society in Snow's novel. Although Snow's works refer primarily to academia, their message can be applied to current situations. Public debates around global warming, nuclear energy and budget constraints all create divides due to a lack of scientific literacy. The scientific community often becomes marginalized in these debates as politics becomes the primary focus. The mainstream beliefs about the scientific and quantitative communities are littered

with suspicion and distrust. However, the burden of communication lies not only with the public; scientists themselves have a responsibility to bridge the gap between the two cultures.

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131 **Continuum Simulations of Granular Systems with Varying Layer Depth**

Michael Hollowed, Loyola University Chicago Advisor: Jon Bougie, Ph.D.
Field: Granular Fluid Dynamics

When shaken sinusoidally, granular systems exhibit waves that form patterns such as stripes, squares, or hexagons. We explore the relationship between granular layer depth and pattern formation using three-dimensional time-dependent continuum simulations of these shaken systems. We characterize stripe patterns formed in granular layers by their wavelengths which exhibit an inverse relation with frequency. With varying layer depth, the wavelengths of patterns also vary for a given frequency, but when properly scaled yield a relationship independent of layer depth. We investigate the relationship between these patterns and shocks that are also formed in the layer to determine whether or not this relationship is similarly independent of layer depth. By conducting simulations of systems with different frequencies and layer depths, we generate data, which we graphically analyze to establish relationships between shocks, patterns, and layer depth.

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132 **A Study of the Local Group of Galaxies Using Virial Theorem**

Tyler Hopkins, Loyola University Chicago Advisor: John Dykla, Ph.D.
Field: Astrophysics

In this study, a general estimate on the amount of dark matter in our local group of galaxies was obtained. The gravitational potential energy and the kinetic energy of each galaxy in our system was determined and then applied to virial theorem. Virial theorem tells us whether or not a group of galaxies is gravitationally bound, and assuming our local group of galaxies is bound, estimates on the amount of dark matter that must exist in our galaxy to satisfy virial theorem can be obtained. The results of this study show that much more mass than we can see on the basis of galaxy luminosity must exist in our local group of galaxies to satisfy virial theorem. For future study, the data from this study along with galaxy morphology and rotation curves can be used to make accurate proper mass estimates for each galaxy in our local group of galaxies.

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133 **Harvesting energy from a moving magnet**

Ben Irvine and Matt Kemnetz, Loyola University Chicago Advisor: Asim Gangopadhyaya, Ph.D.
Field: Electricity and Magnetism

We propose to develop an analytical model for magnetic damping. Magnetic damping occurs when a magnet moves in proximity to a conductor. The changing magnetic field produces an electric field (by the Faraday effect), which generates currents in the conductor. These eddy currents can then produce a magnetic field that opposes the motion of the magnet. This phenomenon is utilized in the braking systems of hybrid cars, some trains and roller coasters. The major benefit of magnetic braking is that an object can be slowed down without losing energy to friction. The kinetic energy of an object is converted directly into electrical energy. In addition, the absence of frictional forces helps parts last longer. For these reasons, magnetic damping is fundamental to the development of future technology in regenerative braking. Magnetic braking is extensively used in industry, where they use computational methods to accurately model magnetic braking. Our improved analytical model will provide an excellent benchmark for computational models and will provide a model to compare with. A better understanding of magnetic braking could pave the way toward new innovations in regenerative braking.

134 Dynamics of Falling Chains

Unleen Kiverkis, Loyola University Chicago Advisor: Asim Gangopadhyaya, Ph.D.
Field: Mechanics

We are examining the dynamics of a falling chain, a classic textbook physics problem that has never been explained on the microscopic level. Traditionally the problem is presented one of two ways. The first being where one end of the chain is in a stationary fixed position and the other end is hanging suspended at a fixed length. The second presentation of the problem is where the chain is in a straight hanging position. The motion of the chain when released has previously been described as free falling, although studies have been conducted showing the chain is actually following conservation of energy laws. Our preliminary experiments confirm that the chain is conserving energy as it falls. The purpose of our project currently is to show how energy is conserved at the microscopic level. We will be working mathematically and experimentally to define the forces acting upon the masses in the chain and describe their motion.

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135 Collective Difusion in Circular and Straight Channels

Ekaterina Kosheleva and Elizabeth Denhup, University of Chicago
Field: Hyrodynamics Advisers: Stuart Rice, PhD; Binhua Lin, Ph.D.

We study the hydrodynamic interactions of colloidal particles confined to move in quasi-one-dimensional circular and straight channels. Digital video microscopy is used to track the motions of silica 1.57 μm spheres difusing in circular and 2mm long straight channels with a 3μm × 3μm square cross section. The collective diffusion coeffcient, defined as the number of particles in a channel times the diffusion coeffcient of the center of mass, is measured for both geometries on a time scale of 200 ms, so that direct particle interactions can be considered negligible. In both the case of a circular channel and a long straight channel, the collective diffusion coeffcient is found to be proportional to the mean linear density of the particles in the channel. This supports the recently proposed relation by Frydel and Diamant claiming that particles in a one-dimensional channel experience hydrodynamic correlations of unbounded range due to the propagation of longitudinal modes in the host liquid. Furthermore, it contrasts with the earlier hydrodynamic description of interaction between two particles in a quasi-one-dimensional system, which is exponentially screened on distances longer than the channel width, and thus implies that a dilute collection of particles in these systems diffuse in a basically uncorrelated way. Finally, by measuring collective diffusion of rings with radii between 3 and 35 μm, we demonstrate that on short time scales, the effect of ring curvature on the collective difusion of the particles is negligible.

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136 Patterns in Oscillating Non-Newtonian Fluids

Yogi Patel and Roxanne Able, Loyola University Chicago Advisor: Jon Bougie, Ph.D.
Field: Fluid Dynamics

Fluid layers, when vertically shaken, form Faraday waves which produce discrete patterns including square, stripe, and hexagon formations. Standard Newtonian fluids have a linear relation between stress and strain, characterized by the viscosity of the fluid. However, sheer thickening fluids increase in viscosity as stress is applied. Corn starch suspended in water acts as a shear thickening, non-Newtonian fluid. We add corn starch to water using Cesium Chloride to match density and prevent separation. This process allows us to vary concentrations of corn starch and Cesium Chloride in order to determine how the properties of the mixture change from fluid to solid while shaken. Our shaker unit is composed of a subwoofer that sinusoidally oscillates a glass container that in the past has held bronze beads. We hope to observe how concentration variations effect phase transitions between Faraday waves and other effects seen in non-Newtonian fluids.

137 Time Dependence of Density Inversion in Granular Layers

Veronica Policht, Loyola University Chicago Advisor: Jon Bougie, Ph.D.
Field: Fluid Dynamics

Granular hydrodynamics studies the flow, movement, and general behavior of grains, i.e. collections of roughly spherical macroscopic particles. The focus of my research has been the nature of density inversion: density inversion is observed when a very low density layer of grains is close to the plate of oscillation with a high density layer of grains above it. Where density inversion occurs, the energy imparted to the grains by the plate's motion can initiate something analogous to a phase-change with the bottom level behaving as a gas and the upper level behaving like a liquid and, in special cases, a solid. To model density inversion, I use a continuum simulation for three-dimensional, time-dependent forms of hydrodynamic conservation equations. I have computationally tested different frequencies and amplitudes of shaking in an attempt to identify a set of ideal circumstances for density inversion. These simulations have shown that the time-dependence of the density inversion is related to its shaking frequency. In our work, we have discovered that although density inversion does not occur as a steady state for lower shaking frequencies, it does occur in a periodic state.

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138 Close packing of spheres in colloidal suspensions

Tom Rudolf and Andrew Wong, University of Chicago Advisor: Binhua Lin, Ph.D.
Field: Colloidal sphere packing

The transition from well-ordered crystalline phases to glassy phases in colloidal suspensions of silicon spheres is analyzed as a function of the ratio of two differently sized particle diameters. Pair correlation functions and packing fractions for each of the sphere ratios are measured and used as quantitative indicators of crystalline or glassy states. It is found that as the ratio of larger spheres to smaller spheres is increased, the packing fraction of the system decreased, along with its long range order, as is indicated by the pair correlation functions. These results are in agreement with what was expected based on previous research in other systems with close sphere packing.

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139 Wall-effects of colloidal materials in confined geometries

Emily Wonder, University of Chicago Advisor: Binhua Lin, Ph.D.
Field: Soft Matter Physics

The study of colloidal particles confined in channels is important in the modeling of other systems, including vascular tissue in biological systems. It has previously been noted that walls in quasi-two-dimensional systems create stratification in the transverse distribution of particles, resulting in a density variance across the channel. By studying the variation of diffusion along different strata, we can see a correlation between density and motion within a single channel system. For this experiment, we use a colloidal solution of silica spheres (diameter = 1.58 μm), suspended in water. This solution is placed on a polymer mold, consisting of channels with widths between 8 and 20 μm. We found significant variation in self-diffusion along different strata, with higher density strata near the wall having the lowest diffusion coefficients. In the process of stratification, walls create what are essentially a series of quasi-one-dimensional channels with different densities and correspondingly different rates of diffusion.

140 Dose Escalation in Image-Guided Radiation Therapy (IGRT) of Lung Cancer Patients

Morgan Woosley, Loyola University Chicago Advisor: Anil Sethi, Ph.D.
Field: Medical Physics

Radiation therapy for patients with lung cancer may be compromised due to respiratory motion. When tumor motion is not accounted for, parts of the target are severely under dosed. Thus, lung tumors have been often treated with large target margins. This unfortunately leads to unnecessary irradiation of surrounding lung and limits target dose escalation. To reduce the effect of respiratory motion, different approaches (gating, breath hold, etc.) have been employed with limited success. We plan to evaluate a simple non-invasive method of determining tumor motion and developing intensity modulated radiation therapy (IMRT) plans that significantly reduce dose to critical structures. Using a new 16-slice CT scanner recently installed in Loyola Radiation Oncology department, maximum intensity projection (MIP) scans will be obtained. Tumor occupancy probability (TOP) information will be derived from these scans. Subsequently, IMRT plans will be optimized based on TOP: regions of target with 100% TOP will receive full dose but for the rest of target dose will be modulated according to TOP. Furthermore, image guidance (IGRT) will be used to obtain information on target motion and limit patient setup errors. The results will be compared to conventional treatment plans based on dose indices, such as, target D95, and critical structures D5, D30, Dmean, where, Dx represents dose received by x% of organ volume.

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141 Determination of Dialational and Shear modulus of metal nanoparticle monolayers

Siheng You and Minke Zhang, University of Chicago Advisor: Binhua Lin, Ph.D.
Field: Physics of Nanoparticle Monolayers

Metal nanoparticles ligated with organic compounds are found to self assemble into monolayers when spread over an air-water interface. When these monolayers undergo uniaxial compression, features including folding and out of plane bending occur. In macroscopic materials, such phenomenal can be characterized by the elastic moduli of the materials. These monolayers are of interest as models for thin films in biological systems, such as cell membranes or lung surfactant. This project focuses on determining the dilational and shear moduli of these nanoparticle monolayers. Monolayers of 15nm iron oxide nanoparticles ligated with oleic acid were subjected to linear compressions on a Langmuir trough and the surface pressure response of the film was measured in both perpendicular and parallel axes using Wilhelmy plates. From these measurements, the moduli were extracted, using methods developed from earlier work done by J.T. Petrov (Langmuir 16 (2000) 3703-3711) on Langmuir monolayers. With these elastic moduli, the bending rigidity of the nanoparticle film can be calculated, and used to predict the out of plane bending of the nanoparticle monolayers.

Mathematics

142 The Influence of Systems and Processes on Cold-Ischemic Time in Liver Transplantation

Brendan Lovasik, Northwestern University Advisor: Daniela Ladner, PhD
Field: Organ Transplant Outcomes Modeling

Background: Systems and processes of care are essential to coordination of procurement and liver transplantation. They influence the length of cold ischemic time (CIT) and hence liver transplant (LT) recipient outcomes. Aim: The aim is to examine the correlation between the time of liver procurement and CIT. We hypothesized that systems and processes of care at certain times of the day were apt to achieve shorter CIT. Methods: UNOS data was used to identify 9,027 adult recipients of a primary deceased-donor LT between 1/06-12/08. Recipients were stratified into 24 groups based on procurement (crossclamping) time. Adjusted multivariate analysis was conducted. The primary outcome was CIT. Secondary outcomes were graft- and patient-survival at 1, 3, and 5 years measured using Kaplan-Meier survival analysis and log-rank tests. $P<0.05$ was considered significant. Results: Mean CIT for the population was 6.8 hrs. The longest mean CIT occurred for procurements conducted at a 0200h, while the shortest mean CIT occurred for procurements conducted at 1500h ($p=0.001$). This was consistent across all UNOS regions. No significant difference in patient characteristics was identified between the 24 time groups. The highest volume of procurements occurred at 0600h, while the highest number of transplant procedures occurred at 0900h. The LT recipients of organs procured at1500h demonstrated higher 1, 3, and 5 -year survival rate for both grafts (88% vs. 85%, 78% vs. 74%, 74% vs. 67%) and patients (90% vs. 87%, 80% vs. 77%, 76% vs. 70%) compared to those procured at 0200h. Conclusion: Procurement time correlates with length of CIT, with longest CIT for LT start time coinciding with first morning elective cases, when resources are most scarce. Scheduling of procurements through hospital independent procurements might mitigate this issue and improve patient outcomes.

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143 Stability Analysis and the Role of Non-Self Adjointness

Anna Scott, University of Chicago Advisor: Gidon Eschel, Ph.D.
Field: Mathematics/Ecology

Stability analysis addresses the reaction of a non-linear dynamical system to an outside perturbation, that is, one not addressed by the original model. The system can have two broad classes of responses: the perturbation subsides and the system returns to its original trajectory, or the perturbation grows and the system follows a new trajectory. Traditional modal analysis only considers stability after the perturbation, in the $t- \infty$ limit. However appropriate for certain dynamical systems, for others, this time scale only allows the introduction of more perturbations, that is, ones not assumed by the $t - \infty$ analysis. Such perturbations can either push the system away from or drive it back towards its equilibrium. This project examines the stability of one non-linear dynamical system, and shows that for ecological systems, stability must be considered in both the short and long term, $t - 0$ and $t - \infty$, respectively.

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144 Modeling the natural history of human papillomavirus (HPV) among homosexual males

Bailey Steinworth, University of Chicago Advisor: Eva Strawbridge, Ph.D.
Field: Biological Sciences

The recently developed vaccines against several types of human papillomavirus (HPV) have been targeted at girls and young women with the aim of preventing cervical cancer. However, HPV infections also affect men, potentially causing anogenital cancers and cancers of the head and neck. One HPV vaccine, Gardasil, has been approved for use in males. In order to guide strategies for vaccination among males, we seek to model the natural history of HPV infection and HPV-caused cancers among homosexual males. Preliminary modeling of interaction between infected and uninfected individuals shows two equilibrium states, one HPV-free and one with endemic HPV infection. In this model, we find there exists a critical value for the rate of HPV transmission below which the HPV-free equilibrium state is stable. Above this critical infectivity rate, the endemic HPV equilibrium state is stable. The critical infectivity depends on the death rate for susceptible individuals, the rate of inflow into the susceptible population, the rate of recovery from HPV infection, and the rate of death for individuals infected with HPV. Our next step is to develop a model that includes cancerous and precancerous states.

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145 Modeling Asymmetry and Heavy-Tails of Financial Data

Wesley Wieczorek, DePaul University Advisor: Mohamed Amezziane, PhD
Field: Mathematics and Statistics

Financial data such as asset returns, exchange rates or option prices cannot be modeled effectively by the Gaussian and other commonly used distributions. These types of data have probability density functions that are heavy tailed and negatively skewed. To account for these features, we propose a class of distribution functions that can be generated by convolution of a smooth and a non-smooth characteristic functions where the smoothing parameter is used to control the thickness of the density tails. To illustrate the advantages of using such class of distributions, we consider special cases when the smooth characteristic functions are the sinc or Gaussian functions and the non-smooth are the double-exponential and the triangle function. As a comparison criterion between distributions, we use Stiltjes-Hamburger conditions for moments' existence and show how the proposed distributions outperform the Student and Pearson IV distributions, which are more commonly used by financial engineers to model stock returns.

Psychology and Social Sciences

146 Identity Construction in Online Self-Injury Forums: Dialogue Between Expert, Public, and Participant Opinion

Kimberly Beiting, University of Chicago Advisor: Eugene Raikhe, Ph.D.
Field: Comparative Human Development

Most researchers consider self-injurious behavior (SIB) to be a maladaptive coping mechanism for emotional pain and a means of establishing a sense of control in a time of uncertainty. There is only very preliminary research reviewing the growing phenomenon of online self-injury communities (Adler and Adler, 2008; Whitlock, Powers, and Eckenrode, 2006; Whitlock, Lader, and Conterio, 2007), and examinations of identity construction in online SIB communities are conspicuously absent. In this study, I use Ian Hacking's theories of "making up people" and the "looping effect" (2007) to investigate how the dialogue between mainstream opinion and those who self-injure influences the way self-injurers construct their identities. With mental health professionals currently regarding self-injury as maladaptive, it is important to understand how their opinions impact the individuals who are the subject of such investigation. This study uses quantitative linguistic analysis (Pennebaker, Booth, and Francis, 2007) and qualitative coding analysis to investigate the self-characterization of online SI community members as they interact with expert and public opinion. A study that focuses on practices of SI and identity formation in an online context is valuable to inform policy decisions concerning such online social spaces and to keep mental health treatment strategies up to date.

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147 Racialized Thought Patterns and Public Opinion on American Health Care Reform

Ren Belcher, University of Chicago Advisor: John Brehm, Ph.D.
Field: Political Science

The American health care reform initiatives of 2010 provide a unique opportunity to study the effects of racialized thought patterns on public opinion formation. Not only does this legislation promise to reduce dire discrepancies in health conditions between blacks and whites; it is also a major accomplishment of America's first black President. And while observational and experimental studies have already suggested that racial prejudice causes opposition to health care reform, we don't know much about the specifics of this relationship.
I employ a survey-embedded experiment to test the hypotheses that racialized thought patterns diminish support for health care reform among whites, and that "colorblind" racial attitudes are employed by opponents to legitimize this diminished support. Experimental results indicate that white subjects react more negatively to health care legislation when the policymaker proposing the plan is black. The magnitude of this effect is modest overall, but is very large among wealthier, politically moderate whites. At the same time, exposure to a black governor predicts increases in colorblind racial attitudes and racial resentment among white subjects. Finally, exposure to imagery of black beneficiaries of the plan predicts a decrease in reported support for President Obama among whites. These results provide preliminary evidence that public opinion on American health care reform is subject to racial attitudes, and that attitudes surrounding the race of the policymaker are especially salient.

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148 The Interplay between Science Knowledge, Socioeconomic Status, and Religiosity: A Regression Analysis

Alicia Bierstedt, University of Chicago
Advisor: Ellie Shockley, Ph.D.
Field: Science Education

Science literacy and knowledge are dismally low in the United States, with some estimates claiming that less than 30% of the population is scientifically literate. To be able to resolve this problem, we must first understand what factors affect basic scientific knowledge. Nationally representative survey data from the General Social Survey (GSS) were used as indicators of basic science knowledge, religiosity (religious service attendance), and socioeconomic status. Based on other research, we expected that higher scores on the socioeconomic index (SEI), a variable encompassing education, income, and occupational prestige, would result in higher science knowledge scores. We also expect that increased religiosity would result in lower science knowledge scores, due to the science denial that occurs in some religious sects. Regressing science knowledge on the main effects and interaction between socioeconomic status and religiosity against the science knowledge indication supports the expected trends, but also reveals unexpected nuances. The impact of religiosity was not eliminated by the impact of SEI, conflicting with the stereotype of the religious lower class and wealthy agnostic intellectual. If the stereotypes were accurate, one of the factors should have fallen out of significance in this model. Instead, both were strengthened compared to simple linear regression models. Religiosity and SEI did not interact significantly, meaning the impact of religiosity on science knowledge did not depend on the SEI level. The general trend of lower science knowledge with higher religiosity, and higher science knowledge with higher SEI, was also more nuanced than expected. Many individuals across the spectra of socioeconomic status and religiosity performed well, suggesting that there is much more to the story of who understands science than is initially apparent.

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149 Effects of Social Experience on Object Decisions

Lisa Blaskowski and Kendall Arslanian, The University of Michigan
Advisor: Stephanie Preston, Ph.D.
Field: Ecological Neurscience

Exclusion and inclusion from a social group have been shown to elicit powerful psychological and behavioral responses. Previous research has demonstrated that excluded individuals' object acquisition behavior varies greatly depending on their attachment style. Rejected individuals are believed to increase self-sufficiency as a result of uncertain status, as opposed to an increase in prosociality shown in non-rejected individuals. Effects of attachment style conditions on object choices following social rejection were examined in the context of a computerized object decision task containing two categories of items; survival and sexual. A within-subjects comparison was conducted measuring object acquisition behaviors in secure vs. avoidant attachment conditions. It was hypothesized that social rejection would increase the relative acquisition of survival items. Additionally, it was predicted that people with avoidant relationship styles will avoid others while those with secure attachment styles will attempt reintegration with the group. However, individuals with avoidant attachment who were socially excluded did not acquire more sexual signals than survival items. Moreover, avoidant and secure individuals exhibited an overall increase in confrontation following social rejection. These findings could suggest that individuals who are socially excluded will acquire more items overall, constituting an adaptive response to an unstable environment.

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150 Quantitative Analysis of Microlending Organizations in Haiti

Nathan Bucklin, DePaul University Advisor: Taryn Roch, M.A.
Field: Microcredit

Haiti has one of the lowest per capita GDP's in the world as well as one of the highest rates of employment. It is often difficult for citizens to access loans through traditional means given their lack of collateral. Microfinancing provide access to loans that would otherwise be unavailable through traditional banks. For example, in 2008 the average traditional loan in Haiti was $12,040, which is approximately 20 times the per-capita GDP of Haiti. Additionally, in 2008 only .56% of Haitians were borrowers of loans from private banks. Given the unique role that microfinancing plays in the Haitian economy, it is important to understand the long-term viability of these microfinance organizations and to make sure they are indeed serving those who truly need microloans. Quantitative data from the three largest microfinance institutions in Haiti, ACME, FINCA, and Fonkoze, was examined from 2003-2009 with consideration given to financial statements and data about borrowers. It was found that all three organizations had greatly increased their total assets while also expanding their operations to serve more clients. All three organizations' lending practices kept in line with the "spirit" of microlending: small loans, low interest rate, short repayment periods, and mostly female clients. However, the three organizations yielded extremely low profit margins and return on investments. Future research might be directed at how these organizations might stabilize their financial situations while still increasing their services to similar demographics.

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151 Efficacy of Novel Therapy Based in Mirror-Neuron System in Recovery of Motor Deficits after Ischemic Stroke

Kristian Coerper, University of Chicago Advisor: Ana Solodkin, Ph.D.
Field: Mirror Neurons, Stroke Recovery

Stroke is the main cause of adult long-term disability in the USA, and motor deficits are these patients main affliction. The limited efficacy of current therapies to restore loss motor function may be due to these therapies not being based in basic motor physiology. In considering this limitation, in collaboration with Dr. Rizzolatti and Buccino in Parma and Dr. Binkofski in Lübeck, we developed a novel therapy based on the presumed motor mirror system (Rizzolatti et al., The Mirror-Neuron System. Annual Review of Neuroscience, 2004. 27:169-192.). The goal of this study was to test the efficacy of this mirror therapy compared to a control therapy. Patients were randomly assigned to the Bobath or mirror therapy to undergo treatment for one month. The outcome measures that were collected before and after therapy included: motor and MRI assessment. The control and experimental groups did not show a statistical difference in their motor evaluations before therapy began (Wilcoxon's test for multiple comparisons; p-value > 0.05). After therapy, the experimental group showed significant differences in motor performance; in the Wolf Motor Function Test (p-value < 0.004), Luria's Motor test (p-value < 0.01), and the MAL-14 (p-value < 0.02) test. In contrast, the control group did not show such differences. Regarding brain imaging: Group analysis of maps of activation obtained with fMRI during complex motor tasks did not show significant differences between the two groups. However, irrespective of group, patients with better recovery showed a decrease in brain activation compared to the pre-therapy maps. This preliminary study follows a previous report on mirror therapy (Ertelt et al., Effects of Action Observation has a Positive Impact on Rehabilitation of Motor Deficits After Stroke. Neuroimage, 2007. 36 Suppl 2: T164-T173). Notably, this study goes further by demonstrating better motor performance after mirror therapy than the Bobath therapy.

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152 Power and Law: Power and Law: Understanding the source of Supreme Court Authority

Elyse Conklin, University of Illinois at Chicago Advisor: Ralph Cintron, Ph.D.
Field: Political Science

Whether we realize it or not, the Supreme Court justices and their interpretation of the Constitution fundamentally impact the lives of each American citizen. Court decisions determine the direction of policy through judicial review, however as an entity, the Supreme Court inherently appears contradictory to the democratic ideals Americans collectively subscribe to. The Supreme Court simultaneously claims to uphold the Constitution and American liberal values as a fundamental check towards the executive and legislative branches, yet Justices are nominated by the President, approved by the Senate, and confirmed for life —with no consultation of the "People." Historically, the Supreme Court has been presented as the 'least dangerous branch' because it fundamentally lacks an enforcement mechanism while the Executive maintains police presence and other agencies and Congress codifies legislation. Rhetoric represents the only means by which the Court can enforce its rulings—the opinion published by the Court must compel obedience from the other branches and the population.
The purpose of this paper is to explore the relationship between the Supreme Court and authority, with a focus on the language that creates and imposes the power of the Court. The word "authority" functions on multiple levels throughout this work; I will first explore the origin of Court authority, with a focus on Marbury v. Madison. Following the starting point of judicial review, I will evaluate the expansion of the Court's authority over life through an in-depth analysis of landmark cases. Finally, through an application of Michel Foucault's theory of biopolitics and truth regimes, I advocate for a reconstitution of power between the population and imperfect mechanisms of power. The Supreme Court fundamentally shapes the political reality of every American citizen, yet claims to be shielded from politics itself—why do we (American citizens) collectively submit to the (often flawed) decisions of the Court?

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153 The Effect of Living Learning Programs on Coping Strategies

John Conway, Loyola University Chicago Advisor: Colleen Conley, Ph.D.
Field: Coping Behaviors

During the transition to college, there are decreases in social support resources (Beck, Taylor, & Robbins, 2003). Research suggests that social support is associated with adaptive coping strategies, such as help-seeking strategies and engagement coping strategies, which are associated with better mental health and academic outcomes (Asberg, Bowers, Renk, & McKinney, 2008; DeBerard, Spielmans, & Julka, 2004; Furukawa, Sarason, & Sarason, 1998).
Recently, to assist in the development of social support networks, Living Learning Programs (LLPs) have been instituted to assist first-year students in the adaptation to college through shared academic interests and common living environments. LLPs are intended to foster social relationships and develop relationships with faculty to aid in the transition to college, but few studies have assessed the effect of LLPs on outcomes other than academic variables (Andrade, 2007; Decker 2003; Dodge & Kendal, 2004). This study tested the hypothesis that students in LLPs would report greater support-seeking coping strategies (i.e., help-seeking, instrumental social support), in comparison to non-LLP students.
First-year students at a mid-sized Midwestern University (n = 1082; 70.1% female, M age = 18.48) completed measures of coping styles before and after the first semester at college. Results indicate that there are no significant differences between LLP students and non-LLP students across help seeking coping F (1, 1082) = .01, p = .92 and instrumental social support coping, F (1, 1082) =..536,

p = .46. These findings suggest that LLPs do not have a significant effect on support-seeking coping strategies. One explanation for these findings is that both LLP students and non-LLP students reside on campus which may lead to common peer interactions and relationship development. Future studies may aim to determine the differential experiences of LLP and non-LLP students.

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154 **Religion and Relationship Power: Implications for Domestic Violence Prevention**

Rebecca Crook, Northwestern University Advisor: Rebecca Seligman, Ph.D.
Field: Medical Anthropology

Given the pervasive crisis of domestic violence in Ghana, an understanding of the interpersonal interactions that appropriate differential access to power to men and women is essential. The first to examine relationship power in West Africa, this study identifies patterns of communication and sociocultural justifications for decision-making among married couples. The study explores how partners initiate and make final decisions regarding finances, childcare, and family planning; whose opinions are considered in discussions of these different issues and how husbands and wives' religious beliefs influence their decision-making approaches.
Fifteen husband and wife dyads from the Presbyterian Church of Ghana and 15 from the Church of Pentecost were interviewed separately (60 participants) using IRB-approved consent forms and interview guides. Three leaders from each congregation were also interviewed to better understand the radically divergent institutional stances towards women. The researcher spent 20 hours a week at both churches' functions (bible studies, Sunday services, special programs) to become integrated into the church communities. The hour-long interviews were transcribed and analyzed using open coding and emerging themes were organized into grounded theory.
The study concludes that in a Christian nation, in which faith communities provide important social messages, support systems and interpersonal guidance to the majority of the country, initiatives to advance women's status must include faith communities. Men generally had more power in decisions pertaining to finances, women had more authority in decisions regarding the home, and decisions surrounding family planning were jointly shared. Another finding is that women often stress that for the sake of harmony, they let their husbands have the final say in decisions or during conflict. The vast majority of women and men asserted that men are the head of the house and that women have a duty to submit to their husbands. The interpretation of scripture played a crucial role in how husbands and wives determined their decision-making approaches.

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155 **The Other Space in Spatial Politics**

Daniel Della Posta, University of Chicago Advisor: Terry Clark, Ph.D.
Field: Political Sociology

Scholars have long sought to formalize the "rules of the game" by which political parties compete with one another for votes. Drawing from theories of spatial competition, many of these analyses have conceptualized parties within a given political system as arranging themselves along some kind of single ideological dimension. In many cases, a party's position along this dimension has been connected to a particular social class or group. However, in more recent years, analysts have pointed to a decline in traditional "class politics" and the rise of new political dimensions centered on social issues, consumption, and lifestyle.
Within this modern political environment, parties can no longer succeed by simply focusing on voters situated within one particular social class, but rather are forced

to appeal to several cross-cutting identities and social locations. However, it is similarly obvious that not all of these "identities" or "locations" will be equally relevant in every electoral situation. Unfortunately, the current literature in the political science and political sociology fields have done little to account for the multi-faceted nature of modern party identities or answer the questions of where and when particular parts of these identities become more or less important than others.
This paper is concerned with two related questions, both of which are answered through a multivariate statistical analysis of results for four political parties in the 2009 French elections for the European Union parliament. First, how does local context—in terms of socioeconomic, demographic, and cultural elements—determine which particular parties will be most directly competing with one another? Second, how do particular aspects of a party's identity and appeal become more or less important when the party is competing more directly with one opponent and less directly with another?

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156 **Kierkegaard and the Sociology of Ideas: Pseudonyms as a Network of Intellectual Selfhood**

Thomas Gilbert, Northwestern University Advisor: Georgi Derlugian, Ph.D.
Field: Sociology of Ideas

Philosophers have long studied how Søren Kierkegaard's use of pseudonyms affects the meaning of the works placed under their name. However, this research lacks the causal connections between philosophical thought and environment that sociology can uncover. One field, the "sociology of ideas," explores how ideas are produced by contact between individuals within historical networks. Scholars Randall Collins and Charles Camic have applied this theory to explain the Vienna Circle and the Scottish Enlightenment, but it is not clear how the concept of network contacts would apply to Kierkegaard, who was an intellectual loner. Yet by analyzing Kierkegaard's writings and 1840s Copenhagen, my research shows that Kierkegaard's employment of pseudonyms represented the independent creation of a network of fictional philosophers with whom he could develop ideas on his own terms. Furthermore, Kierkegaard sought to tie his writings to the legacy of German Idealism, but as he did not personally know its luminaries, he created literary voices that embodied the contradictions within their ideas, thus "linking up" with thinkers who would otherwise have been inaccessible. Kierkegaard's open acknowledgement of the pseudonyms in his later works represented his attempt to collate these fictional voices into a unified framework, thus completing their transition from a network of separate voices to different parts of a single philosophical system. While scholars typically group these pseudonyms according to their respective places within Kierkegaard's doctrine of aesthetic, ethical, and religious "spheres of being," my research instead organizes them according to their respective purposes within Kierkegaard's self-produced network, such as "network organizer" or "stand-in for Hegel." This research promises to both improve philosophers' understanding of Kierkegaard's motivations when expressing his ideas, as well as refine the sociology of ideas through a case study of how a single philosopher possessed the agency to invent his own path to creative genius.

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157 **Musical training and the aging auditory system: implications for cognitive abilities and hearing speech in noise**

Emily Hittner, Northwestern University Advisor: Nina Kraus, Ph.D.
Field: Music Cognition

Human communication rarely occurs in optimal environments; rather, we are often surrounded by background noise. Understanding speech in noise requires the active recruitment of cognitive and perceptual resources. Unfortunately, perceptual acuity and cognitive skills are known to diminish

with age. Given that these factors contribute to perceiving speech in noise, it is not surprising that difficulties hearing in noise are one of the first complaints reported by people in an aging population. As such, there is a growing interest in identifying possible interventions that could offset these negative effects of aging. Musical training strengthens the perception of speech in noise in young adult musicians, but it has not yet been determined if these benefits extend across the life span. Here, we investigated the effects of musical training on speech-in-noise perception in normal hearing middle-aged adults by comparing the performance on behavioral assessment for musicians and nonmusicians between the ages of 45-65 years. Consistent with the findings in young adults, middle-aged adult musicians demonstrated enhanced speech-in-noise performance, more acute temporal resolution skills and higher auditory working memory ability. Our results indicate that musical training may mitigate the impact of the age-related cognitive and perceptual decline, specifically for the perception of speech in background noise.

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158 **Coping methods as predictive factors in disordered eating behavior**

Samuel Johnson, Loyola University Chicago Advisor: Colleen Conley, Ph.D.
Field: Clinical Psychology

Existing literature has implicated coping strategies in the etiology and maintenance of health behaviors including a link between negative/non-productive coping strategies and disordered eating behavior (Hasking 2006; Hansel & Whittrock 1995). Disordered eating behavior has been widely studied and described in female populations (Visser 2008; Lavender & Anderson 2010). However, recent trends in research have indicated an apparent increase in disordered eating among males (Ray 2004). The paucity in available research necessitates a closer examination of the relationship between male disordered eating behaviors and coping methods, as it may contribute to the development of more reliable screening and treatment techniques. In the present study, longitudinal data were collected using self-report measures from 319 first-year students at a private Midwestern university. The survey examined a variety of psychosocial factors, including measures on disordered eating behavior (EAT-12) and coping strategies (COPE scale). For the present study, investigators were interested in identifying the predictive relationship between student coping styles and disordered eating. Hierarchical linear regression analysis did not identify a significant relationship for both males and females when using the more general engaged and disengaged subscales of the COPE at the start of the academic year as predictors of disordered eating at the end of the academic year (scores on the EAT-12). Interestingly, an exploratory analysis of each of the more specific COPE subscales revealed several significant findings for both genders. For females, the distraction and self-blame subscales were significant ($F(16, 225) = 6.70$, $p < .05$) predictors of disordered eating. Alternatively, for males, the venting, instrumental social support, proactive, religious, and help-seeking subscales were all significant ($F(16, 60) = 2.19$, $p < .05$) predictors of disordered eating. These findings indicate a significant predictive relationship between different coping methods and disordered eating behavior for both genders.

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159 **Multiple-Talker Speech Processing: Cognitive Costs in Audio-Only and Audio-Visual Contexts**

Presenter: Chi-Hyun Kim, University of Chicago Advisor: Howard Nusbaum, Ph.D.
Field: Cognitive Psychology

Talker differences result in variability in the relationship between acoustic patterns and phonetic categories. Despite this diffculty, listeners are adept at comprehending speech in multiple-talker contexts, albeit at a cognitive cost. So far, this cost has been demonstrated only in audio-only speech. Other work in single-talker contexts have shown, however, that when listeners are able to see the talker's speaking face,

speech recognition is improved under adverse listening conditions. Does seeing a talker's face reduce the cost of recognition in multiple-talker contexts? We used a speeded word-monitoring task in which listeners make quick judgments about target-word identity in single- and multiple-talker contexts. Results show better recognition performance in single- talker conditions compared to multiple-talker conditions for both audio-only and audio-visual speech. Resolving talker variability does not seem to be made easier by information. In light of this finding, we discuss the critical roles played by listener expectations and by information from the auditory stream.

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160 **Associations between language processing and nonverbal communication skills and social skill development among youth with spina bifida.**

Kimberly Klages and Lauren O'Hara, Loyola University Chicago
Field: Clinical Neuropsychology Advisor: Grayson Holmbeck, Ph.D.

Objective: The purpose of this study was to investigate language processing and nonverbal communication skills of youth with spina bifida (SB) using the Comprehensive Assessment of Spoken Language (CASL) and the Diagnostic Analysis of Nonverbal Accuracy (DANVA). Furthermore, this study aimed to investigate whether the CASL and the DANVA are significant predictors of social skill development among youth with SB.
Participants and Methods: This study was part of a larger longitudinal study examining neuropsychological functioning and psychosocial adjustment among youth with SB. Participants included 134 families of youth with SB (62 male, 72 female) between the ages of 8 and 16 (M = 11.42, SD = 3.13). Youth completed the Non-literal Language, Inference, and Pragmatic Judgment subtests of the CASL, and the Faces, Paralanguage, and Posture subtests of the DANVA. Additionally, Vocabulary and Matrix Reasoning subtests of the Wechsler Abbreviated Scale of Intelligence (WASI) were administered to estimate for IQ. Caregivers completed demographic questionnaires and the Social Skills Rating System (SSRS).
Results: Participants preformed in the Low Average to Average range on the CASL: Non-literal Language (M SS = 93.69, SD = 19.14), Inference (M SS = 85.57, SD = 20.81), and Pragmatic Judgment (M SS = 88.33, SD = 18.80). Furthermore, participants preformed in the Low Average to Average range on the DANVA: Faces (M SS = 88.87, SD = 22.19), Paralanguage (M SS = 87.02, SD = 17.12), and Postures (M SS = 88.05, SD = 16.83). These subtests were significantly associated with the WASI full-scale IQ score. Regression analyses revealed that the Non-literal language subtest of the CASL was significantly associated with the self-control subtest, and the Inference subtest of the CASL was significantly associated with the responsibility and assertiveness subtests. Furthermore, the Paralanguage subtest of the DANVA was significantly associated with each domain of social skill development, and the Faces subtest of the DANVA was significantly associated with only the cooperation subtest.
Conclusion: Findings suggest that language processing and nonverbal communication skills of youth with SB are within the average to low average range. Analyses also reveal that performance on the CASL and the DANVA significantly relate to social skill development of youth with SB.

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161 **Early Elementary Literacy Instruction and the STEP Assessment**

Alexandra Krueger, University of Chicago Advisor: Sara Ray Stoelinga, Ph.D.
Field: Education

Since states place such high stakes on standardized tests, educators much must dedicate much attention to these kinds of summative assessments. Educational specialists rely on such information to

set consistent, widespread standards. However, frequent and ongoing formative assessments yield valuable information that is useful at the school and classroom level, because teachers can directly relate the assessment information to their teaching instruction. This relationship between many kinds of formative assessments and classroom teaching has not been thoroughly examined in practice. In this study, I explore two questions about the relationship between Strategic Teaching and Evaluation of Progress (STEP) Literacy Assessment and teachers' classroom literacy instruction. First, how does STEP influence the ways in which teachers enact classroom instruction? Second, do certain teacher characteristics and teaching approaches correspond to—or even cause—identifiable trends in the classroom STEP data? Data included interviews with teachers about their literacy instruction and analysis of their students' STEP data from the 2009-10 school year for five classrooms—three first and two third grades— in two Chicago Public Schools. Interviews were coded to determine themes. The most significant finding was how teachers use STEP data to provide students with the differentiation and instructional content that meets their educational needs, therefore, increasing student learning. Teachers reported subsidiary instances when they do not use STEP data or feel that there are weaknesses with the program. A secondary finding that emerged was that school factors, aside from direct classroom literacy instruction, can impact student STEP achievement.

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162 **False cognate detection: Examining bilingual lexical systems**

Kathleen Lee, University of Illinois at Chicago Advisor, Gary Raney, Ph.D.
Field: Eye-tracking, Bilingualism

The study tests parallel activation of Spanish and English in cognate text processing. Across languages, false cognates look and sound similar but do not share meaning whereas true cognates share similar meaning, sound, and appearance. False cognate detection can test models predicting that native and second languages are kept, activated, and processed in the same places in memory (Dijkstra & Van Heuven, 2002; Kroll & DeGroot, 1997). 35 Spanish-English bilinguals read sentences with true cognates (TC), false cognates (FC), no cognates, or were nonsense (semantically incorrect) sentences. We conducted a 2 (TC vs. FC) x 2 (trigger vs. target) x 3 (low vs. medium vs. high Spanish proficiency) mixed analysis of variance (ANOVA). Across proficiencies, participants read FC words longer than TC words. The interaction between cognate condition and proficiency showed that the magnitude of reading time (RT) difference between TC and FC varied with proficiency. Separate ANOVAs for other interest areas had significant main effects and interactions.

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163 **Project MENTOR**

Alexandra Luterek, Amanda Cimaroli, and Marcus Knight, Loyola University Chicago
Field: Youth Development Advisor: Julia Pyrce, Ph.D.

Project MENTOR is a three-year, holistic health program that assists thirty youth living in an at-risk, lower-income urban community on Chicago's South side. The community faces high rates of poverty, unemployment, obesity, gang activity, teen pregnancy, sexually transmitted diseases, and violence. Within the high school from which participants were recruited, 82% are considered low-income students (Chicago Public Schools, 2009). Project MENTOR targets the social, physical, intellectual and emotional development of students via involvement from the school, parents, and community members. Key components of programming include mentoring, family support services, and a six-week summer participatory action research (PAR; Cammarota, 2008) program, the latter of which will be featured in this presentation.

A key tenant of PAR is the focus on acquisition of knowledge in addition to life skill sets. Along these lines, participants in Project MENTOR identified the public health concern of sexual health as the topic of interest. After conducting focus groups and researching sexual health, the group presented

their results to fellow students and community members. Through this process, adolescents were invited to think critically about a research question, outline methodology, conduct data, and learn from within their own socio-cultural context. Such activities were designed to deepen community engagement, develop research skills, and improve interpersonal communication.
Through the collection of data via focus groups with youth participants, findings suggest that the PAR approach empowered youth to explore the causes and consequences of issues in their community. Youth reported feeling accountable and motivated to share their findings with larger audiences. Findings also suggest an increased sense of connection to one's community, and increased motivation to work together to improve their environment. These preliminary findings will be used to inform future program development, and as data collection on Project MENTOR as a whole.

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164 **Speech Timing and Pause Structure in L1 and L2 English**

Brett Margolis, Northwestern University
Field: Speech Science Advisor: Tyler Kendell, Ph.D. ; Ann Bradlow, Ph.D.

A significant portion of our waking lives is spent in conversation. Most linguistic studies focus on the words and sounds used in speech, while few put the spotlight on the silences between words. How do English speakers use pauses in spontaneous speech? Do different speakers use pauses differently? Do native and non-native speakers pause differently? Answers to these questions can have profound implications for our understanding of speech production, and have applications in a number of areas, including determining a speaker's native language, reducing accents, and improving public speaking.
I examined the pauses in the conversational portion of a corpus of digital speech recordings from native and non-native speakers of English, the Wildcat Corpus (Bradlow et al., 2007). In the conversation elicitation task used for this corpus, various combinations of native and non-native speakers compared two similar pictures to find ten differences between them. The interlocutors could not see each other's picture and had to solve this picture puzzle through conversation. I marked and labeled all silent pauses to indicate their quantities, durations, types (e.g. grammatical, articulatory,filled with 'uh' or 'um, or silent), syntactical positions, and immediately surrounding context. Data collected so far show that, in general, native English speakers and Chinese and Koreans speaking English use similar pause types; however, when Korean speakers restart their sentences they exhibit longer pauses than English and Chinese speakers. I explore whether this may relate to basic word order differences which is subject-verb-object in English and Chinese, but subject-object-verb in Korean. There are also signs of accommodation between speakers. English speakers have longer pauses when talking to non-native speakers than to native speakers. The findings also agree with the study done by Clark and Fox Tree (2002) that speakers use 'uh' before short pauses and 'um' before long pauses.

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165 **Coping Socialization in African American Youth: Do Kids Listen to Their Mothers?**

Jessie Montes de Oca, Loyola University Chicago Advisor: Noni Gaylord-Harden, Ph.D.
Field: Clinical Psychology

Low income, African American youth face stressors at higher rates than other groups (Brantley et al., 2002). To facilitate adaptation to stress, parents socialize their children to use coping strategies (Abaied, & Rudolph, 2010; Kliewer, Fearnow, & Miller, 1996). The current study examined associations between mothers' socialization of coping and child coping strategies, as well as how discrepancies between mother and child reports of coping socialization predict child coping. The current study builds on prior research by focusing on African American youth and by using both parent and child reports of coping socialization. It was predicted that mothers' socialization of coping strategies would predict children's use of those coping strategies, that larger discrepancies between mothers

and children would predict more maladaptive coping, and that the impact of discrepancies would be influenced by child gender. Participants were 95 African American youth (mean age = 11.80, 59% female and 95% low income) and their parents from a community-based, family-support agency in a metropolitan area. Youth reported on coping strategies and maternal coping socialization. Mothers self-reported on coping socialization. As predicted, children's reports of socialization of engagement and disengagement coping were positively associated with children's use of engagement and disengagement coping. Mothers' self-reports of coping socialization were unrelated to child coping. Larger discrepancies between parent and child reports of coping socialization were associated with more maladaptive coping, but these specific associations varied by gender. Results are discussed in terms of the implications of multiple reporters of parents' socialization on children's coping behavior.

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166 The Dressing Room as a Key Environment for Negative Body Talk Among Peers: A Qualitative Investigation

Anna Morrow, Northwestern University Advisor: Renee Engeln-Maddox, Ph.D.
Field: Social Psychology

Body dissatisfaction in women has long been implicated as an important contributor to eating disordered behavior (Stice, 1994). Although body dissatisfaction is often treated as a trait-level variable, research has indicated that body dissatisfaction significantly fluctuates across different situations ranging from having lunch with a female friend to trying on swimsuits at a store (Haimovitz et al., 1992). Myers et al. (1992) coined the term "the elastic body image" to refer to this idea. Consistent with these findings, self-objectification (another correlate of body dissatisfaction) can be "triggered and magnified by certain situations" (Fredrickson et al., 1998, p. 270). Fredrickson et al. (1998) manipulated participants' self-objectification by having them try on a swimsuit or a sweater. Negative consequences in the swimsuit condition included increased body shame, suggesting a link between objectifying contexts/experiences and body image disturbance. Women's body dissatisfaction may also be affected by the presence of peers. Research on expressing body dissatisfaction in groups of peers suggests that a woman may engage in negative body talk to fit into a social group (Nichter, 2000) or gain support and validation from peers about her body (MacDonald-Clarke et al, 2009). Such talk is associated with increased body dissatisfaction (Salk & Engeln-Maddox, 2010).

The current study was a qualitative investigation of the content of peer-to-peer negative body talk in one specific situation: the dressing room. Participants were 92 undergraduate women at a Midwestern university. Participants were asked to write a script for a hypothetical conversation with a friend that would take place while they were trying on swimsuits. Using grounded theory methods, these scripts were examined for negative body talk. Four themes emerged. Two research assistants then coded the scripts for the presence or absence of each of these themes: direct expressions of body dissatisfaction (kappa = .82; e.g., I look so gross, I hate my stomach); plans for behaviors aimed at re-shaping the body (kappa = .79; e.g., I really should work out more), upward social comparisons (kappa = .71; e.g., You are so much skinnier than me), and empathetic but often self-degradating responses to the friend's body dissatisfaction (kappa = .87; e.g., I'm the one who's fat). Responses in the first category focused primarily on the stomach and legs. In the behavior category, many participants made plans to work out with their friend. In this scenario, all participants (94% of whom were not overweight) engaged in at least two of the categories of negative body talk, with 82% engaging in all four. The dressing room may trigger body dissatisfaction due to the presence of mirrors and focus on the evaluation of one's appearance. These data support claims regarding the widespread nature of body dissatisfaction among women, termed normative discontent by Rodin et al. (1984). The elastic body image may be especially likely to move in the direction of body dissatisfaction in a dressing room, both because it appears to be a key context for negative body talk and because such talk may be exacerbated by the presence of peers.

167 The Effects of Cultural Priming on Emotional Memory Biases and Interpersonal Relations,

Brandon Ng, Northwestern University Advisor: Joan Chaio, Ph.D.
Field: Cultural Psychology

Emotional memory bias toward negative memories is a central characteristic of depression and anxiety (Mathews & McLeod, 1994). Recent findings in cultural neuroscience suggest that cultural values (more specifically, levels of individualism and collectivism) can moderate the relationship between vulnerability to anxiety and depression and the development of these memory biases. It has also been shown that certain races are more vulnerable to negative affect. For example, Chiao and Blizinsky (2010) illustrated that having the short allele of the 5-HTTLPR Serotonin-Transport Gene, which is significantly more prevalent in Asian populations, left individuals more prone to anxiety and depression in the face of environmental threats and were more sensitive to negative information. This study investigated the complex relationship between race, culture, and negative memories.20 Asian and 20 Caucasian students at Northwestern University were first primed with either individualistic or collectivistic cultural values using a prime (Trafimow, Triandis, & Goto, 1991), and were then asked to view a series of positive, negative, and neutral photos from the International Affective Picture System (Lang, 1993; Ochsner, 2000). Participants were then asked to complete the "Reading the Mind" task, in which they were asked to look at pairs of eyes from 72 faces (36 Asian and 36 Caucasian faces) that expressed some form of emotion, and were asked to choose the correct emotion from 4 answer choices given. Afterwards, participants were given a surprise memory recognition task in which they had to identify the original 45 photos from a combined set of 90 IAPS photos (the 45 originals with 45 foils, matched with each of the originals). Participants were then asked to complete a series of surveys, namely the State and Trait Anxiety Inventory (STAI), Beck's Depression Inventory (BDI), and Ryff's Well-Being Scale (WBS). It was hypothesized that people primed with collectivistic cultural values would remember more of the negative IAPS pictures (and respond more quickly in terms of reaction time), be better at guessing the correct emotions for the pairs of eyes they saw, show ingroup bias for eyes that were members of their ingroup (i.e. an Asian participant primed collectivistic should be better at interpreting the emotions of an Asian pair of eyes compared to an Asian participant primed individualistic). Furthermore, it was predicted that participants primed with collectivism would report higher levels of state anxiety only, higher levels of depression, and report less well-being. The results of the study are currently being analyzed, but there have been significant effects of the collectivistic prime for state anxiety and well-being in accordance with the hypotheses.

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168 MUSICAL TRAINING PROMOTES DEVELOPMENT OF ATTENTION ABILITIES: EVIDENCE IN CHILDREN AND ADULTS

Samantha O'Connell, Northwestern University Advisor: Nina Kraus, Ph.D.
Field: Sustained Attention Development

Increasing effort is being expended to define activities that strengthen what might be considered the cornerstone of human perception: attention. While musical training is known to bolster auditory-specific cognitive skills, such as auditory short-term memory, little is known about how musical training strengthens attention – especially during developmental years. We aimed to determine the impact musical training on auditory and visual attention abilities in 7-13 year old children (N=30) and young adults (N=29) using The Integrated Visual and Auditory Plus Continuous Performance Test. Musician and non-musician groups did not differ according to age, sex, or IQ. Outcomes reveal that, compared to non-musicians, musician adults demonstrate enhanced sustained auditory attention. Children with musical training, however, possess a more global attention advantage, with enhanced sustained attention in both auditory and visual domains. Attention performance in both children and adults correlates with musical practice histories, with more years of musical

practice relating to increased attention ability in the auditory domain. Taken together, these results suggest that musical training promotes the development of global attention mechanisms but that these advantages become constrained to the auditory domain with maturation. Given the high prevalence of developmental attention disorders and their detrimental impacts on educational performance, outcomes should inform educators, scientists, and clinicians involved in the assessment and remediation of learning deficits.

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169 **Improving Therapy Outcomes by Enhancing Learning During Sleep**

Christina Panton, Northwestern University Advisor: Richard Zingbarg, Ph.D.
Field: Anxiety

Researchers have been searching for ways to enhance the effectiveness of exposure therapy. As cognitive behavior therapy, including exposure-based techniques, is rooted in learning, it seems likely that research and theorizing about learning and memory can provide clues regarding ways to enhance exposure therapy. Indeed, one possible, novel means of enhancement has been suggested by a recent study demonstrating that the memory consolidation that occurs during sleep can be enhanced by presenting sounds associated with newly learned material (Rudoy et al, 2009). These results have been translated to an exposure therapy paradigm seeking to enhance consolidation of therapeutic learning. The current study explored whether presenting sounds associated with therapeutic information during sleep leads to greater symptom reduction than exposure alone.

Participants were selected for high blood-injection-injury fear scores as measured by the Mutilation Questionnaire (total score >17). They began with a Behavioral Approach Task (BAT) comprised of 12 pictures related to blood-injection-fears ordered hierarchically from least to most fear-inducing. The time spent viewing each picture was also collected via reaction times. After each picture, participants rated their anxiety and physical sensations on a 0-10 scale. After the BAT, participants completed 30-40 minutes of exposure for blood-injection-injury fears (i.e. brief films of blood and surgery, holding a bag of blood, handling needles, etc.). The last five to ten minutes of the exposure session entailed a reflection period. During that period, participants were guided to reflect on the positive lessons gleaned from the exposure session while listening to a unique piece of music.

The participants were randomized into two groups: an auditory enhancement condition and a control group. The control group received exposure alone. Participants in the auditory enhancement condition also listened to the music presented during the reflection period nightly while sleeping for one week. Participants returned after one week to complete the same BAT.

Preliminary data analyses from the first 18 participants were conducted. The difference scores for ratings of anxiety and physical sensations during the Behavioral Approach Task were in the direction of superiority for the sleep rehearsal condition though the group differences were not statistically significant. In addition, participants in the sleep rehearsal condition increased their looking time at the BAT pictures more than the control group and this difference approached significance, $F(1,16)=4.245$, $p=.056$. Another 45 participants will be run and the data will be reanalyzed. These preliminary findings suggest that perhaps one can augment exposure therapy via cued sleep rehearsal of therapeutic learning by presenting associated sounds during sleep.

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170 Fostering Peer Networks for First Generation College Students through Living Learning Communities

Koonal Patel, Northwestern University Advisor: Colleen Conley, Ph.D.
Field: Psychology

Past research documents the unique difficulties faced by first generation college students (FGCS) in comparison to traditional students. FGCS are more likely to be employed and commuters; though, less likely to seek outside academic resources (e.g., academic advising, club involvement) (Pike & Kuh, 2005). Recent findings suggest these factors are negatively associated with development of social networks and decreases the likelihood of utilizing University resources, which is associated with higher student dropout rates (Barry, Hudley, Kelly, & Su-Je Cho, 2009; Bui, 2002; McCarron, G. & Inkelas, K., 2006). Recently, Living Learning Programs (LLPs) have been implemented at many universities to foster peer connections through shared academic and social experiences in a residential community. For FGCS, these peer networks may offer opportunities to discuss their unique experiences and receive support on campus. To determine LLP involvement on participants' perceived peer support (PPS), a 2 (LLP condition: LLP, non-LLP) x 2 (Pre-Post: pre-semester, post-semester) analysis of variance (ANOVA) on PPS was conducted. The main effect of LLP group was nonsignificant, $F(1, 125) = 0.72$, $p = .40$, suggesting that FGCSs in the LLP ($M = 3.37$), and non-LLP ($M = 3.47$) conditions did not differ in PPS. There was a significant main effect of Pre-Post semester assessment on participants' PPS, $F(1, 125) = 3.94$, $p < .05$, suggesting that participants pre-semester ratings of PPS ($M = 3.48$) were significantly lower than their post-semester ratings of PPS ($M = 3.36$). The data did not support a LLP Condition x Pre-post semester interaction predicting PPS, $F(1, 125) = .004$, $p = .95$, which suggest PPS did not depend on whether participants were in the LLP or non-LLP conditions at follow up. These findings suggest that LLPs offer no difference in fostering peer networks for FGCS than traditional style student housing.

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171 Carrying the Weight: The Relationship Between Minority Youth BMI and Daily Screen Time

Bernadette Pivarunas, DePaul University Advisor: Jocelyn Carter, Ph.D.
Field: Child-Clinical Psychology

Youth obesity is the single greatest predictor of obesity in adulthood, and obesity rates in minority youth are particularly elevated (Franko & George, 2009). Poor nutrition coupled with an increase of sedentary activities place minority youth at a pronounced risk for becoming overweight and/or obese (Franko et al., 2009). The purpose of the study was to determine the prevalence of obesity in a sample of urban Chicago 3rd and 4th grade youth as well as to determine the relationship between daily screen time (time spent watching television and/or movies as well as playing video or computer games) and body mass index (BMI). Participants were recruited from four elementary schools in neighborhoods identified as being at high risk for overweight/obesity and included both African American and Latino youth. Participating children completed surveys with examiners reading questions aloud in addition to having their height and weight measured by examiners. Thirty-five percent of the sample ($N = 76$) was either overweight or obese according to BMI classifications established by the Center for Disease Control (2009). The average weight exhibited by the sample was 77.3 pounds ($SD = 28.2$). Daily screen time, measured in hours, ($M = 5.0$, $SD = 4.5$) was moderately positively correlated with an increased BMI, $r(30) = .363$, $p < .05$.The average daily screen time exhibited by the sample is considerably high as pediatric obesity preventionists agree that daily television viewing time should not exceed two hours (Lazarou & Soteriades, 2010). Further, the prevalence of a BMI classified as either overweight or obese is extremely high. Both findings confirm the need for programs that empower youth to make healthier food and lifestyle choices; in addition, these findings corroborate a need for ethnically appropriate parental education that encourages parents to set healthy limits on sedentary activities.

172 Exposure to Media & the Thin Ideal: How Do Women Respond?

Lauren Potthoff, Loyola University Chicago Advisor: Scott Leon, Ph.D.
Field: Body Dissatisfaction

The female beauty ideal in Western cultures advocates an unrealistically thin body, which is consistently perpetuated by the media. The current study examined women's emotional and cognitive reactions to media images portraying this ideal. Participants' body dissatisfaction and disordered eating behaviors were also examined. Results suggest that higher levels of body dissatisfaction reported by participants were significantly associated with participants wishing they look like the models. Further, higher levels of body dissatisfaction were associated with participants wishing to be as thin as the models in the images, wanting to lose weight, and admitting their willingness to give up specific foods or drinks.

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173 Analyzing the Presence and Effectiveness of Abstract and Concrete Representations in Elementary School Science

Maria Ptouchkina, Northwestern University Advisor: David Khalr, Ph.D.
Field: Cognitive Development

Learning from graphical illustrations is a core component of all levels of science education. In addition, the way that information is represented has a profound impact on students' learning. One open question in the learning sciences is whether information should be presented in concrete form, or whether it should take on more symbolic form. We report the preliminary findings of two studies that assess the impact of different types of representation in K – 12 geoscience textbooks. The first study categorized the relative frequency and types of integration with text of various types of representations; the second study investigated the effects on learning of these different types of representations. We found that across all levels the texts contained more concrete representations (e.g. photographs) than abstract representations (e.g. charts or graphs). Majority of instructional analogies were not graphically represented. When the instructional graphics were represented graphically, only the target of the analogy was present. In the second experimental study, we examined the effect of concrete and abstract representations on learning and motivation. While at present our study has too few subjects to look at meaningful learning differences between conditions, we have already found that the children in the concrete condition report being more engaged and interested in the lesson than children in the abstract and relevant concrete conditions. Additionally, this study is valuable in that we incorporate the use of eye-tracking methodology to assess learning from abstract and concrete representations. We believe that this is the first study to use eye tracking to assess the specific aspects of graphical representations of concrete and abstract materials that are actually attended to by students.

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174 The Museo Textil: Creating Value and Accomplishing Change in the Art Museum

Leah Reisman, University of Chicago Advisor: Shannon Dawdy, Ph.D.
Field: Anthropology

In recent museological scholarship, education and public engagement are increasingly viewed as the foci of museums. This has been accompanied by a prevalence, especially in science and natural history museums, of innovative exhibitions featuring multimedia and interactive elements. Meanwhile, many art museums remain characterized by "white cube" displays that privilege the aesthetic. As such they are sometimes viewed as less able to meaningfully engage and educate visitors, as isolated from everyday life. However, in 2008, an

institution came into existence that inverts this relationship between exhibitionary style and capability, presenting a case of an art museum that intends to meaningfully engage its visitors and impact public life. The Museo Textil de Oaxaca (MTO) is a private museum in Oaxaca, Mexico. The museum's goal is to support the large population of weavers in Oaxaca; they use a quintessential art-museum-style display to exhibit textiles, meant to convince visitors that textiles are art and increase their willingness to pay high prices for handmade textiles in the marketplace. The MTO thus mobilizes the art museum format in service of a tangible, counter-hegemonic social project; to cause visitors to revalue textiles as art, increase their market value, and better the lives of artisans. It negotiates the divide between conceptions of a conventional art museum and an institution instrumentally relevant to its surroundings. Drawing on material culture theory on value, especially that of Arjun Appadurai and Igor Kopytoff, this project will present analyses of the MTO's exhibitions, workshops and internal culture that assert "white cube" displays as essential to the accomplishment of the MTO's goal. By expanding Kopytoff and Appadurai's conceptions of the biographies of things in asserting the multiple valuations of textiles simultaneously manifested through the art museum display, this project allots such exhibitionary styles new potential in a rapidly changing museum world.

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175 A Novel Measure of Fat Talk and Its Association With Body Dissatisfaction

Kathryn Rulon and Sara Morrow, Northwestern University
Field: Social Psychology Advisor: Renee Engln-Maddox, Ph.D.

"Fat talk" is a term first used by Nichter and Vukovick (1994) to refer to women speaking negatively about the size/shape of their bodies.
This study used a novel vignette-based task to assess the frequency of fat talk among women and to determine whether scores on this assessment could predict body dissatisfaction or eating disordered behavior. Participants were 89 women at a mid-western university. Participants completed measures of body dissatisfaction, eating disordered behavior, and self-reported fat talk frequency. Within six weeks of pre-testing, participants were given six vignettes. They were asked to write a conversation that might happen in each scenario. Responses to each vignette were coded for presence or absence of fat talk. Inner rater reliability was acceptable (all kappas ≥ 0.83). Total fat talk scores were created by summing the number of vignettes in which fat talk occurred (0—no fat talk in any vignette to 6—fat talk in every vignette).
Ninety percent of participants fat talked in at least one vignette (M = 2.32 vignettes; SD = 1.29). Total fat talk scores were correlated with body dissatisfaction, r (87) = .24, p=.02, but not with eating disordered behavior, r (87) = .17, p = .17. In other words, fat talk appears to be linked more closely with problematic attitudes toward the body than with actual disordered behaviors. Fat talk scores were also significantly correlated with the factor assessing feelings that one is "getting fat," r (87) = .28, p = .02, and the factor assessing social comparison with thinner others, r (87) = .36, p = .002. These results provide further evidence for the link between fat talk and body dissatisfaction (e.g., Gapinski et al., 2003) and support the validity of vignette measures as a means of assessing the content and frequency of fat talk.

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176 Keep Evanston "Evanston": How Morality, Economics, and Race Affect Prohibitionist Policies in a Local Community

David Schieber, Northwestern University Advisor: Gary Fine, Ph.D.
Field: Historical Sociology

In 1853, Northwestern University added an amendment to its charter prohibiting the sale of alcohol within 4 miles of the center of campus. This amendment began over 120 years of prohibition in

Evanston, culminating in prohibition's repeal in 1972. In this paper, I review the often-overlooked history of alcohol in Evanston, applying the theory of moral entrepreneurship and community identity to explain how Evanston remained dry for such a long time. Social institutions, such as the Women's Christian Temperance Union and religious groups, worked to create a community identity for Evanston through morality claims. In time, this identity came under attack through threats of repeal, and the city had to struggle to retain a positive self-image. Ultimately the community used an image of morality to preserve Evanston as an upper-middle class community, but once morality lost its ability to shape political action, Evanston shifted to a focus on economic revitalization to preserve this upper-middle class identity.

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177 **The Effects of Exercise on Stress and Quality of Life in the Mentally Ill**

Amal Shakir, University of Illinois at Chicago Advisor: Kathryn Engel, MA
Field: Exercise

There is a broad range of research in support of the idea that exercise can alleviate symptomatic behavior for the chronically mentally ill, yet more research and application of findings remain pending. Stress is a common factor in both social and environmental situations which can make vulnerable populations, such as the mentally ill, more susceptible to physical comorbidities. This study will examine the relationship between exercise and stress and quality of life for chronically mentally ill people. Participants from a large, suburban mental health center who exercised about 5 times a week took the Perceived Stress Scale and Quality of Life Scale at pre and post intervention. Data collection is currently ongoing and will be analyzed using a repeated-measures analysis of variance (ANOVA). The likely implications of this research will be to help improve the quality of the exercise program offered at the facility.

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178 **The Great Convergence: Emerging Coalition of Meaning between the Chinese Communist Party and Ding Ling**

Zhiyu Shang, Northwestern University Advisors:Robert Launay, Ph.D.
Field: Biological Anthropology Melissa Macauley, Ph.D.

Recent research on Chinese politics and history over-simplifies the ties between the Chinese Communist Party (CCP) and intellectuals in the 1930s into two assumptions. First, the CCP always had a coherent ideology. Second, the intellectuals were pre-disposed to this ideology because of left-leaning thoughts. This paper is a case study of the CCP and Ding Ling, the most famous female intellectual, and one among the 40,000 intellectuals who converted to the CCP in the 1930s, when China was in chaos of colonization and warlordism. The paper compares narratives of both sides to suggest that these assumptions ignore a dynamic process of emerging meaning. This paper, following John and Jean Comaroff's study of religious conversion, suggests that Ding Ling experienced a double conversion. She converted politically and personally. Ding Ling attributed the chaos to problems in the Chinese culture. She felt powerless and meaningless because she was part of the old culture and had no way out. In 1933, Ding Ling joined CCP claiming that she eventually decided to convert from an independent revolutionary to a meaningful "screw" of the revolution. This paper challenges Foucauldian power theory and Bourdieu's practical theory in that both sides' demands and perspectives were mismatched. The mismatched encounter led to an unexpected and emerging cultural paradigm, which promised to solve national chaos, an emerging personal identity to Ding Ling as an empowered and meaningful comrade of national salvation, and an emerging feminist ideology of the CCP to incorporate all females, including intellectuals, into a nationalist narrative, instead of only advocating for female workers' rights. This paper explores the process in which intellectuals' quest for cultural meaning transformed into a particular political paradigm. It

further presents a deeper look into the regional politics, which could be shaped by and shaping the cultural and intellectual sentiment for meaning.

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179 **Tooth Loss Positively Predicts Cardiovascular Disease Risk in Adult Filipino Women**

Junzi Shi, Northwestern University Advisor: Chris Kuzawa, Ph.D.
Field: Biological Anthropology

Cardiovascular disease (CVD) is a growing global epidemic. Recent studies have shown that CVD is negatively associated with oral health, reflecting the propensity of oral fauna to cause systemic inflammation, which in turn thickens the arterial walls. Oral fauna corresponds closely to oral lesions resulting from tooth loss. This study's primary objective was to investigate the association between tooth loss and CVD controlling for relevant covariates related to lifestyle, and to evaluate the possible mediating role of C-reactive protein (CRP), an inflammatory marker. Measures of tooth loss, anthropometry, disease history, pathogen exposure, income, and urbanicity ranking were evaluated as predictors of CVD in 1619 women participating in the Cebu Longitudinal Health and Nutrition Survey in the Philippines. Maximum likelihood logistic regression models were used to predict CVD risk in women who developed CVD after age 20. Extreme tooth loss, defined as greater than 25 teeth missing,was the strongest predictor of elevated CVD risk [OR= 2.11; p< 0.018]. Two candidate pathways were considered, a) inflammation, which is caused by bacteria entering the bloodstream from oral lesions; b) obesity, which may occur due to edentulous individuals eating softer, higher caloric foods. First, waistcircumference, a measure of obesity, was tested as a possible mediator but did not appear to be asignificant predictor of CVD. Next, when CRP was taken into account, the association between tooth loss and CVD became stronger and more significant [OR= 2.17; p<0.015]. Nonetheless, tooth loss was not predictive of CRP, and CRP was positively, but not significantly, correlated with CVD risk. These results underscore the need for additional research on the potential mediating role of inflammatory markers to determine how tooth loss is associated with elevated CVD risk in the Philippines.

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180 **Drone Strikes and the Discourse of Ungovernability in Pakistan's Tribal Regions**

David Showalter, University of Chicago Advisor: Jennifer Pitts, Ph.D.
Field: International Relations

In this paper, I attempt to make sense of the Central Intelligence Agency's unprecedented and covert campaign of airstrikes by unmanned aerial vehicles (UAVs or "drones") in Pakistan's Federally Administered Tribal Areas. After first giving the history of offensive drone aircraft, I describe the rapid expansion of the drone campaign into Pakistan, first under President George W. Bush and continuing (and even accelerating) under President Barack Obama. I also detail the response of the Pakistani government to the attacks. Because the program remains officially classified, and because no attempt at justification under domestic or international law has ever been provided for the campaign, I turn for explanation to the contemporaneous concern within the American defense apparatus with "ungoverned areas," of which Pakistan's tribal regions are the exemplar. Through a close analysis of both the Defense Department's final framework on "ungoverned areas and threats from safe havens," and the RAND monograph from which the framework draws much of its theoretical substance, I enumerate a number of deficiencies within the current doctrine on ungoverned areas. Not least among these is the inability of the framework to account for the drone strike campaign—the most prominent component of American foreign policy in the ungoverned area par excellence. This disjuncture between official doctrine and actual policy demonstrates the perils of reflexively classifying (and thereby insulating and legitimating) the activities of American military and intelligence agents, and illuminates changing notions of sovereignty and state authority in contemporary international politics.

181 **Birth Size and Maternal Nutrition During Pregnancy Predict Blood Pressure in Filipino Adults**

Anita Shroff, Northwestern University Advisor: Chris Kuzawa, Ph.D.
Field: Biological Anthropology

Background- An adverse uterine environment is thought to program blood pressure (BP) later in life, most likely due to fetal undernutrition.
Methods and Results- This study draws on a large sample (n=1632) of Filipino young adults aged 20-22 to examine the relationships between systolic blood pressure (SBP) and diastolic blood pressure (DBP) to birth weight and maternal nutritional status during pregnancy. The data for this analysis come from the Cebu Longitudinal Health and Nutrition Survey (CLHNS), a community-based birth cohort study in Cebu City, Philippines begun in 1983. The baseline maternal survey was given at 30±4 weeks gestation and the children were surveyed at birth and through childhood into adulthood. A series of linear regression models were used to examine the relationship between SBP and DBP to birth outcomes, maternal nutritional status during pregnancy as measured by triceps skinfold thickness, and maternal dietary intake during pregnancy while controlling for socioeconomic status, age, height, and BMI of the young adults, and other confounders. Birth weight was inversely related to SBP in males, and birth weight and length were inversely related to DBP in males. Maternal triceps skinfold thickness was inversely related to SBP and DBP in males and to DBP in females. Components of the mother's diet during pregnancy had varying relationships with the young adult BP of male and female offspring.
Conclusion- Maternal nutritional status and dietary intake during pregnancy have implications for offspring's BP regulation later in life.

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182 **Asians with Disabilities Outreach Project Think-Tank (ADOPT)**

Gaurav Singh, University of Illinois at Chicago Advisor: Rooshey Hasnain, Ph.D.
Field: Employment Policy Reform

"Asians with Disabilities Outreach Project Think-Tank," or ADOPT, is designed to help the vocational rehabilitation (VR) agencies increase their capacity to help Chicago-based Asians with disabilities (AWDs) gain meaningful access to the state VR system, and to increase the quality training and workforce opportunities through culturally and linguistically relevant outreach efforts. Compared to other ethnic and racial minorities with disabilities, AWDs are under-represented in the U.S. rehabilitation and disability system. In Illinois the proportion of Asians being served by the state VR system is less than 1.09%. These numbers are alarmingly low, given the large population of AWDs in the Chicago area—4.1% of whom are working-aged. To address this service gap, ADOPT has established a strong network of Chicago-based immigrant and disability groups to support AWDs who are striving to achieve self-sufficiency, community integration, and a better quality of life. ADOPT's central purpose is to identify outreach strategies that VR, city and state officials, Asian businesses and community-based providers can implement to help Asian jobseekers with disabilities secure access to employment and training opportunities in their communities. Our success will be measured through the increased number of AWDs using DRS and new partnerships with both the private and nonprofit sectors that address the key issue. The information collected for this project will be used to develop a toolkit highlighting culturally-relevant outreach strategies, recommendations, and best practices that can help bridge the service gap in the Asian American community in the greater metropolitan Chicago area.

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183 Embodied Authority: Medical Choice and Decision Making in San Ignacio, Belize

Kathryn Smiley, Northwestern University Advisor: Rebecca Seligman, Ph.D.
Field:Medical Anthropology

Any casual observer of Belize will easily note the presence of multiple medical paradigms, mainly Mayan medicine and biomedicine. The holistic, ethnobotanical philosophy of Mayan medicine draws a sharp contrast with biomedicine, which is the paradigm used by the medical establishment in Belize. As the second largest urban area in Belize, residents of San Ignacio have no issue accessing Western medicine.Medical authority in San Ignacio lies neither within the biomedical establishment nor the traditional healers, but instead rested within individual's personal knowledge and sense of health. People in Belize use their embodied understanding of health to guide their medical decision making, simultaneously choosing to reject the standard practice of both Mayan and Western medicine. Self-diagnosis and home remedies are extremely common, not because people do not have access to other forms of treatment, but because people trust their own embodied knowledge of health more than any outside authority. Through an analysis of original ethnographic research with twenty participants, this study demonstrates that knowledge of traditional medicine and alternative forms of treatment are increasing in San, Ignacio. In fact, anti-globalization sentiment and a general distrust of Western profit-driven systems are fueling the search for other solutions.

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184 The Impact of Psychological Utility on Group Affiliation

Suzanna So, University of Chicago Advisor: Joshua Correll, Ph.D.
Field: Social Psychology

Most individuals tend to be members of multiple groups, but groups may vary in their capacity to adequately fulfill one's needs (e.g., acceptance needs). Recent research has referred to this capacity of groups as psychological utility (Correll & Park, 2005). Depending on the context (e.g., when individuals experience social rejection), certain attributes of groups may seem more appealing or appropriate to the perceiver (e.g., warmth). These characteristics may then influence the groups individuals affiliate with. Therefore, we predict that participants will judge groups differently depending on state of need. In this study, undergraduate students were randomly assigned to recall a time when they felt excluded or powerless. Next, participants were given profiles of two groups and informed that they would work with one of the groups in a subsequent session. The members of one group were described as friendly and the members of the other group were described as competent. Then, participants rated both groups and indicated which group they would prefer to work with. As predicted, excluded participants rated the friendly group more favorably than the competent group, and preferred to work with them in a subsequent session. Compared to the excluded participants, powerless participants rated the friendly group less favorably and the competent group more favorably, although the patterns were not statistically significant. Thus, there appears to be initial evidence demonstrating that participants will prefer groups that provide the most utility for their current state of need. By serving specific needs, ingroups may serve as a social resource for individuals.

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185 Gender differences in event reporting: The role of positive automatic thinking

Emily Stuart, Loyola University Chicago Advisor: Colleen Conley, Ph.D.
Field:Positive Automatic Thinking

Previous research has supported the effects of positive automatic thinking in promoting mental health (Missel & Sommer 1983). Positive automatic thoughts have been found to be negatively associated with depression (Burgess & Haaga, 1994), and anxiety (Ingram, 1995).Further, studies suggest that positive automatic thinking is correlated with decreased depression in response to

negative events (Lightsey, 1994). Few studies have investigated the buffering effect of positive automatic thinking on negative events, or how this relationship may be moderated by gender. The present study hypothesized that increased positive automatic thoughts would buffer the effect of negative life events on perceived stress. Additionally, it tested the hypothesis that gender will moderate these effects.
College students (n=1083, 70.9% female, M age = 18.48) completed measures positive automatic thinking, perceived stress and the stressful life experiences. A series of hierarchical multiple regression analyses was conducted to test the three-way interaction among gender, positive automatic thinking and stressful life experiences predicting perceived stress. The three-way interaction was significant (B=.14, p=.03). Further analyses revealed that there were nonsignificant differences between males and females (|Bs|<.07, ps >.11). Across gender, stressful life experiences were predictive of perceived stress for both high positive automatic thinking (B=.46, p<.001) and low positive automatic thinking (B=.53, p<.001). These results suggest high levels of positive automatic thinking may act as a buffer against perceived stress in response to stressful life events.

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186 **Examining and Comparing the Most Used Coping Strategies of High School Freshmen and Seniors**

Sarah Suh, Northwestern University Advisor: Steven Wood, Ph.D.
Field: Psychology

Research on coping strategies, especially among adolescents, has been relatively new. Research on coping strategies, however, is becoming more significant because anxiety and stress are becoming larger parts of teenagers' lives, perhaps indicating that they are using inefficient coping strategies. It is crucial for adolescents to learn proper coping methods before becoming more independent, especially before leaving for college. The purpose of this study was to determine the most used coping strategies of high school freshmen and seniors and to see if there are any differences in their methods of coping. Results were intended to reveal if students leave high school with efficient coping methods necessary for maintaining good mental health. A validated questionnaire was distributed to 113 freshmen and 159 seniors. This validated questionnaire analyzed the use of three different coping strategies: Problem Solving, Seeking Social Support, and Avoidance. A two-proportion z-test was used to analyze the most used coping strategies. The results indicate that the most used coping strategies for freshmen were Seeking Social Support (42%) and Avoidance (42%) equally, while seniors used Avoidance (52%) the most. Freshmen used Seeking Social Support significantly more than seniors (p=.004) and seniors used Avoidance significantly more than freshmen (p=.021). Results and previous research indicate that adolescents could benefit from using more efficient coping strategies, making it necessary for the creation and implementation of effective intervention programs for adolescents' coping with stress in the future.

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187 **CHILD OBESITY INGRAINED IN BLACK AND HISPANIC CULTURE**

Claudia Telles, University of Illinois at Chicago Advisor: Rosa Macias, Ph.D.
Field: Public Policy

Over 64 percent of Americans are obese; Blacks and Hispanics have the highest rates of obesity and are 50-20 percent more prevalent to obesity than whites. 1 out of 3 children and adolescents are considered obese. I have read a series of scholarly articles in relations to culture, food policy, school policy, obesity, rates of obesity among races, and the effects of these specific policies. The findings on these literatures have been substantial to assume many institutions are abiding by the policies but yet have still managed to interpret the policies to their own personal benefit and disregarding Americans health. Not only are policies affecting Black and Hispanic youth but their culture seems to

be endorsing this health epidemic. Obesity is increasing at an alarming rate and is seriously affecting today's young generation. We are in dire need of reforming and creating policies where these children and adolescents can be guaranteed a future without obesity and major health issues. The new and reformed policies need to be implemented in order to avoid institutions from affecting young Black and Hispanic children.

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188 **Priming Pathogens: Effects on Culture and Perceptions**

Cindy Teng, Northwestern University Advisor: Joan Chaio, Ph.D.
Field: Cultural Psychology

The culture-gene coevolution theory describes a positive correlation between geographical pathogen prevalence and the cultural attribute of collectivism across nations. Regions with higher prevalence of pathogens were associated with populations that display higher levels of collectivism (Fincher et al., 2008; Chiao & Blizinsky, 2009). Certain collectivistic behaviors such as heightened vigilance and avoidance of foreign pathogen risks could reduce introduction of new pathogens into one's community, which could be evolutionarily adaptive in regions of high pathogen prevalence (Tanaka et al., 2002; Hamamura & Park, 2010). The exposure to and one's perception of environmental health risks such as transmission of infectious diseases could influence one's behavior and attitudes, which could ultimately influence the development of certain cultural values. The current study examined the directionality of the pathogen-culture correlation on an individual level and determined if simulated pathogen risks elicit different cultural attitudes (individualism or collectivism), behaviors towards diseases, and levels of anxiety. Participants were randomly assigned to receive either health- or pathogen-salient pictorial primes. The pictorial pathogen prime consisted of 60 images of sections of the human body with visible symptoms of infectious diseases while the health prime consisted of 60 images of corresponding healthy body parts. Participants then responded to essay prompts related to either healthy living or infectious disease epidemics. Following the essay prime, participants completed surveys measuring levels of collectivism, perceived vulnerability to disease, and anxiety. We hypothesized that compared to participants primed with health concepts, participants primed with pathogen risks would show higher levels of collectivism, germ aversion, and statedependent anxiety. This study examined how simulated exposure to pathogen risks influences development of cultural values, attitudes towards diseases, and levels of anxiety. The findings from this research could contribute to our understanding of diversity and has implications in global health.

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189 **Solving the Bi-Equation: Differences in Sexual Behavior and Connectedness in Heterosexuals, Homosexuals, and Bisexual**

Timothy McAlister, Loyola University Chicago Advisor: Anthony Burrows, Ph.D.
Field: Sexual Orientation Development

The goal of the study was to examine differences in sexual behavior and connectedness to family, friends, work, school, and religion between different sexual orientations. An advertisement for the study was posted on various social networking sites with a hyperlink to the study. The participants completed a 15-20 minute survey via the internet. The survey consisted of topics such as sexual debut age, discourse of sexual identity to: friends, family, and others, and opinions about the fluidity of sexual orientation and within group differences and similarities. Participants had an opportunity to participate in a follow up study that will give them a chance to give more specific answers or explain prior answers or their point of view. Results showed that individuals of the same gender identities had more likenesses than members of the same sexuality orientation. Homosexual men that have a feminine gender identity show a significant lower sexual debut age than homosexual

men that had a masculine gender identity. However, all homosexual were more likely to have a lower oral sexual debut age than intercourse that involved penetration. Connectedness to others was higher in male homosexuals with a masculine identity compared to a feminine identity (feelings of love and respect). However, homosexual men with a masculine identity were less like to disclose sexual orientation to other. When it was disclosed, it was often to a female.Homosexual and bisexual individual were significantly more likely to feel that sexual orientation was fluid and not fixed.

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190 **Neglected, Rejected, and Controversial Statuses: The Relationship to Adolescents' Social Status Goals**

Ariana Vella, DePaul University Advisor: Yan Li, Ph.D.
Field: Adolescent Psychology

The consistent linkages social status has to adolescent behaviors (e.g., perceived popular to relational aggression, social preference to prosocial behaviors) underscores the significance of social status among adolescents but adolescents' desires to pursue a higher social status, namely social status goals, is not well understood. However, some social statuses are more concerned with social status goals than others: neglected adolescents are not too interested in their current status, while controversial and rejected adolescents actively pursue higher social statuses . In this present study, we investigated the differences in neglected, rejected, and controversial adolescents' endorsements of social status goals, specifically the popularity goal (e.g., the desire for perceived popularity) and the social preference goal (e.g., the desire for social preference). It was hypothesized that neglected adolescents would not endorse social status goals while controversial and rejected adolescents would endorse both goals. Participants included 54 neglected, 52 rejected, and 53 controversial adolescents from 6 th, 7th, and 8thgrades who completed a self-report measure assessing their social status goals. Their responses related to the respective social status goals were summed to form a final score representing the endorsement of that particular goal. Our findings indicated that adolescents who identified as either the neglected or the controversial social statuses were differentiated regarding their social status goals. That is, the neglected status was negatively related to both social status goals while the controversial status was positively related to the endorsement of both goals. The rejected status was not related to the pursuit of either social status goals. Results are discussed in terms of the pursuit of social status and the potential ramifications these pursuits may have on adolescent behavior.

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191 **Is Reassurance Seeking Specific to Depression?**

Lisa Wang, Northwestern University Advisor: Richard Zingbarg
Field: Psychology

The current study examined the psychometrics of a measure of Anxious Reassurance Seeking. Joiner and colleagues (1995) define Excessive Reassurance Seeking as a relatively stable tendency to frequently elicit reassurance about one's worth from close others despite previously receiving this reassurance. They further hypothesized that Excessive Reassurance Seeking is specific to depression. In contrast, Anxious Reassurance Seeking may be defined as a tendency to ask for reassurance based on apprehension about the future, worries, and decision-making. Although long discussed as a clinical phenomenon related to anxiety disorders, no one has systematically defined or measured it. In this study we developed and examined the psychometric properties of a self-report measure of Anxious Reassurance Seeking. One hundred and seven participants completed an anonymous online survey comprised of 11 self-report measures. The validity, reliability, and factor structure were examined. It was found to be highly reliable and contained two factors: Facet 1(engaging in reassurance seeking behavior) and Facet

2 (close-other annoyance with the reassurance seeking behavior). Both facets were highly correlated with worry. We also investigated whether Excessive Reassurance Seeking is specific to depressive symptoms or if previously neglected variables, like worry or Intolerance of Uncertainty, are better predictors. When worry was added to the model, depressive symptoms no longer significantly correlated with Excessive Reassurance Seeking. Then when Intolerance of Uncertainty was examined, it significantly correlated with Excessive Reassurance Seeking and depressive symptoms were no longer significantly associated. Taken together, these results suggest that reassurance seeking is not specific to depression as previously believed. Reassurance seeking extends beyond seeking confirmation of worth and approval to seeking assurance about worries. Moreover, even the association between depressed mood and reassurance seeking about one's worth and approval appear to be largely shared with worry and Intolerance of Uncertainty.

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192 **Growing Green: Urban Gardening and "Community" in the Humboldt Park Neighborhood of Chicago**

Emily Wright, Northwestern University Advisor: Timothy Earle, Ph.D.
Field: Anthropology

Urban gardens in Chicago are utilized for numerous purposes that vary depending on the neighborhood in which they are located and the people involved. For residents, urban gardens can beautify their neighborhood, provide a source of fresh food, offer a gathering place for events, and connect them to the natural environment. For developers, urban gardens may help attract newcomers to a revitalized area and administrators may use gardens to improve the city's image for external investors. In the case of Chicago's Humboldt Park neighborhood, the gardeners themselves have different intentions too, from increasing neighborhood security to growing ingredients for value-added food products. Although each of these social actors has a specific agenda, they all refer to the gardens as places that build, strengthen, and support the community. However, this notion of a single, united community becomes nuanced when viewing the gardens from a spatial perspective. This study examines five urban gardens in Humboldt Park as physical, representational, and symbolic spaces within the social, economic, and political landscape of the neighborhood and the city at large. Through interviews and participant-observation, I explore how Humboldt Park gardeners construct the space of the gardens and in doing so, how they perform their identification with a certain community. Humboldt Park, the heart of the Chicago Puerto Rican community and an area with increasing gentrification, provides a highly contested context in which to study the relations between people of different race, class, and age within the shared space of the urban garden.

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193 **Can island dwarfism explain the tiny brain of the Flores "Hobbit"?**

Lu Yao, Northwestern University Advisor: Robert Martin, Ph.D.
Field: Anthropology

The putative new Late Pleistocene hominid species Homo floresiensis, reported in 2004, differs from other Homo species in South-East Asia (H. erectus, H. sapiens) in having comparatively short stature and by far the smallest endocranial volume ever found in the genus. The initial explanation proposed was island dwarfism, an empirical generalization according to which large mammals evolve smaller size on islands to reduce resource needs. Since the Flores hominid was discovered, several apparent cases of brain size reduction have been published, but the island rule had not previously been applied to brain size. To determine whether island dwarfism applies to brain size as well as body size, volumetric and linear measurements were collected on skulls of pigs (n=66), deer (n=69), and

gibbons (n= 87), three of the most prevalent mammals indigenous to the South-East Asian islands and mainland regions. Scaling analysis of endocranial volume relative to body size reveals that there is no difference between island-living mammals and their mainland relatives. The island samples of adult pigs, deer and gibbons did not display dwarfing in brain size. Indeed, contrary to expectation, island dwarfing was not even observed in body size for pigs and gibbons of the region. Thus, these results suggest that island dwarfism cannot be invoked as a general principle to explain the tiny brain size of H. floresiensis.

Humanities

194 **Fact and Fiction: The Use of History in Alexandre Dumas' Valois Trilogy**

Anastasia Klimchynskaya, University of Chicago Advisor: George Hoffman, Ph.D.
Field: Literature/History

Alexandre Dumas, one of France's most prominent historical novelists, set out to depict the entirety of French history in fictional form, and yet his novels were criticized for their historical inaccuracy, while Dumas was accused of having "raped history." However, upon an examination of his works, it becomes apparent that Dumas was using history and fiction as a means to promulgate his own ideas, while the portrayal of history in his works is a reflection of the political situation and literary culture of the nineteenth century. The object of my research was to analyze several novels by Dumas and compare his portrayals of history to those found in the historical and literary sources he is known to have used. I discovered that Dumas' portrayal of history was not as unfaithful as it is believed to be. His novels are romanticized and exaggerated retellings of history, as is typical of the Romantic Movement in France. However, the way in which he portrays characters and their qualities is quite faithful to the sources. What has changed is the reasons for why the characters are portrayed this way. At a time when monarchy, class, and wealth were in question, Dumas went back to a time when all of those things were changing and being developed and rewrote them to present his own response to those questions. For example, the royalty of the sixteenth century was weak because Louis XIV had not yet said "I am the state," while Dumas' royalty was weak because he was writing at such a time of revolutions and social upheaval, yet those weaknesses are presented in a similar manner. Dumas is one of few authors to use history in such an extensive fashion, and these discoveries have the potential to shed new light on the exact role of history and literature in nineteenth-century France.

195 **Obstetrician-Gynecologists' Beliefs about When Pregnancy Begins**

Grace Chung, University of Chicago Advisor: Furr Carlin, M.D.
Field: Bioethics, Clinical Medical Ethics

Objective: To assess the incidence and predictors of obstetrician-gynecologists' beliefs about when pregnancy begins.
Methods: We mailed a questionnaire to a stratified, random sample of 1,800 practicing US obstetrician-gynecologists. The outcome of interest was obstetrician-gynecologists' views of when pregnancy begins. Response options were: At conception, At implantation of the embryo, and Not sure. Primary predictors were religious affiliation, importance of religion, and having a moral objection to abortion.
Results: The response rate was 66% (1154/1760). Half (57%) believe pregnancy begins at conception. Fewer (28%) believe it begins at implantation, and 16% were not sure. In multivariable analysis, considering religion the most important thing (Odds Ratio 0.5, 95% confidence interval 0.2-0.9) and

objecting to abortion (OR 0.4, 95% CI 0.2-0.9) were independently and inversely associated with believing pregnancy begins at implantation.
Conclusion: Obstetrician-gynecologists' beliefs about when pregnancy begins appear to be shaped significantly by whether they object to abortion and by the importance of religion in their lives.

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196 **Roots and Routes of the Polish Memoir**

Angelica Krajewski, Loyola University Chicago Advisor: Dan Vaillancourt, Ph.D.
Field: Polish Literature

Poland's great 19th century poet Cyprian Norwid wrote, "Neither a sword nor a shield is the nation's weapon; but a masterpiece is!" Indeed Polish writers—including the five Nobel Prize laureates in literature—have produced high quality works in numerous genres, including creative nonfiction, or memoir. Examples of strong memoirs include Laments (1580) by Jan Kochanowski, Memoirs (early 1690s) by Jan Pasek, Poland and Moscow (1864) by Apollo Korzeniowski, and A Year of the Hunter (1994) by Nobel laureate Czesaw Miosz. The memoir tradition is so rich in Polish culture that Miosz characterized Poles as having a "craze for memoir." Despite the artistic value of Polish memoirs and the popularity of the genre in Polish culture, the Polish memoir rarely appears in the scholarly work—and anthologies—of Western European and American writers. For example, no Polish memoir even cracks the top 36 of post-Renaissance European memoirs listed in Saul K. Padover, Confessions and Self-Portraits. Among many reasons accounting for the invisibility of the Polish memoir in modern scholarship is that, in the words of Marian Kaczmarek, "We do not yet have a history of Polish memoir and it will probably not be written soon." Our project aims to establish the Polish memoir among the world's leading memoir traditions. We examine the roots and routes of the Polish memoir, the roots of the tradition and the routes it took to establish itself. We respond to three questions: First, why is the Polish contribution to memoir overlooked in the history of world literature? Second, what are the roots of the Polish memoir, from its emergence at the end of the Medieval period to the partitioning of Poland in 1795? Third, what are the routes the Polish memoir traveled—its style and content—to establish a distinct ontology in the memoir genre?

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197 **Project Victory Garden**

Elias Majid, Loyola University Chicago Advisor: Charles White, Ph.D.
Field: Urban Agriculture

The problem of distance and ignorance are recurring themes in the faults of the modern food system. Food is grown in one location than shipped a great distance to the rest of society, locking in a spiritual, physical and mental distance from our food. This distance is inadvertently causing us to make blind choices about our food in daily life because of the physical and mental separation from food. In looking to immerse people to again interact with food, production of food will have to be adapted to contemporary urban standards. This project has been working to re-introduce food production on Loyola University Chicago's campus as a proxy to the city of Chicago. Where a container garden on a concrete terrace was created and evaluated. Two questions were evaluated 1) are plants in a container garden a viable source of food production, 2) Will the garden create a distinguishable increase in population in terrace space. Data of plant height and productivity were recorded to evaluate viability of the plant. Plants which fell within a 10% of the average growth height of the plant were deemed viable. Of The three plants evaluated for viability (tomato, bell pepper, and basil) only basil was found to be viable of container gardening. A garden effect on the local human population was observed during the Loyola welcome week where a new population of students was introduced to the space. As time increased human visitation of the treatment terrace and control leveled out however time spent in the garden increased as the days progressed. The acclimation of Humans to the space demonstrates the lack of knowledge

in interaction with food producing plants. Future studies will focus on selection on viable container garden plant species and further analyzing the human response to a container garden space.

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198 **TheSpatial Moment of Power**

Saul Moreno, M. Ajose, and P. Baulier, Illinois Institute of Technology
Field: Urban Planning Advisor: Marshall Brown, Ph.D.

The centennial of Daniel Burnham and Edward Bennett's 1909 Plan of Chicago, President Barack Obama's election, and Mayor Richard M. Daley's retirement are all landmark events in Chicago's recent history. Chicago has reemerged as a global center. This urban design project will envision the center of Chicago as a center of the world – what the sociologist Saskia Sassen called a "spatial moment of power." The site for the project is the Chicago Circle – a large highway in¬terchange located in the center of the city. The unrealized core of Burnham's 1909, which was intended to become a Civic Center for the city instead, is the third most congested traffic interchange in the U.S. The Circle has become an increasingly noticeable void surrounded by increasing density and massive transportation infrastructure including three highways, the CTA transit blue line, an interstate bus station, Union Rail Terminal, and the Chicago River. The myriad possibilities for reprogramming and redevelopment lead to the idea of a scenario planning exercise in which multiple futures can be explored for the site.
Scenario planning in urban design is a tool that activates the Nth dimensions of transformation, revision, and narrative. We must adopt the mindset and techniques of scenario planning – constructing multiple urban futures rooted in, though not beholden to current realities. By simply asking "What if...?," new possibilities for multiple realities begin to emerge. The Circle Interchange project explores a series of scenarios for a single, yet critical site in the city. It is a "creative conversation" generated from a field of questions about the future of Chicago. Though the topics and scales vary, all of them have potential implications for the site. Through a process of editing and revision, three lead scenarios have emerged: Chicago Social Stock Exchange (CSSE), First City / Worldtown, and The O Plan.

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199 **Beyond the "Morbid Gaze": Today's TV Doctors and the Crisis in Healthcare**

Monika Rastogi, University of Illinois at Chicago Advisor: Marsha F. Cassidy, M.A., Ph.D.
Field: Medical Humanities

When the medical drama first became a staple on network television in the 1950s, American audiences welcomed the projection of handsome, infallible physicians such as Dr. Kildare. Modern medical dramas reveal analogous leading figures; from the prodigious Dr. Meredith Grey to the unerring Dr. Gregory House, series creators are intent to retain a niche for the stereotypical physician hero though health care reform has redefined the physician's role in patient care. Previous studies support the claim of medical dramas serving as cultural reassurance to an audience troubled about the state of health care; however, no research has been conducted regarding the vastly disparate media portrayals of hospital-based care and care given in private practices. My research addresses this question by doing a comprehensive content analysis of randomly selected episodes of Grey's Anatomy, a hospital-based program, and Private Practice, a private practice-based program. The results show that the latter program's patients are more holistically treated and have a more personal doctor-patient relationship than their hospital-treated counterparts. Moreover, the physicians of Grey's Anatomy spend far more time dealing with financial and administrative concerns than those of Private Practice. Grey's Anatomy also devotes more time to displaying the patient's body in pieces, a phenomenon that televisual scholar Jason Jacobs terms the "morbid gaze." This study

interprets the morbid gaze as being a visual analogy for non-holistic patient care. Certain aspects of both dramas are remarkably similar; both attribute to the physician heroic qualities and depict him/her as the sole source of patient care, indicating that the physician's primacy transcends administrative and institutional limitations. Because television is a pervasive source of health care information for many individuals, these findings are critical in their identification of the underlying messages in today's primetime medical dramas.

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200 An Analysis of Limb Element Asymmetry in an Ancestral Puebloan Population

Kendra Sirak, Northwestern University Advisor: Erin B. Waxenbaum, Ph.D.
Field: Biological Archaeology

While a skeletal growth trajectory resulting in perfect bilateral symmetry is ideal, organisms, including humans, often deviate from this course of development. Previous research has revealed little evidence for a genetic basis of asymmetry; therefore, external stressors must be considered as factors that influence the development and maintenance of symmetrical morphological traits. This study examines the presence of fluctuating asymmetry (FA) and directional asymmetry (DA) in an Ancestral Puebloan population (919-1640 CE) and investigates some of the nutritional, pathological, and mechanical insults that may influence asymmetry in long bones. Because environmentally imposed stressors impacting skeletal asymmetry vary with age, the individuals (n=198) in this sample are divided into five age categories with asymmetry assessed using maximum length measurements of the humerus, radius, femur, and tibia.
Frequency distributions reveal a trend of DA favoring the right side of both upper limb bones, likely a result of hand preference for mechanical demands; lower limb bones show weaker trends of DA, resultant from even bilateral distribution of mechanical forces during bipedal locomotion. DA presents frequently in adolescents and adults; infants, buffered from mechanical demands as a function of age, exhibit symmetry or FA. Statistical analysis indicates significant levels of bilateral asymmetry in the humerus ($p < 0.01$) and tibia ($p < 0.05$). Consistent with previous findings, asymmetry in the long bones is influenced by environmental factors that reduce an organism's ability to produce symmetric morphological traits. This study provides evidence that external stressors may have impacted the development of bilateral asymmetry in this sample.

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201 Doctor Bertha Van Hoosen: "Surgical Daughters" and Mother-Love

Morgan Valenzuela, University of Illinois at Chicago Advisor: Jennifer Brier, Ph.D.
Field: History, Theories of Sexuality

Prominent Chicago-based doctor, Bertha Van Hoosen was born in 1863 at Stony Creek Farm, her family's ancestral home in Rochester, Michigan. A graduate of the University of Michigan (1884) Van Hoosen went on to settle in Chicago, briefly establishing her own private practice. Her presence in Chicago would mark the beginning of a distinguished career. From her first appointment as an emergency physician for the 1893 World's Fair she moved on to become head obstetrician at Northwestern University and later served as the first female faculty member at the University of Illinois at Chicago. She is recognized for her pioneer use of "twilight sleep" in childbirth and as the founder of the Medical Women's National Association (MWNA, 1915); additionally, she became head of obstetrics at Loyola in 1918. Though she operated as a woman in a man's profession, her closest and most significant personal relationships were with other women. Though Van Hoosen fits the generalized profile for a participant in a romantic friendship – one of a white, comparatively well-off/affluent, college-educated woman who never married – an examination of Van Hoosen's memoir (Petticoat Surgeon) and various letters to a student she mentored (a "Surgical Daughter", achieved in UIC's Special Collections) a unique facet to same-sex love is revealed. Historian and queer theorist,

Julian Carter's Mother-Love separates itself from framing all same-sex relationships as lesbian-esque relations and romantic friendships and provides a historical element in same-sex love. The application of Mother-Love to Van Hoosen's accounts of close relationships with female mentors, her own students, and her female family members provides a more accurate understanding of past same-sex relationships and provides insight to the broad realm of expressing affection that we tend to overlook in today's world.

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202 **Maternal Health and Nutrition in Ho, Ghana: a new way forward**

Allyson Westling, Northwestern University Advisor: Frank Tu, M.D., MPH
Field: Maternal Health and Nutrition; Public Health

Good nutrition is vital to a healthy pregnancy. In the city of Ho, Ghana, and its surrounding communities, this is a domain that is often overlooked in public health discourse. The Health Outreach and Peer Education (H.O.P.E.) Center, a community health center in Ho, has begun to broaden its maternal health services to this patient population. One major asset of the Center is its unique Childhood Nutrition Program. The project improves child malnutrition in the area by equipping mothers with the farming, nutritional basics, and food preparation knowledge they need to prepare healthier meals for their children. Already, rates of childhood malnutrition have been reduced as a direct result of this public health intervention.

The purpose of this research study was to better understand the nutritional knowledge, practices, and beliefs of pregnant women in the area to identify aspects of the Center's current Childhood Nutrition Program that could be expanded to meet the specific dietary needs of the maternal demographic. An individual, 40-item interview was conducted among 30 pregnant women, approximately half of whom had been patients at the H.O.P.E. Center and half of whom had neither been to the Center nor participated in the nutrition program.

The study found that women typically had access to a wide variety of nutritional foods. However, they often ate smaller amounts of their typical meal or avoided certain items because of their pregnancy. Many women could identify what foods were healthy for pregnancy, but many didn't know what constituted an unhealthy food. Most subjects indicated that they would be willing to participate in a program designed to teach them healthy nutritional practices during pregnancy and to adapt their diets accordingly. These results show that the H.O.P.E. Center's current nutrition program could be modified to meet the needs of pregnant woman in the Center's catchment areas. It can equip them with the knowledge that they need to make healthier nutritional decisions.

MENTOR RECOGNITIONS

Chicago area undergraduates are fortunate to have excellent support and mentorship from professors, postdoctoral fellows, graduate students, and peers. Students were invited to send in messages to express their gratitude for the guidance they have received in their research careers.

"*Thank you Dr. Hetling for all of your guidance and encouragement over the past year. You* never doubted our ability to make this idea a reality."
-Aimee Bobko, Amber Langston, Alex Rybczynska and Amanda Vicich, University of Illinois at Chicago

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Poster Assignments

Presentation Session I

1:00pm- 3:00pm

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