CONFERENCE PROGRAM

CHICAGO AREA
Undergraduate Research Symposium

April 26, 2008

Hermann Union Building, IIT
Chicago, Illinois

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

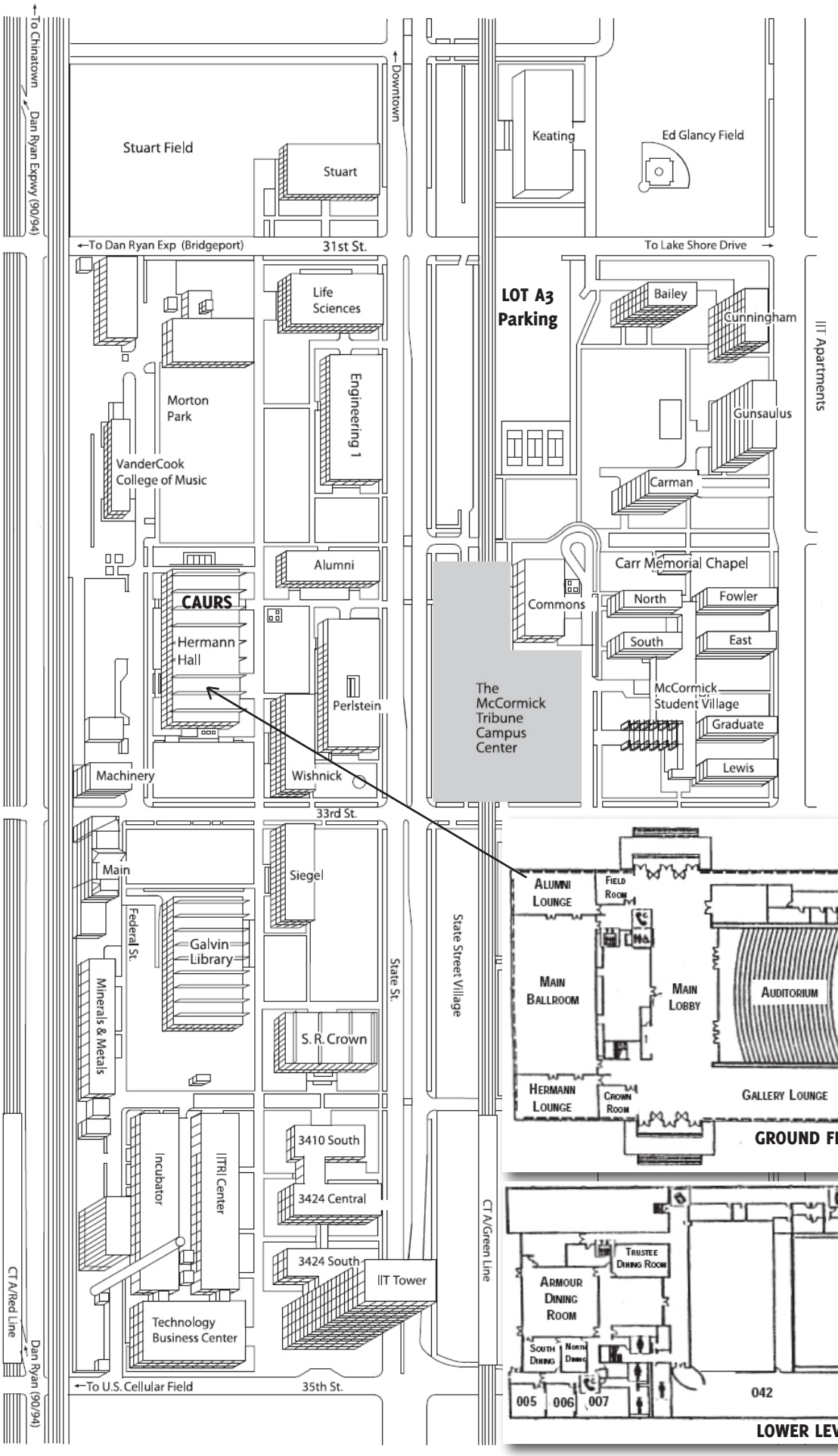
CHICAGO AREA UNDERGRADUATE RESEARCH SYMPOSIUM

April 26, 2008

10:00 - 10:45 a.m.	**Registration and Breakfast** *Main Lobby*
10:45 a.m.	**Opening Address** *Auditorium* Carlo Segre, Ph.D., Associate Dean for Special Projects of IIT Graduate College, and Professor of Physics
11:00 a.m.	**Oral Presentations (Please choose one room)** *Armour Dining Room, Trustee Dining Room, 006, 007*
12:15 p.m.	**Lunch with graduate/medical school information tables** *Main Lobby and Gallery Lounge*
1:15 p.m.	**Poster Presentations, Session I** *Collaboratory EXPO*
2:15 p.m.	**Coffee Break** *Gallery Lounge*
2:45 p.m.	**Poster Presentations, Session II** *Collaboratory EXPO*
4:00 p.m.	**Research Lecture** *Auditorium* Eric Brey, Ph.D., Assistant Dean of the IIT Office of Undergraduate Research and Assistant Professor of Biomedical Engineering
5:00 p.m.	**Banquet Dinner and Awards Ceremony** *Main Ballroom* Keynote Address by Chef Ben Roche Pastry Chef at Moto Restaurant and the Director of Research and Development at Cantu Designs

MAP

IIT Campus
Hermann Hall



Contents

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Founder:
Chandler Robinson

Advisor:
Thy Nguyen, Northwestern University

The Chicago Area Undergraduate Research Symposium would not have been developed without the help of countless people at all 6 participating institutions. In particular, we would like to thank the following individuals for their help and support:

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

Illinois Institute of Technology
Allan S. Myerson, Ph.D, P.E., Provost and Senior Vice President
Carlo Segre, Professor of Physics and Associate Dean of the Graduate College
Essam Abozid, Assistant Director, External Events & Summer Conferences
Erin Quinn, Catering Coordinator

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Brenda White, Department Assistant, University Career Services

University of Chicago
Robert J. Zimmer, Ph.D, President
Richard P. Saller, Provost

University of Illinois at Chicago
Lon Kaufman, Ph.D., Vice Provost for Undergraduate Studies and Dean of the Honors College

To CAURS participants, faculty, and guests,

Welcome to the 4th annual Chicago Area Undergraduate Research Symposium! This symposium was created to celebrate the efforts of undergraduate reasearchers 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 6 fine research institutions.

Every year, our event grows, both in numbers and in enthusiasm. We have our largest turnout yet this year, and we have been extremely impressed by the quality of submissions. As you take a look at a program, you can see a whole range of subjects, from Mexican indigenous history to aerospace engineering to neurovirology to mental health care. Our undergraduates yield from all 4 class years and all 6 six participating institutions, and some participants are even visiting from other institutions as well. We extend a warm welcome to everybody taking part in this year's event and hope you will gain much from attending this event.

We would also like to take this opportunity to show our deepest appreciation to the students who organized this event. The Chicago Area Undergraduate Research Symposium is a completely student-run event and requires months of careful planning. The students on the Inter-School Board are truly stellar individuals who have incredible achievements themselves. They have spent many hours planning the event and attending meetings far from their campus, especially during this year's long winter, and they deserve to be recognized heartily for their great work. And also a very special thank you to Xuan Kang and Manuel Lopez from IIT who have been incredibly dedicated host directors of the conference. We have been truly lucky to have the opportunity to work with such motivated and bright individuals who have made this event possible!

Of course, we are extremely grateful for the faculty members and administration who have supported our event. The fact that we have so many professors willing to advise research projects and judge at our event demonstrates their strong support for undergraduate research, and for that we give many thanks.

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!

Terrance Lee and Alice Tang
CAURS regional directors
Northwestern University

ILLINOIS INSTITUTE OF TECHNOLOGY

Transforming Lives.Inventing the Future.

April 18, 2008

Dear CAURS Participants and Visitors:

On behalf of Illinois Institute of Technology, welcome to the fourth annual Chicago Area Undergraduate Research Symposium. I am delighted that IIT is hosting and helping to sponsor this event and that IIT students are participants and organizers.

Undergraduate research is a vital part of a university's activity. Through research students can apply what they learn in the classroom and make informed decisions about their careers in science and engineering.

Today's events would not be possible without the efforts of the student organizers. Such an inter-institution event is challenging to coordinate and they have all done an outstanding job.

Congratulations!

Best regards,

John L. Anderson

www.iit.edu

John L. Anderson
President

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Office of the Dean of Students

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Facsimile: (773) 702-5846

April 15, 2008

Dear CAURS participants and visitors,

I am delighted that the Chicago Area Undergraduate Research Symposium is now in its fourth year. This event is a wonderful opportunity for students to present their research before an audience that is both critical and receptive.

Research is an essential activity of universities. At the University of Chicago, undergraduates learn from faculty for whom research is central to their professional work. Students' own experiences with research prepare them for the substantive contributions they will make in their future careers.

I congratulate the conference organizers who have worked together to create this event, and applaud the collaborative participation of so many Chicago-area colleges and universities.

Sincerely,

Susan M. Art

Susan M. Art
Dean of Students in the College
University of Chicago

Office of the President Northwestern University
Rebecca Crown Center
633 Clark Street
Evanston, Illinois 60208-1100

nu-president@northwestern.edu
Phone 847-491-7456
Fax 847-467-3104

NORTHWESTERN
UNIVERSITY

April 7, 2008

Dear CAURS Participants, Supporters and Guests:

On behalf of Northwestern University, I am delighted to welcome you to the fourth 2008 annual 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. Hopefully, some of you will 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 just four years, AURS has established chapters at twenty universities in the United States and Australia, and launched regional symposia in Chicago, St. Louis, Princeton and Melbourne, with a fifth planned for London. 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,

Henry S. Bienen
President

DEPAUL
UNIVERSITY

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1 East Jackson Boulevard
Chicago, Illinois 60604-2287
312/362-8890
FAX: 312/362-7577

April 26, 2008

Dear CAURS participants,

I am delighted DePaul University has joined the Illinois Institute of Technology, Loyola University, and University of Illinois at Chicago, Northwestern University and the University of Chicago in sponsoring the 4rd Annual Chicago Area Undergraduate Research Symposium. As a university that places a premium on teaching and applied learning, DePaul is proud to be part of such an innovative symposium that provides an outstanding opportunity for students to receive hands-on experience in presenting and discussing research projects in a professional environment.

Research entails not only the discovery, acquisition and dissemination of new knowledge but also the development of methodologies of inquiry, instruction and professional practice. It is my hope that today's interactions provide you not only greater insight into your fields of study, but also a deeper appreciation for the research process and how it benefits students, academia and society at-large.

On behalf of DePaul, I would like to thank all of the student organizers whose time and dedication made today possible. This cross-university collaboration is truly impressive and an undertaking that takes a tremendous amount of energy. I congratulate all of you and wish continued success with this richly rewarding event.

Sincerely,

Rev. Dennis H. Holtschneider, CM

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

FACULTY AND GUEST PRESENTERS

Carlo U. Segre, Ph.D., Illinois Institute of Technology

Associate Dean for Special Projects of IIT Graduate College, and Professor of Physics

Opening Address

Carlo U. Segre is the Associate Dean for Special Projects of the Graduate College of IIT and Professor of Physics. He received his B.S. in physics at the University of Illinois at Urbana-Champaign and his Ph.D. in physics at the University of California, San Diego. His postdoctorate work was done with Professor Mark Croft at Rutgers University in New Jersey. He has been on the IIT faculty since 1983 with a one-year sabbatical in Trieste, Italy at the International Centre for Theoretical Physics. He has over 70 referred publications and is a member of several professional societies including the American Physical Society, the American Association of the Advancement of Science, and Sigma Xi. His research interests center around the structure and electronic properties of complex materials including superconducting, magnetic and catalytic materials.

Eric Brey, Ph.D., Illinois Institute of Technology

Assistant Dean of the IIT Office of Undergraduate Research and Assistant Professor of Biomedical Engineering

Research Lecture

Eric Brey received his B.S. in chemical engineering from the University of Louisville and his Ph.D. in chemical engineering from Rice University. He did his post-doctoral work in the Department of Surgery at Loyola University Medical Center. Besides his many publications and contributions to books such as Principles of Regenerative Medicine, his accolades include a visiting professor appointment at Chang Gung Memorial Hospital in Taiwan and a 2004 International Society of Applied Cardiovascular Biology Young Investigator Award. His research interests include neovascularization, tissue engineering, cell-matrix interactions, and vascular imaging. His multidisciplinary research involves collaborations with scientists, engineers, and clinicians both domestically and abroad. Dr. Brey is highly supportive of undergraduate research and a wonderful source of support and guidance for young investigators.

Ben Roche

Pastry Chef, Moto Restaurant, and Director of Research and Development for Cantu Designs

Keynote Lecture

Twenty-two year old, Ben Roche discovered a fascination with science after creating Alka Seltzer "bombs" as a young boy in his best friend's kitchen in Beaufort, South Carolina. So it seems fitting that this young, aspiring pastry chef now finds himself working alongside Postmodern culinary star, Chef Homaro Cantu. At Moto where the kitchen resembles a lab with tanks of nitrogen gas, helium and liquid nitrogen being used daily in cooking techniques, Roche's love of science and his Johnson & Wales culinary degree are in perfect harmony.

Worlds away from Moto, Roche's first kitchen experience was in South Carolina during high school. He took a job as a dishwasher in a bakery and found himself peering over the pots, pans and suds to watch the chemical reactions in the baking process. He was hooked. After graduating from high school, Ben enrolled in the Baking &Pastry program at Johnson & Wales. While in culinary school, he worked at a pastry shop in the Italian Village neighborhood of Providence, Rhode Island. There he learned the importance of organization and efficiency and was promoted to night manager at the age of 18. His externship led him outside the country, to Hook, England one and-a-half hours northwest of London to an intimate, boutique hotel called Tylney Hall. In England, Ben learned the art of translating innovative ideas into delicious desserts, a skill that would be invaluable to him in the years to come.

With his pastry diploma in hand, Roche wanted to return to the United States and had his sights set on Chicago and Charlie Trotter's. After a short stint in Houston, he was given a two-day trial period to prove himself at Trotter's and that he did. He was brought on as a baker and after 8 months was promoted to the pastry team. His experience at Charlie Trotter's prepared him for the demands that he would face at Moto. Roche met Chef Cantu through a mutual friend and the two science-minded chefs hit it off immediately. The rest is history.

Now side-by-side in the kitchen at Moto, the two chefs rely on each other to make their zany ideas a reality. Every Tuesday they sit down with the rest of the culinary crew to throw out pie-in-the-sky menu ideas and to plot scientific ways of achieving them. Some of the latest winners to make it to the plate are a yuzu sphere and doughnut soup. As Roche explains, "Working in the kitchen at Moto is all about a new way of thinking. Many of the traditional principles of a dish are stripped away and inspiration comes from places other than cookbooks such as movies and art. Chef Cantu inspires us all to alter our thinking and stretch our imaginations."

UNDERGRADUATE PRESENTERS

Armour Dining Room

Bryant Priromprintr, Northwestern University
Smooth Muscle Myosin Heavy Chain (SMMHC) Structure, Function, and Role in Acute Myeloid Leukemia in the inv(16) Fusion Protein

Bryant Priromprintr is a senior at Northwestern University studying biological sciences and economics. He was born and raised in Riverside, California where his parents still reside. Bryant started his research in molecular biophysics with Dr. Ishwar Radhakrishnan in September of 2006, during the fall quarter of his junior year. His project has been focused on learning structural information about the C-terminal domain of the smooth muscle myosin heavy chain protein. His interests are not solely invested in research, however, as he is heavily involved in teaching, community service, and other leisurely activities such as golf. Bryant has explored his passion for teaching not only as a teaching assistant to undergraduate biology courses, but also as an instructor for a weekend science enrichment program for children ages 6-12. Bryant hopes one day to put these experiences to use by pursuing an MD/MBA degree and practice medicine as a pediatrician.

Amber Gibson-Knowlden, DePaul University
Online Social Networking Sites: The Creation of the Virtual Identity Utilizing Social Normatives of Sex, Gender, and Sexuality

Amber Gibson-Knowlden is a senior at DePaul University double majoring in Sociology and Women's and Gender Studies. Amber is also a student in the fifth year Women's and Gender Studies Graduate Program. She is currently studying the social implications of social networking websites and the creation of the virtual identity with regard to race, class, gender, and sexuality. After utilizing these sites Amber became concerned with the trends she observed centered around sex, gender, and sexuality. She plans to continue her study of social networking sites and online identities throughout her master's and doctoral research. She is also currently leading a project to create a socially conscious social networking site.

Outside of her academic work, Amber is committed to her activist work involving human and animal rights. Amber works with and supports Greenpeace, Amnesty International, and several animal rights organizations. She is the co-founder of the student based organization of Students for Animal Defense. In 2005, Amber was awarded the People for the Ethical Treatment of Animal's Proggy Activist of the Year award. Amber is also a wife and the proud parent of a 14 year old boy.

Zarah Carranco, University of Chicago
Moments that Define Indigeneity: A Historical Look at Mexico's "Indigenous Problem"

Zarah Krystine Carranco was born and raised in San Angelo, Texas. The daughter of Mexican immigrants who instilled in her a strong work ethic, Zarah came to realize the struggles facing

minorities at an early age. Zarah left west Texas to attend the University of Chicago and pursue a bachelor's degree in International Studies. While a student at the U of C, Zarah became deeply involved in community outreach and education programs which varied in scope – from being a Rape Victim's Advocate to serving as Service Vice President of Alpha Phi Omega, a co-ed service fraternity, to teaching arts and crafts to local children. It was through her course work at the University where she came to appreciate the importance of championing universal human rights, preserving and learning from our common histories and the beauty of her own Mexican cultural roots. At the end of her 2nd year, Zarah was awarded a Mellon Mays Undergraduate Fellowship; as a fellow she was presented with unique opportunities to pursue independent research in subjects of her own interest. Now a 4th year student nearing the end of her studies, the fruition of her research has culminated in a B.A. thesis that explores the history of the "indigenous problem" in Mexican society and politics. Zarah hopes to carry these lessons and accomplishments into her future endeavors.

Robert Whittlesey, Illinois Institute of Technology

Corner-flow separation and delaying the onset of stall in an axial compressor

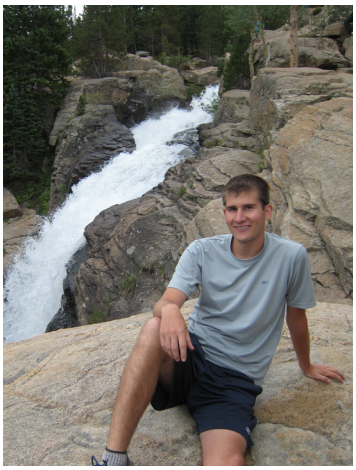
Robert Whittlesey is a student at the Illinois Institute of Technology pursuing a double-major in aerospace engineering and mechanical engineering. Robert grew up in Bellevue, WA, just outside of Seattle. From an early age, Robert spent a lot of his time near the water -- whether swimming, boating, or simply walking along the beach at his grandparents' cabin. From this, Robert became particularly interested in fluids and hence his interest in fluid dynamics. He first became involved in this project through his fluids course instructor, Professor Candace Wark who introduced him to Professor David Williams. Profs. Wark and Williams have served as co-advisors for the project, which Robert has been a contributing member since the beginning of his junior year. Robert continued work through the summer and into this year. Through this project, Robert has grown to thoroughly enjoy research -- tackling unique problems in innovative ways.

Robert's future goal is to attend graduate school to pursue a Ph.D. Graduating this May, he has selected the California Institute of Technology to attend in the fall and looks forward to addressing new research problems while there. His main research interest is in fluid mechanics, particularly biological fluid dynamics. He would eventually like to become a full professor, combining teaching and research together. In his spare time, Robert enjoys cooking, running (to offset the calories from cooking), and spending quality time with friends. He has also been known to paint.

Presenters

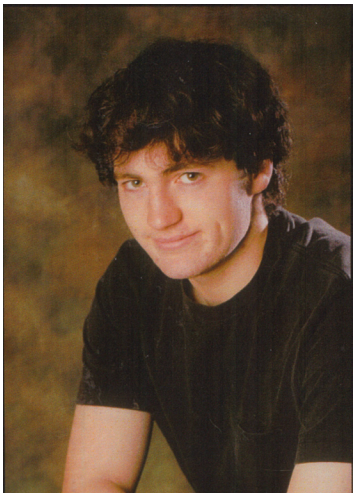
Trustee Dining Room

Brandon Merling, Northwestern University
Effects of Half and Half Addition on Antioxidant Power of Coffee



Brandon Merling is currently a sophomore at Northwestern University, majoring in Biomedical Engineering (B.S. expected June 2010), with a specialization in transport processes and tissue engineering. He was born and raised in Cincinnati, OH, where he attended Indian Hill High School. This is his first year as a researcher, thanks to Dr. Shelby Hatch's fascination with the chemical properties of coffee and Northwestern's Fellow Assistant Researcher Awards program, but plans to continue to expand his experience in the upcoming years. At Northwestern, he is heavily involved in Slivka Residential College, where he has served as an Associated Student Government Senator and currently resides as Facilities Director. Outside of Northwestern, Brandon enjoys many outdoor activities, including flyfishing, skiing, and whitewater kayaking.

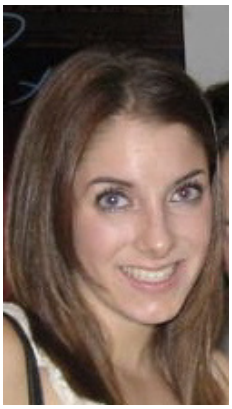
Brian Leahy, University of Chicago
Nano-thin Membranes: Manipulating the structure of Langmuir-type monolayers



Brian Leahy is a third year physics student at the University of Chicago, where he has made Dean's List every year since matriculating. He has worked with Binhua Lin's lab group since the summer of 2007. Before working with Langmuir monolayers, he researched the dynamics of colloidal suspensions. His current research involves studying the effects of vanishingly thin membranes under compression and various ways to manipulate their structure. He was born and raised in the city of Chicago and plans on staying there after graduate school.

Julia Fraser, Northwestern University
Buried by the Benta: Cemetery Patterning in Middle Bronze Age Hungary

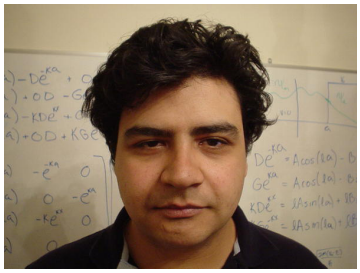
Julia Fraser is a senior anthropology major at Northwestern University.



At Northwestern, she became interested in anthropology while working as a research assistant to a linguistic anthropologist. After her sophomore year, she traveled to Hungary to work on the Szazhalombatta Archaeological Excavation, under the direction of Northwestern archaeologist, Dr. Timothy Earle and an international consortium of scholars. While in Hungary, she developed a research project on cemetery patterning during the Middle Bronze Age. The following year she was awarded Northwestern University's Undergraduate Research Grant and returned to Hungary to continue working on the project which would form the basis of her senior thesis in anthropology. In addition to academics, Julia was a four-year member of the varsity cross-country team at Northwestern. After graduation,

she hopes to find work as a contract archaeologist and apply to graduate school to study art and archaeology.

Charles Cherqui, Loyola University
Shape invariance and the exactness of quantum Hamilton-Jacobi formalism



Charles Cherqui is a senior at Loyola University Chicago. He will graduate this May with degrees in Physics and Mathematics. Charles arrived at Loyola with a real interest in participating in research. He focused on both math and physics in order to get all the tools needed to conduct research in theoretical physics. He began by attending weekly seminars led by the chair of the physics department, Dr. Asim Gangopadhyaya. That spring he started working with the chair in the field of supersymmetric quantum mechanics(SUSYQM). This would lead to his first publication in Physics Letters A, an internationally recognized peer reviewed journal. That experience led to new research opportunities on a variety of topics. He has begun work in theoretical astrophysics with Dr. John Dykla and on the history of modern physics with Dr. Aleksandr Goltsiker. Charles has also continued his research with Dr. Gangopadhyaya in SUSYQM .

Charles plans on attending the University of New Mexico this fall as a graduate student and teaching assistant. Though much of his undergraduate research has been concentrated in theory, he is determined to keep an open mind as he begins the next stage in his academic career. He is especially curious about low temperature phenomena and is eager to learn about the experimental side of physics. In his spare time he is an avid record collector and computer music enthusiast. This is his second year of participating at CAURS.

Room 006

Emily Jane Glassman, University of Chicago
Investigation of the Unimolecular Dissociation of CH3SO2

Emily Jane Glassman is a third-year student majoring in chemistry and biological chemistry at the University of Chicago. In 2006, she received an NSF Research Experience for Undergraduates grant to do physical chemistry research at Wellesley College. Since September 2006, she has been working with Dr. Laurie Butler at the University of Chicago, conducting both theoretical and experimental studies in the field of atmospheric combustion chemistry. In 2007, Emily Jane was chosen to be a Beckman Scholar. Most recently, she presented her research at the 235th annual American Chemical Society conference in New Orleans.

After graduating, Emily Jane plans to pursue a Ph.D. in atmospheric aerosol chemistry. She also plans to strengthen the ties between researchers and the community at large in hopes of achieving greater environmental awareness.

Presenters

Evelyn Salazar, Loyola University
The Family Grows: Beauty in Latin America

Evelyn Salazar is a Mulcahy scholar and senior at Loyola University Chicago. She is double majoring in Political Science and English Literature as well as minoring in Women's Studies. She is a member of Alpha Sigma Nu, Sigma Tau Delta, and Pi Sigma Alpha. She is fluent in Spanish and does volunteer work at her local church, Manantial de Vida. After graduation, Ms. Salazar plans to attend law school, where she will focus on immigration law.

For the past two years, Ms. Salazar has been conducting research with Dr. Dan Vaillancourt, Professor of Philosophy at Loyola University Chicago for his forthcoming book *Beauty: The Sources*, which will be the world's first collection of sources devoted exclusively to beauty. Their recent research on beauty in Latin American has culminated in a co-authored 3,000-word article, "*The Family Grows: Beauty in Latin America*," which has been accepted at the International Conference on Diversity in Montreal, Canada (June 2008). The article will also be submitted to the peer-reviewed International Journal of Diversity.

Vanessa Coffman, DePaul University
Earthworm Impacts on Restoration efforts in Buckthorn (Rhamnus cathartica) Invaded Soils

Vanessa Coffman is a senior completing a B.S. in Environmental Science with a minor in Chemistry at DePaul University. She has received both the Presidential and Clare Boothe Luce Scholarships and is a member of the Honors Program and the Dean's List. At DePaul she also finds time to play for the women's lacrosse team, is a teaching assistant and a member of Iota Sigma Pi. In 2006, Vanessa conducted research abroad in Kenya investigating human perceptions of wildlife in the Amboseli ecosystem. Her current research, and topic of her presentation today, involves the chemical impacts of invasive earthworms in buckthorn invaded habitats. When she's not in a lab coat, and even sometimes when she is, Vanessa enjoys traveling, Anderson Cooper, and spending time with friends. After graduation Vanessa will be returning to Africa to pursue restoration efforts in Sierra Leone and eventually enter a M.S. / PhD program.

Miriam Bodenheimer, University of Chicago
Characteristics of Successful Rural Development Projects in Aymara Communities in the Andes

Miriam is finishing her fourth year at the University of Chicago where she is pursuing a BA in International Studies with a focus on international development and human rights. She spent last academic year studying abroad in Seville, Spain, where she spent her days enjoying the beautiful weather, perfecting her Spanish, and taking classes at the University of Seville with Spanish students. After a brief return to the US, she next headed off to a small Andean town in Peru, where she held an internship with a small women's empowerment and microcredit NGO. Upon receiving a grant, she designed a workshop to teach impoverished women about basic business strategies and visited many rural neighborhood organizations to teach this

and other workshops – many of her classes were held outside along dirt roads. The conditions Miriam observed during her internship inspired her to analyze small-scale development projects in rural indigenous communities in the Andes for her Bachelor's Thesis. Although she is planning to continue working in the field of development, Miriam will spend the next two years working as a paralegal in Washington, D.C. for an international law firm.

Room 007

Tim Linden, Northwestern University
Using X-Ray Binary Models to Probe Electron-Capture Supernovae

Tim Linden is a senior at Northwestern University majoring in the Integrated Science Program and Physics. Growing up in Stow, Ohio, he has been intrigued by the sciences since a young age, and has slowly steered this interest towards theoretical physics. For the last two years, he has worked as a research assistant with Professor Vicky Kalogera on the topic of X-Ray binaries in starburst clusters, with the goal of eventually explaining the spatial distribution and effect of stellar metallicity on bright X-Ray sources in nearby galaxies. This research has allowed him to learn both about astrophysics and the role of computational modeling in research science. In addition to research he has enjoyed the opportunity this year to assist freshman as a physics tutor for the Integrated Science Program.

In order to procrastinate, Tim spends time watching Cleveland sports, surfing the internet, and competing in any pickup game he can find. He is looking forward to continuing his academic studies next year as a graduate student at the University of California, Santa Cruz.

James Daley, University of Illinois at Chicago
Population trends of birds in a developing metropolitan region

James Daley is a senior at the University of Illinois at Chicago majoring in Biological Sciences. His primary academic interests are in avian and urban ecology, plant-animal interactions and evolutionary biology. In future studies, he intends to continue investigating the interactions between avian assemblages and human-modified landscapes. James is passionate about finding ways to promote sustainable development that integrate research and habitat stewardship with grassroots organization and public policy. He strongly believes that conservation biology is fundamentally connected to issues of economic disparity and social justice. After graduation, James plans to pursue graduate work in ecology and a career educating and advocating for sustainable use of land and resources.

Michael Carlson, Loyola University
Phenomenology as Critical Theory

Michael Carlson is finishing his degree in English and Theology at Loyola University Chicago, graduating cum laude with departmental honors in both programs. He is a member of Sigma Tau Delta, international English honor society. His research is funded through Loyola University's Mulcahy Scholarship grant. The results of that research are being presented at this symposium. His research interests are inter-disciplinary and include but are not limited to 19th and 20th century British and

Presenters

American literature, post-modern theologies and how texts can interpolate both authors and subjects. Michael spent his junior year as a student at Trinity College Dublin where he studied British and Irish literature as well as Theology. He published an article in Trinity College's Literary Society publication. He was a member of Trinity College's Theological Society, Historical Society, and Literary Society during his year there, as well as the Orchestra Society. He plays jazz and orchestral trombone and has worked several summers at a fine arts camp. He was recently an intern in the office of State Senator John Sullivan. Michael grew up in Macomb, IL in a family of six and will be an uncle in October.

Nicole Baran, University of Chicago
Gender, Testosterone, and Risk Aversion in MBA Students

Nicole Baran is a third year at the University of Chicago pursuing a double major in Comparative Human Development, with a specialization in Comparative Behavioral Biology, and Economics. Her academic interests include biopsychology, human evolution, evolutionary social psychology, primate and animal behavior, game theory, and behavioral, experimental, and development economics. For the last year, she has been working with Luigi Zingales and Dario Maestripieri as a research assistant on the Templeton Chicago MBA Longitudinal Study team. This study has been investigating the economic, psychological, and behavioral determinants of economic success in the entire 2008 class of MBA students at the University of Chicago, Graduate School of Business. She also serves on the CAURS Inter-school Board. In her free time, she enjoys cooking, making jewelry, reading, swing dancing, shopping, and generally being social. After graduation, she plans to pursue a Ph.D. and remain in academia indefinitely.

BIOLOGY

1 In vivo magnetic resonance imaging with Gadolinium based contrast agents

Josh Abecassis, Northwestern University
Field: Biology Advisor: Dr. Thomas Meade, Ph.D.

Cardiovascular disease remains the leading cause of mortality in the United States. Synthetic grafts have shown promise in large blood vessel applications, but there has been very little success (43%) in small diameter blood vessels because of early graft occlusion due to thrombosis (i.e. clot formation). One successful approach to overcoming this problem has been to use a poly (1,8-octanediol cocitrate) (POC) based biodegradable scaffold seeded with a layer of endothelial cells. However, there is a need for a non-invasive, in vivo mechanism to assess cell seeded endothelial grafts. Our goal is to investigate the feasibility of using magnetic resonance imaging (MRI) as a noninvasive mechanism for long term in vivo tracking of the cell monolayer. To increase the contrast of the cell layer and allow for a more effective monitoring, cells are labeled with a recently developed Gadolinium-based contrast agent, C6-Gd. This helps to differentiate the cell layer from surrounding tissue, creating an innovative, non-invasive way to monitor the cell monolayer. Uptake and viability studies showed that the agent labeled the cell at 10 mM incubation concentration and did not adversely affect cell function. MR Imaging and relaxivity measurements have indicated that there is suboptimal brightness in the cell mass. This may be due to the subcellular localization of the contrast agent. If sequestered in an endosome, the diffusion of water is impeded, thereby limiting the intensity of the MRI contrast agent. We have investigated several methods to ensure our agent is more localized in the cytoplasm. For example, treatment with chloriqone will disrupt endosomal vesicles. This will result in an effective method for cellular labeling that maximizes signal intensity by promoting optimal cellular localization.

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2 Development of a mouse model through the use of the Cre/loxP system to study adult oligodendrocyte ablation

Kavin Arasi, University of Chicago
Field: Neurology Advisor: Brian Popko, Ph.D.

In order to study CNS demyelinating diseases resulting from oligodendrocytes (OI) cell loss, we sought to create a mouse model with the use of a Cre/loxP recombination system. Cre recombinase can be used to excise DNA fragments flanked by loxP sites facing in the same direction. For time specificity of Cre recombination we used the PLP/CreER^T transgenic mice, in which Cre is fused onto a mutated ligand-binding domain of the human estrogen receptor (Doerflinger *et al*., 2002) and is activated by intraperitoneal (IP) injections of tamoxifen. Furthermore, for tissue specificity, CreER^T is under the transcriptional control of the myelin proteolipid protein (PLP), which allows Cre recombination to occur specifically in oligodendrocytes of the PLP/CreER^T mice. We used the PLP/CreER^T recombination system to activate the expression of diphtheria toxin (DTA) in oligodendrocytes, which ultimately results in apoptosis of these cells. For this purpose, PLP/CreER^T mice were mated with ROSA/DTA mice to produce the PLP/CreER^T; ROSA/DTA mice, in which upstream eGFP and Neo sequences flanked by loxP sites prevent expression of DTA (Ivanova *et al*., 2005). Five week-old PLP/CreER^T; ROSA/DTA mice were IP injected with tamoxifen that induced oligodendrocyte ablation and demyelination through excision of the eGFP and Neo sequences throughout the CNS by 21 days post injection (pi). Eventually, these mice developed severe neurological problems and most died. Nevertheless, around 30% of the mice survived and showed a wild-type phenotype with normal OI cell numbers by day 70 pi, indicating remyelination. This process of remyelination is significant, as it

allows for further research into recovery of the CNS myelin-degenerative diseases in humans.

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3 **Impacts of leaves grown under elevated carbon dioxide on detritivore bacterial and fungal communities in a temperate woodland stream**

Amit Bansal, Loyola University
Field: Molecular Microbiology Advisor: John J. Kelly, Ph.D.

Global atmospheric CO_2 levels are increasing rapidly and are expected to double within the next 50 years. Such increases in atmospheric CO_2 have been shown to cause significant changes in plant growth and leaf chemistry. Since leaf litter serves as a major source of organic carbon for many stream ecosystems, changes in leaf chemistry have the potential to significantly impact the food webs of these streams. Our hypotheses were that growth of trees under the level of CO_2 predicted for the year 2050 (720 ppm) would result in differences in leaf chemistry, and that these chemical changes would result in population shifts within the aquatic bacterial and fungal communities colonizing these leaves. To test these hypotheses, three tree species common to northern Michigan, quaking aspen (*Populus tremuloides*), black willow (*Salix nigra*) and red maple (*Acer rubrum*), were grown under ambient (360 ppm; AMB) or elevated CO_2 (720 ppm; ELEV) for 6 years. Analyses of leaves revealed significant, species-specific changes in leaf chemistry with ELEV treatment in all three tree species. Senesced leaves were collected and placed into the East Branch of the Maple River in northern Michigan for fourteen days to become microbially colonized. Terminal restriction fragment length polymorphism (T-RFLP) analysis was used to analyze the composition of the bacterial communities (using primers targeting the 16SrRNA gene) and the fungal communities (using primers targeting the intergenic transcribed spacer region) colonizing the decomposing leaves. Non-metric multidimensional-scaling analysis of the T-RFLP data showed a significant impact of ELEV treatment on bacterial and fungal communities colonizing aspen leaves, but no impact of ELEV treatment on bacterial or fungal communities colonizing willow or maple leaves. Clone library sequencing revealed that fungal communities on aspen leaves were dominated by *Cladosporium* and *Cadophora*, with higher fungal diversity on ELEV leaves, and bacterial communities on aspen leaves were dominated by Bacteriodetes and Alpha and Beta Proteobacteria, with differences in community composition between AMB and ELEV leaves.

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4 **The role of NF-κB in islet allograft survival**

Cortlyn Brown, University of Chicago
Field: Immunobiology Advisor: Maria-Luisa Alegre M.D., Ph.D.

Autoimmune diabetes develops when the pancreatic β-cells that produce insulin are destroyed by the body's own immune system. Clinically, islet transplantation has the potential to cure type 1 diabetes eliminating the need for daily insulin injections. However, islet viability in the transplantation process remains a major obstacle. In addition to hypoxia, as a result of the isolation process, inflammatory cytokines including IFNγ, TNF, and IL-1β are implicated in early loss of β-cell mass after transplantation. One way to achieve a successful islet transplantation is to genetically engineer β cells to over-express survival factors. NF-κB is a ubiquitous transcription factor involved in the survival of many different cell types, but its role in the β cell remains to be determined. Our goal is to determine whether NF-κB facilitates the death or survival of transplanted islets by engineering β cells to express adenoviral vectors that activate or inhibit NF-κB. We have generated adenoviral-based constructs that encode for a constitutively active IKKβ (Ad-IKKβ-CA), a kinase involved in the activation of NF-κB and for a super-repressor IκBa (Ad-IκBa-SR), a molecule that prevents NF-κB nuclear translocation, respectively. As a model for β cells *in vitro* we have utilized the pancreatic β-cell line, MIN6. We have found that exposure to inflammatory cytokines promoted MIN6 cell

death. Ad-IκBa-SR transduction did not protect MIN6 cells from cytokine-induced cell death. Future experiments will investigate whether Ad-IKKβ-CA transduction will protect MIN6 cells from exposure to inflammatory cytokines. These data may lead to clinical applications where gene therapy strategies may be employed to enhance islet allograft survival.

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5 **BAXΔ2: A potent death molecule for cancer therapy**

Alex Bunce, Illinois Institute of Technology
Field: Cancer Therapy Advisor: Jialing Xiang, Ph.D.

It is well known that Bax (Baxa) is a pro-death protein and a tumor suppressor gene. BaxΔ2 is a new isoform isolated from a prostate cancer cell line, which has an exon 2 deletion from the most common form of Bax. However, it is not clear whether BaxΔ2 still has its pro-death ability. This function was determined by engineering a genetic construct consisting of the BaxΔ2 gene fused with a gene encoding green fluorescence protein (GFP), which was delivered to prostate cancer cells. A comparison of the function of BaxΔ2 and Baxa was then analyzed. A hemacytometer was used to count live and dead cells two days after transfection in order to calculate the death rate. Results suggest that the BaxΔ2 isoform more potently induces cell death then Baxa. BaxΔ2 also co-localizes to the mitochondria, which was determined by immunostaining. This suggests that both Baxa and BaxΔ2 have the same cellular target. Hopefully, an understanding of this gene will lead to advances in the area of cancer treatments.

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6 **The impact of corn (zea mays) on restoration efforts in buckthorn (rhamnus cathartica) invaded soils**

Chelsea Carey, DePaul University
Field: Restoration Ecology Advisor: Liam Heneghan Ph.D.

Considerable efforts have been devoted towards restoration of degraded prairie and savanna areas in the Chicago-land region. Continued attempts at successful restoration, however, have been hindered by the presence of invasive species, particularly European buckthorn (Rhamnus cathartica). Buckthorn invades natural areas by outcompeting native plants for resources resulting in the loss of biodiversity and an introduced buckthorn monoculture. Once established, buckthorn alters the soil chemistry dramatically. Most notably the soil has elevated inorganic nitrogen levels, altered C:N ratios, elevated pH, and elevated moisture content. These changes leave a legacy affect long after the buckthorn monocultures are removed, thus hindering restoration efforts. Due to its high nitrogen requirement, corn (Zea mays) was planted in an attempt to decrease soil nitrogen levels and reestablish pre-buckthorn soil chemistry. This study examines the potential for corn as a tool in restoring ecosystem properties to pre-invaded conditions.

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7 **Earthworm impacts on restoration efforts in buckthorn (*Rhamnus cathartica)* invaded soil**

Vanessa Coffman, DePaul University
Field: Ecological restoration Advisor: Liam Heneghan, Ph.D.

In an effort to manage and restore native habitats in the Midwest, buckthorn (*Rhamnus cathartica*) has been a substantial obstacle. Soil beneath buckthorn has higher percentage of nitrogen and carbon, modified nitrogen mineralization rates, elevated pH, and soil moisture than those areas where buckthorn is not present. These belowground alterations appear to favor the invader while reducing the viability of the native species, ultimately resulting in a decimation of the native flora. In addition to the impact of buckthorn on the native plant community, buckthorn also imposes another, less well understood, indirect effect on the ecology of invaded systems. This is through its

facilitation of another nonnative suite of species, namely European earthworms (*Lumbricus* spp). Earthworms, in turn, are known to chemically and physically alter their environments, which promotes their own survival. The simultaneous and mutually reinforcing invasion of two species [in this case, buckthorn and earthworms] is referred to in literature as an *invasional meltdown* and this meltdown has been verified in Chicago's woodlands and prairies. While much is known about buckthorn's specific contribution to the degradation of native lands and the chemical processes associated with generalist detritivores, that is, earthworms, little is known about how buckthorn and earthworms simultaneously alter soil properties in these specific habitats. Utilizing terrariums, or mesocosms, ecological impacts of earthworms and buckthorn were examined in a greenhouse for the equivalent of one summer growing season. Specifically, changes in pH levels, plant-available nitrogen concentrations, total carbon and nitrogen concentrations, cations and anions essential for plant growth, and leaf letter decomposition were measured. The preliminary results of this study suggest that there is indeed a mutualistic relationship between the two invasive species, one that may have substantial consequences for natural area restoration with the presence of one invader exacerbated by the presence of the other.

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8 **Population trends of birds in a developing metropolitan region**

James Daley, University of Illinois at Chicago
Field: Ecology and Evolution Advisor: Chris Whelan, Ph.D.

Bird species respond differently to anthropogenic landscape modification, and may be categorized as increasers or decreasers in an urban environment. I analyzed the relative occurrence of bird species across a rural to urban gradient in northeastern Illinois by examining USGS Breeding Bird Survey (BBS) data for 23 routes. The BBS is the most comprehensive and large scale monitoring program of bird species in North America. The routes I examined included 14 in agricultural landscapes, 2 in moderately urbanized landscapes, and 2 in highly urbanized landscapes. Based on previous such analyses, I expected more urbanized sites to exhibit increased overall abundance and decreased species richness, and rural sites to exhibit lesser abundance and elevated richness, with both diversity and abundance peaking at intermediate sites. I expected increaser species to include rock doves, house sparrows, house finches and cardinals, and for these species to predominate in both highly and moderately urbanized areas. Species richness patterns followed predicted trends across the gradient, with diversity peaking in intermediate areas and declining in highly urbanized areas. However individual species that predominated were red-winged blackbirds, European starlings, common grackles and house sparrows; these species drove population trends across all sites. This is likely due to the highly agricultural character of the rural Midwest. In subsequent analyses, I intend to analyze these population trends in relation to geographic patterns of conversion of agricultural to urban environments.

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9 **Herpes simplex virus type 1 induces filopodia in neural cells to facilitate viral surfing**

Rohan Dixit, Northwestern University
Field: Neurovirology Advisor: Deepak Shukla, Ph.D.

Herpes simplex virus type-1 (HSV-1) is a neurotropic virus with significant potential as a viral vector for multisynaptic pathway tracing and CNS gene therapy. This study provides visual evidence that recombinant HSV-1, altered to express green fluorescent protein (GFP), can "surf" along dendrites in differentiated P19 neuronal-like cells to efficiently reach the soma. The virus also promotes cytoskeletal rearrangements which facilitate viral spread in vitro. These cytoskeletal changes are characterized by often dramatic increases in both dendritic and glial filopodia, which viral particles may also surf along while targeting the cell. Viral surfing, cell infection and new filopodia induction

were each reduced by the actin polymerization inhibitor cytochalasin D, suggesting the involvement of the actin cellular cortex in these processes. The observation of neuronal cytoskeletal reorganization in response to HSV-1 may shed light on the mechanisms by which acute viral infection associated with herpes encephalitis produces cognitive deficits in patients.

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10 **Establishment success of the parasite *Acanthocephalus dirus* in relation to egg density and prior infection status**

Daniel Elke, DePaul University
Field: Behavioral Ecology Advisor: Timothy Sparkes, Ph.D.

Parasite infection typically results in negative effects on hosts. However, negative effects of parasite infection are not restricted to the hosts. In some cases, multiple parasites infect the same host and these parasites have negative effects on each other. The acanthocephalan parasite *Acanthocephalus dirus* undergoes development from the egg to the adult stage inside the body of an aquatic isopod, *Caecidotea intermedius*. The parasite then completes its life cycle in the body of a stream-dwelling fish, such as a creek chub. In this lab-based experiment, juvenile isopods were exposed to leaf material that contained different densities of *A. dirus* eggs for 24 hours (5 or 10). After this time, the isopods were fed parasite-free food for 30 days. We then dissected the isopods and compared establishment success in relation to prior infection status (presence or absence of one or more parasites). We found that neither factor influenced establishment success, which was approximately 22% across all groups.

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11 **Defining the mechanism of gene recruitment to the nuclear periphery**

Alexander Froyshteter, Northwestern University
Field: Molecular Biology Advisor: Jason Brickner, Ph.D.

Nuclear architecture has important roles in the regulation of gene expression. DNA in the eukaryotic nucleus exhibits spatial organization that can rapidly change in response to transcriptional and developmental cues. Studies in yeast and other organisms have found that certain inducible genes are dynamically recruited to the nuclear periphery when transcriptionally active. These findings suggest that proximity of the DNA to the nuclear periphery could play a role in regulating gene expression. Therefore, a fundamental understanding of how genes are recruited to the nuclear periphery can shed insight into how cells target DNA to a specific nuclear location and the functional implications of this controlled targeting event. We are using the yeast *GAL1* gene as a model system to dissect the molecular requirements of gene recruitment to the nuclear periphery. Using a candidate approach, we have classified four broad categories of non-essential proteins that might be involved in recruiting genes to the nuclear periphery: which include 1) nuclear pore components, 2) chromatin remodifying proteins, 3) nucleoplasmic motor proteins, and 4) other nuclear periphery proteins. Using a gene deletion technique based on homologous recombination, we have generated a collection of null mutants and analyzed the requirement of these protein candidates in *GAL1* gene recruitment. By means of a quantitative chromatin localization assay, we have found a subset of nuclear pore components and chromatin remodifying proteins to be required for gene recruitment to the nuclear periphery. These results suggest that the nuclear pore complex is the site to which active genes are recruited and that chromatin modifications may play a key role in targeting of active genes to the nuclear periphery. The significance of studying the mechanisms of gene localization can be imperative to uncovering the biological pathways involved in medical conditions linked to the alteration in chromatin spatial organization.

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12 The effects of protease inhibitors, ALLN and E64d, on different stages of *P. falciparum* gametocytogenesis

Samrawit Goshu, Loyola University
Field: Drug development Advisor: Kim Williamson, Ph.D.

Human malaria is caused by four species of *Plasmodium*; *P. falciparum* being the one that causes the most mortality. The malaria parasite has two life stages: sexual and asexual. The parasite completes its sexual stage in the mosquito and the asexual stage in a mammalian host. Dr. Williamson's Lab is interested in the sexual life cycle of *Plasmodium falciparum* and strategies to block transmission of the parasite from the human host to the mosquito vector. Many of the available anti-malarials do not inhibit development of sexual stage parasites and therefore the persistence of gametocytes after drug treatment allows continued transmission of the disease. The current project focuses on observing the role of proteases in gametocytogenesis and oocyst formation. To test this, we evaluated the effects of drugs that have been shown to inhibit specific classes of proteases, including E64D, ALLN, ALLM, SAK1, SAK2, JCP104 and Epoxomycin on an in vitro culture of parasitized red blood cells. Preliminary data indicate that inhibitors of cathepsin-like cysteine proteases, SAK1 and SAK2 do not block oocyst production, while papain-like cysteine protease inhibitor, E64d blocks oocyst production and the cleavage of gamete surface protein, Pfs230, but does not reduce gametocyte formation. In contrast, preliminary data suggests ALLN inhibits oocyst production, Pfs230 cleavage, and gametocytogenesis. The only other compound tested that blocked gametocytogenesis is proteasome inhibitor, Epoxomycin. This data suggests that proteosomes, not cysteine proteases, are required for gametocyte production and could be good targets for transmission blocking drug development.

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13 Impacts of long term biosolids addition on an Illinois agricultural soil

Tanya Grancharova and Katherine Policht, Loyola University
Field: Microbial Ecology Advisor: John Kelly, Ph.D.

The wastewater produced in our homes and businesses is not safe for direct release into the environment, so it must be treated prior to release. In urban and suburban areas wastewater is generally treated in large-scale wastewater treatment plants (also known as sewage treatment plants). Biosolids, which are composed mainly of dead bacterial cells, are a by-product of wastewater treatment that requires disposal. One option for the disposal of biosolids is to apply them to soil as a fertilizer. Biosolids should be effective fertilizers because they have high nutrient content. However, there are some concerns about the land application of biosolids due to the fact that some biosolids can contain material (e.g. heavy metals) that can have a negative impact on soil bacteria, and soil bacteria are important because they are the key drivers of the nitrogen cycle, which controls the availability of nitrogen to plants. In this study we evaluated the long term impacts of biosolids additions at a field site in Will County, IL established by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC). The site is an agricultural field used for corn production, and biosolids have been applied annually to the site at five different application rates for a period of 10 years. Our results indicated that biosolids additions resulted in increased concentrations of soil nutrients (phosphorous and nitrogen), increased corn yield, and a significant increase in the rate of nitrification, a key step in the nitrogen cycle driven by soil bacteria. In addition, our results indicated that long term biosolids additions did not result in significant increases in chromium, cadmium, or nickel, and only the highest biosolids application rates resulted in significant increases in zinc, copper, and lead. Future work will examine the composition of bacterial communities in these soils to assess the impacts of biosolids additions on these communities.

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14 A Study of the *CUE2* Gene and the Formation of Prion Aggregates

Joan C. Hufana, University of Illinois at Chicago
Field: Genetic Research Advisor: Sue Liebman, Ph.D. and Anita Manogaran, Ph.D.

Found to be the cause of Creutzfeldt-Jakob disease in humans, "Mad Cow" disease in cattle, and Scrapie in sheep, prions are proteinaceous infectious particles. In prion disease, a protein misfolds and takes on a stable conformation. The altered protein can further convert normally folded protein, into the altered form. These misfolded prions form large stable aggregates. A greater understanding of how prions behave on a molecular level has been greatly enhanced by the study of prions in *Saccharomyces cerevisiae*, or budding yeast. In yeast, the [PIN+] prion is caused by the misfolded form of the Rnq1 protein. Like mammalian prions, [PIN+] is infectious and aggregates. Fusion of the *RNQ1* gene to the green fluorescent protein results in distinct cytoplasmic fluorescent foci in [PIN+] cells. Many studies have focused on chaperones, which assist in protein conformation and are required for the maintenance of the [PIN+] prion. A large scale screen of 4800 non-essential gene deletions have shown that only the Hsp104 chaperone is required for [PIN+] maintenance. Interestingly, a deletion in the *CUE2* gene results in claw-like fluorescent aggregates, when RNQ1: GFP is over-expressed instead of distinct foci. A newly made *CUE2* disruption confirmed this altered aggregation phenotype. While the function is still unknown, the Cue2 protein has been shown to bind to ubiquitin. I am currently testing the effects of Cue2 over-expression on the [PIN+] aggregate and trying to understand whether cue2- binding of ubiquitin plays an important role in the aggregate phenotype.

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15 Claudin-7 correlates with breast carcinoma histological grade but not with outcome

Ekaterina Khramtsova, University of Illinois at Chicago
Field: Pathology Advisor: Andre Kajdacsy-Balla, M.D., Ph.D.

The claudin family of proteins is important in epithelial cell tight junction formation and function. Normal breast epithelial cells have strong expression of claudin-7. Previous publications have shown an inverse correlation of claudin-7 immunohistochemical expression and breast cancer histological grade. However, no formal study has been performed to investigate whether claudin-7 immunohistochemical expression can be used as prognostic marker.
A total of 438 consecutive women with primary invasive breast cancer underwent surgery for breast cancer between 1974 and 1995 at Vancouver General Hospital. Outcome data was available for all patients. A tissue microarray was built with duplicate 0.6 mm cores. Claudin-7 immunohistochemistry was performed and scored using the HercepTest algorithm. Any discrepancies between the five observers were resolved by consensus review.

There was an inverse correlation between Elston grade and claudin-7 expression (Spearman Pearson coefficient $r = -0.16$, $p < 0.05$). There was no difference in survival curves when patients were stratified according to claudin-7 expression (Log rank test, $p=0.35$). Correlation between claudin-7 expression and axillary node positively was direct and marginally statistically significant ($p=0.0485$, Wilcoxon rank-sum test). Higher claudin-7 expression was present in lymph node positive cases. We found no correlation with tumor size (Spearman Pearson coefficient $r = 0.03$).

Even though tumors with high claudin expression (3+) had better histology grade on average, they were associated with lymph node metastases. Without computer-assisted image analysis claudin-7 expression cannot be used as a prognostic marker for breast cancer, but we are currently reanalyzing Claudin-7 expression using a commercially available imaging system (Aperio ScanScope). Automated analysis of TMA is based on optical density of chromogen detected antigen.

16 Transmission of an Acanthocephalan egg stage parasite in relation to diet preference of its intermediate host

Darin A. Kopp, DePaul University
Field: Behavior Ecology Advisor: Timothy C. Sparkes, Ph.D.

The parasite, *Acanthocephalus dirus*, undergoes development in its intermediate host the isopod, *Caecidotea intermedius* and reproduces in its definitive host a creek chub or sunfish. After fertilization occurs mature females parasites, containing eggs, pass out of the body of the fish and fall to the substrate of the stream. Consequentially, the parasite lifecycle repeats when the isopod consumes *A. dirus* eggs. Research has shown that infection of the intermediate host can affect its behavior in ways that increases transmission to definitive hosts. In contrast, little is known about the potential for *A. dirus* to influence transmission from its egg stage to the intermediate host. Since the parasite is transferred trophically, we examined the possibility of the parasite to affect feeding behavior of juvenile isopods. Four test groups were used, each consisting of a leaf and a parasite that varied in sex and developmental stage. Across all four groups, leaf material was fed upon more than parasite bodies; however a comparison of the number of feedings on the different parasite groups revealed that there was significantly more feeding on mature female parasites. This could indicate an isopod preference for mature female parasites, which in turn could benefit the parasite by increasing infection success and rate of egg dispersal.

17 Treatment delay in acute coronary syndromes: Bad things happen to those who wait

Melissa Lara, Loyola University
Field: Nursing: Acute Coronary Syndromes Advisor: Holli A. DeVon, Ph.D., R.N.

The purpose of this study is to describe gender differences in time to treatment in the emergency department during an episode of acute coronary syndromes and to examine factors which may predict delay in seeking treatment. The conceptual model was designed by the authors and postulates that gender differences in the response to symptoms is based on the four domains of psychosocial, biological, physiological, and anatomical functioning. Degree of myocardial necrosis is related to the length of ischemic episode. Studies have shown that 40% of patients delay more than 6 hours resulting in little or no opportunity for myocardial salvage. The convenience sample comprised 112 women and 144 men that were admitted through the emergency department and hospitalized for acute coronary syndromes. Data were collected during structured interviews in each patient's room. Frequencies, means, and median time to treatment were analyzed. Regression models using predictor variables previously reported in the literature (age, income, race, diabetes, mood, and prior history of heart disease) will be constructed to determine impact on time to treatment. Mean time to treatment for women and men was 21.70 and 15.15 hours respectively. This was significantly different (p=0.05). Median times for women and men were 8.83 and 5.00 hours. Only 29% of the sample arrived in the emergency department within 2 hours of symptom onset. Predictors of time to treatment will be reported. These significant delays in arrival to the emergency department represent significant risk of sudden death and missed opportunity for effective reperfusion therapy. Knowledge of characteristics associated with delay may help nurses and healthcare providers target high-risk populations for education and behavior modification

18 **Effects of PPCPs on Adult and Juvenile *Procambarus clarkii*.**

Drew E. Lee, Loyola University
Field: Urban Stream Ecology, Ecotoxicology Advisor: Emma J. Rosi-Marshall, Ph.D.

PPCPs (pharmaceuticals and personal-care products) are a novel class of contaminants that are commonly detected in U.S. streams. However, their effects on stream ecosystems have only begun to be studied by aquatic ecologists and other scientists. Caffeine (a stimulant) and cimetidine (a histamine antagonist) are two PPCPs that are widely detected in U.S. streams. Caffeine antagonizes cAMP and adenosine; while, histamine regulates invertebrate stomatogastric and olfactory functions. We hypothesized that chronic exposure to these PPCPs would affect the life history and metabolic activity of *Procambarus clarkii* (crayfish). Adult crayfish were exposed to varying concentrations of caffeine or cimetidine for 6 weeks, and growth, mortality, egestion and basal metabolic rate (BMR) were measured. Juveniles were exposed to caffeine for 7 weeks, and growth and mortality were measured. For the adults, growth, mortality, and egestion were not significantly different among treatments; however, BMRs from the low concentrations were significantly lower than the control after 2 weeks, but not subsequently. For the juveniles, the Instantaneous Growth Rates for crayfish exposed to high caffeine was significantly lower than low caffeine concentrations and mortality was higher for juveniles exposed to low caffeine and medium caffeine concentrations than for those in the other treatments. These experiments suggest that these PPCPs affect *P. clarkii*, with juveniles possibly being more sensitive to PPCPs than adults.

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19 **SCN-enriched transgenic expression of *Clock*^{wt} restores circadian wheel running behavior in *Clock*$^{\Delta 19}$ mutant mice**

Samuel Lee, Northwestern University
Field: Circadian Rhythms Advisor: Joseph Takahashi, Ph.D.

Most organisms possess an endogenous circadian rhythm that drives the daily timing of biological functions and mechanisms with a period of close to 24 hours even in the absence of any environmental cues such as light. While most peripheral organs and tissues in mammals have circadian rhythms in isolation, the suprachiasmatic nucleus (SCN) is known to be the dominant circadian pacemaker that coordinates and synchronizes the peripheral circadian oscillators. A dominant negative mutation in the *Clock (Clock*$^{\Delta 19}$) gene, one of the primary transcriptional activators in the circadian feedback loop, results in a lengthening of the free-running period in mice along with the loss of their rhythmic wheel-running behavior in constant darkness. Previously, a bacterial artificial chromosome (BAC) was used to drive the transgenic overexpression of wildtype CLOCK in *Clock*$^{\Delta 19}$ mutant mice in order to rescue the aberrant circadian wheel running behavior caused by the *Clock*$^{\Delta 19}$ mutation. In the BAC transgenic mice, transgenic overexpression of *Clock*^{wt} mimics the spatial expression of endogenous *Clock*^{wt} gene expression, which results in the overexpression of *Clock*^{wt} in almost all tissues throughout the body. In order to investigate the roles and contributions of the SCN and the central nervous system in the control of circadian rhythms, we utilized the tetracycline transactivator (tTA) system to conditionally drive the expression of the *Clock*^{wt} transgene in a brain-specific and temporally-controlled manner in *Clock*$^{\Delta 19}$ mutant background mice. Our results show that the phenotypic state of the *Clock*$^{\Delta 19}$ mutant animals is dependent on *Clock*^{wt} transgenic expression and that overexpression of the *Clock*^{wt} transgene in the SCN and CNS of *Clock*$^{\Delta 19}$ mutant mice is sufficient in restoring their free-running period and circadian wheel running rhythmicity in constant darkness.

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20 Clot extrusion as an alternative mechanism for cerebral microvascular recanalization

Meghna Motiani, Northwestern University
Field: Neurobiology of Disease Advisor: Jaime Grutzendler, M.D.

Occlusion of cerebral capillaries by microemboli is common during human surgery and may occur spontaneously throughout life, although it usually remains asymptomatic. Typically, hemodynamic forces of the fibrinolytic system clear these occlusions. However, if this system fails to operate, prolonged occlusion of blood vessels will result in the disruption of synapses; it is unknown whether an alternative mechanism exists to reestablish vessel patency. To investigate this possibility, we have developed a model that monitors the natural course of emboli in-vivo, in the brain of a live mouse. This model induces fluorescent microclot/ microsphere embolization via the common carotid artery and tracks the movement of the clots using transcranial time-lapse imaging with two-photon microscopy. Our results indicate that while many clots wash out within the first day post-embolization, the remaining clots cause significant cessation of blood flow. At around 3 days, microscopy reveals intravascular leakage of the fluorescent clots into the surrounding tissue, suggesting that an opening in the Blood Brain Barrier helps to translocate the clots outside the vessel to reestablish normal flow. Interestingly, this data points to the discovery of a previously unrecognized protective mechanism of cerebral microvascular recanalization. Inefficiencies in this extracting mechanism may directly impact blood vessel viability and synaptic recovery. For humans, this degeneration may contribute to the pathological and age-related cognitive decline associated with Alzheimer's Disease.

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21 The W-curve: A 3D visualization of long genomic sequences

Samuel Master, Yacin Nadji, Illinois Institute of Technology
Field: Bioinformatics Advisor: Douglas Cork, Ph.D.

The W-curve is effectively used for visualizing long genomic sequences and finding global patterns without a priori knowledge of the sequence. A major shortcoming of the current gene mapping, search, alignment and treeing process is that they attempt to perform exact matches, or alignments. The representation of DNA sequences as strings contributes to the rationale for doing exact matches. While this matches nature in one way, it makes any sort of fuzzy matching difficult. The basic rule of fuzzy matching is to reduce the degrees of freedom within the problem space in trade for approximate matching. The problem here is that linear systems only have one degree of freedom. The W-curve describes DNA as a threedimensional curve. The multi-dimensional space allows for fuzzy matching and can be faster for locating genes within a chromosome. For example, long genomic introns and various long repetitive sequences can be quickly found when visualized using the W-curve. This is shown with the surrounding repetitive sequences in the Hba 1 and Hba 2 genes.

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22 Synthetic evolution of the TTG2 gene in *Arabidopsis thaliana*

Kara M. Nordin, Loyola University
Field: Developmental Molecular Biology Advisor: F. Bryan Pickett Ph.D.

Gene duplication events have enhanced the evolvability of organisms. Without these types of events, the mutational space that genes could explore would be limited by mutant impacts on the ancestral function of genes. According to the Duplication-Degeneration-Complementation model, proposed by Force, Pickett, Lynch et. al., subfunctionalization mutations could preserve duplicates through the accumulation of complementary mutations. However, epigenetic processes may provide an almost immediate partitioning of complementary functions between duplicates. To test this process, the promoter and 5' cis regulatory region of the gene Transparent Testa Glabra2 (TTG2), have been engineered into two separate expression vector constructs each containing a different fluorescent

reporter gene to construct synthetic duplicated genes. TTG2 codes for a WRKY transcription factor present in *Arabidopsis thaliana*. The TTG2 gene contains regulatory subfunction regions driving expression in trichomes, root cells and seed coats. Transgenics have been made to determine if TTG2 expression domains are epigenetically partitioned to various tissue locales. Epigenetic alterations of duplicate gene expression may precede mutational events and pre-adapt duplicates for retention.

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23 **Understanding Biodiversity: a biogeographic study of *Pteroglossus* aracaris**

Swati Patel, Northwestern University
Field: Evolutionary Biology Advisor: Jason Weckstein, Ph.D.

The Neotropics is the most biodiverse terrestrial ecosystem on Earth. Although previous studies have proposed hypotheses to explain the processes that resulted in such high species level of diversity, many questions still remain unanswered. To further understand patterns of speciation in the Neotropics, I am studying the evolutionary relationships and geographic distributions of the bird genus, *Pteroglossus*, which is a medium sized toucan that inhabits the canopies of lowland humid forests. First, to understand the evolutionary relationship between *Pteroglossus* species I am sequencing mitochondrial DNA and using this molecular data to reconstruct the phylogenetic history of the group using computer program PAUP*. Then, I am comparing this phylogenetic tree to the geographic distributions of these toucans by mapping the distributions of *Pteroglossus* species onto the phylogeny. Using these and other analyses, I am looking for barriers, such as rivers and mountain ranges that may be associated with the divergence of these species. Finally, I am making inferences regarding the spatial and temporal geological events that resulted in speciation of *Pteroglossus,* which are critical to answering the broader question of how such immense biodiversity arose in the Neotropics.

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24 **Light-Induced Repression of Direction Change in Moving Diatoms**

Alexander Pike and James Sbarboro, University of Chicago
Field: Physiological Ecology Advisor: Stanley Cohn, Ph.D.

Diatoms, a group of unicellular golden algae, are an essential component of aquatic ecosystems and contribute a significant percentage of earth's oxygen production. They are a fundamental source of food in almost all aquatic environments. Many diatoms are motile, and must be able to regulate their movement to maximize light absorption while avoiding photodamage and predators. Previous work has shown that exposure to high irradiation light at the leading end of diatoms, or lower level irradiation at the trailing ends, induces a rapid reversal of direction.

While our data showed that high irradiance exposure (>10^5 µmol/m^2/s) to the trailing end of cells did not cause a reversal of direction, we undertook further investigation to determine if such exposure affected subsequent leading end light exposures. Using three different diatom species (*Stauroneis phoenicenteron, Pinnularia viridis and Craticula cuspidata*), we subjected cells to high irradiation exposures at the trailing ends, and then subjected the cells to a subsequent high irradiation exposures at the leading ends, after various delays. The effectiveness of secondary leading end exposures to induce a direction change was then compared to control leading end irradiations. Irradiations were given at three different wavelengths (Blue-475 nm, Green-550 nm, Red-650 nm) to compare the sensitivities of cells to different light colors.

Trailing end Irradiations of *Stauroneis* cells caused significant repression to subsequent leading end irradiations, with maximal repression occuring 20 sec after initial exposure. This repression dissipated over time, with no repression of seen after 45-60 seconds. In *Pinnularia*, blue irradiations caused

repressions of subsequent leading end irradiations, but this effect was shorter lived (10-20 seconds) and was not observed with red or green light. Initial experiments on *Craticula* showed only weak if any repression. Such work indicates that diatoms exhibit a strong species-specific light sensitivity in their regulation of motility.

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25 **Smooth muscle myosin heavy chain (SMMHC) structure, function, and role in acute myeloid leukemia in the inv(16) fusion protein**

Bryant Priromprintr, Northwestern Univeristy
Field: Biophysics Advisor: Ishwar Radhakrishnan, Ph.D.

Smooth muscle myosin heavy chain (SMMHC) is a protein affected by inv(16), which fuses the C-terminal coiled-coil domain of SMMHC with a majority of the core binding factor β (CBFβ) transcription factor. inv(16) is the most common chromosomal inversion found in gene karyotypes of patients diagnosed with acute myeloid leukemia (AML). Current models propose that SMMHC, a type of myosin-II, a contractile protein found in smooth muscle cells of various organs of the body, exists as a bipolar dimer by way of a C-terminal coiled-coil and a globular Nterminal head with ATPase activity. The three-dimensional structure of the C-terminal tail has yet to be fully characterized by biophysical methods.

The focus of this project has been to study the C-terminal domain (CTD) of SMMHC. Here we analyze the nature of the SMMHC domain and provide some insight into the structure of the multimerization domain. NMR analysis of 13C and/or 15N labeled SMMHC suggests that the coiled-coil has a natively unfolded tail. Secondary chemical shifts also suggest that the extreme C-terminus samples alpha helical conformations, but is still rather unstructured. The remaining 125 residues forming the rigid structured coil produced no NMR signal. The structure of the remaining rod-like coil and oligomerization state of SMMHC was studied using analytical ultracentrifugation and crystallography. Velocity sedmientation experiments have been run at varying salt concentrations of 100 mM (low salt), 150 mM (physiological), and 200 mM or 300 mM KCl (high salt) because SMMHC demonstrates a strong salt dependence *in vitro* in order to multimerize and exist as coiled-coil dimer. Unexpectedly, Monte Carlo analysis showed that at lower micromolar concentrations of potassium chloride, SMMHC may exist as a globular monomer, aggregated filament, or in several heterogeneous dimer conformations. These findings both verify and add to currently existing hypotheses of the domain's structure. We hypothesize a novel mechanism for the formation of smooth muscle myosin filaments. Current models tell that filaments form as ordered anti-parallel dimers, which aggregate into tetramers, octomers, and so on, but we suggest that formation of filaments may not be as straightforward.

In order to completely resolve SMMHC's full three dimensional structure, we have been conducting crystallization trials. In the near future we hope to be able to use these protein crystals for X-ray crystallography in order to solve the rod domain's structure.

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26 **Parasite-related suppression of mating behavior in the stream isopod, *Caecidotea intermedius***

Lizbeth Rodriguez, DePaul University
Field: Behavioral Ecology Advisor: Timothy Sparkes, Ph.D.

We examined the relationship between mating behavior of the stream isopod, *Caecidotea intermedius* and infection by the parasite *Acanthocephalus dirus* (thorny-headed worm). Previous research on these organisms has shown that parasite infection correlates with suppression of male mating behavior. This mating suppression could be beneficial to the parasite if mating behavior

decreases exposure to predatory fish that serve as final hosts for the parasites. Here, we examined whether suppression of male mating behavior could be reversed by removing the organisms from their natural ecological context (i.e., in the absence of cues from the stream such as those from predatory final hosts). This type of reversal may be expected if suppression of mating behavior is costly for the parasite. Using a field-based experiment, we examined the mating behavior of infected and uninfected males over a 10-hour time-period. During this time, males were held either in the stream (i.e., with predatory final hosts present) or on the stream-bank (i.e., predators absent). Males were then exposed to females at 200, 400 and 600 minutes and mating behavior recorded. We found that infected males underwent a reversal of mating suppression during the first 200 minutes and that this reversal was maintained throughout the observation period. We also found that reversal was not dependent on holding conditions within the experiment. Thus, mating suppression is flexible in nature but this flexibility does not appear to be a direct response to local ecological conditions.

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27 **Effects of jasmonic acid and an endophytic fungus on plant resistance to an insect herbivore**

Lacy Simons, Truman College
Field: Biology Advisor: Yvonne Harris, Ph.D.

Tall fescue (*Lolium arundinaceum*) forms a mutualistic relationship with the fungal endophyte *Neotyphodium coenophialum*. The endophyte provides constitutive resistance to herbivores through the production of alkaloid compounds. Moreover, herbivore attack induces elevated synthesis of loline alkaloids; that is, the fungus also provides wound-inducible resistance for its host. Jasmonic acid and its conjugates are key signaling compounds in many plant species and play a role systemically in the up-regulation of defensive compounds within plants following attack by pathogens or herbivores. The purpose of our study was to determine if and how the plant and fungus respond to methyl jasmonate (MJ) exposure and if these responses interact in antagonistic or synergistic ways. Plants were exposed to MJ via gaseous diffusion within an environmental chamber. Response to MJ was assessed using an herbivore bioassay, GC-MS to quantify alkaloids, and real time RT-PCR to quantify RNA from a loline alkaloid biosynthesis gene. We found that MJ hindered infected tall fescue's resistance against insect herbivores by down-regulating transcription of the lolC gene. We found the opposite for uninfected tall fescue; its exposure to MJ resulted in a significant increase in resistance to an insect herbivore, apparently through stimulating defense compounds produced by the plant. These results indicate that MJ induces the production of defensive compounds by uninfected tall fescue when it lacks fungal infection while it compromises the ability of the fungus to provide protection from herbivores.

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28 **Parasite-related changes in feeding, antipredatory behavior and color of hosts**

Gary Sperka, DePaul University
Field: Behavioral Ecology Advisor: Timothy Sparkes, Ph.D.

In this experiment, the parasite *Acanthocephalus dirus* was observed in its isopod host *Caecidotea intermedius*. Trophically transmitted parasites (TTPs) are parasites that infect more than one host in their lifetime and depend on one host (final host) to consume another host (intermediate host) to complete this life cycle. TTPs often manipulate the appearance of intermediate hosts to increase conspicuousness to final hosts (e.g., color, behavior). Uninfected isopods typically have a dark brown body color while infected isopods tend to be much lighter in color. This lighter color exposes the host to predators (i.e. parasite's final host). In addition, infection status also influences antipredator behavior. Infected isopods tend to be found out in the open, where they are at high risk of predation. However, most of the previous research on this type of relationship has been done in the lab. We used a 5-month field survey to examine the relationship between infection status and color/behavior

modification in the field. Percent of color change, feeding behavior, and antipredatory behavior were measured in this experiment and we will present the results.

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29 **Investigating transcription silencing through determining the occupancy of TAFs at repressed and active promoters**

Alice Tang, Northwestern University
Field: Molecular Biology Advisor: Jonathan Widom, Ph.D.

When mechanisms responsible for the heritable repression of gene expression fail to halt transcription, the result is unregulated cell growth, leading to cancer. By understanding the mechanism by which transcription silencing occurs, it is possible to determine which events are responsible when repression fails to occur. We aim to accomplish this goal by studying the core promoter-recognition complex which consists of TATA box-binding protein (TBP) and the TBP associated factors (TAFs) which provide the stability for the core complex to bind to the promoter. This complex is the first transcription factor from the transcription-initiation complex to bind to the promoter, so its absence prevents subsequent attachment of necessary transcription factors to initiate transcription. Our lab has shown that the repression of transcription takes place at the level of the TBP recruitment, as the amounts of TBP at repressed promoters was significantly less than at active promoters. By analyzing the occupancy of the TAFs which stabilize TBP to bind to the promoter, we aim to discover which TAFs are responsible for the failure of TBP to bind at silenced genes.

Through ChIP assay using strains of *Saccharomyces cerevisiae* with each TAF TAP-tagged, we have been able to assess the occupancy of TAF6, TAF9, and TAF10 using traditional and Real Time PCR. We analyzed the naturally expressed mating locus (MAT) to test the degree of occupancy of each TAF at silenced and active promoters. From our results, TAF6 and TAF9 showed no significant trends when comparing repressed and active promoters. However, a strong correlation between relative occupancy of TAF10 and whether the promoter was active or repressed was evidenced. This suggests TAF10 is a key protein in determining whether TBP binds to promoters and transcription is activated.

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30 **Effects of aggregation suppression on toxicity in C. elegans models of protein aggregation**

Happy Thakkar, Northwestern University
Field: Molecular Biology Advisor: Richard Morimoto, Ph.D.

Aggregation of misfolded proteins is a hallmark of many neurodegenerative diseases, including Amyotropic Lateral Sclerosis (ALS) and the polyglutamine (polyQ) disorders. polyQ disorders are caused by abnormal expansions of a glutamine repetitive tract that induce protein misfolding and aggregation. Aggregates in familial forma of ALS arise from unstable, mutant Cu,Zn-superoxide dismutase 1 (SOD1) proteins that tend to form oligomers and filamentous arrays. Although aggregates have been observed to accumulate in parallel with the clinical course of these neurodegenerative diseases, studies to date have been unable to definitively establish if aggregation is causal, consequential, or incidental to neurotoxicity. A genome-wide RNA interference screen identified 67 suppressors of visible aggregates in polyQ and SOD1 *C. elegans* models. This study characterizes the consequences of polyQ aggregation suppression on toxicity. Animal movement, characterized by speed and coordination, serves as a readout for organism toxicity, and automated tracking software has been developed to this end. Motility assays suggest that the presence of visible aggregates is uncoupled from toxicity, lending credence to the hypothesis that polyQ-induced toxicity is not directly caused by aberrant protein-protein interactions facilitated by end-stage aggregates. A better understanding of the aggregation process, its regulation, and its link to toxicity

will provide insight into the mechanisms by which neurodegenerative disorders are triggered.

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31 **Studies on the interactions and responses of gram-negative bacteria carrying tetracycline resistance genes, with emphasis on agriculturally relevant compounds.**

Gustavo Untiveros, Ilinois Institute of Technology
Field: Microbiology / Molecular Biology Advisor: Douglas Cork, Ph.D.

Bacitracin, monesin, salinomycin, lasalocid and bambermycin are important feed additives used in the poultry industry due to their antimicrobial activities and used as dietary production enhancers. Initial studies in our lab have suggested loss of resistance and plasmid loss effects in some gram-negative bacterial classes. In the current study, six selected gram-negative poultry strains (3 Esherichia coli& 3 Salmonella enterica) with resistance to tetracycline and ampicillin (determined by antibiotic susceptibility testing) were screened for the presence of plasmid-borne tetR and ampR genes. Plasmid DNA profiling on agarose gel electrophoresis indicated sizes ranging from 3 to 50 kilobases in the selected strains. The plasmids were further evaluated for curing or decrease in copy number following in vitro exposure to various concentrations of the aforementioned feed additives. The compounds sodium dodecyl sulfate and acridine orange were additionally applied as known curing agents. More studies are now carried on for molecular characterization of tetracycline resistance gene(s) in bacteria of poultry importance. Usage of tetracyclines and antimicrobials linked to tetracycline resistance in both human and animal vectors can increase selective pressures and potentially result in the increased dissemination and transfer of tetracycline resistance genes. Tetracycline resistance is most often acquired due to the acquisition of new genes. Plasmids are ubiquitous extrachromosomal, double stranded DNA carriers of antimicrobial genes and these are all new and require careful sequencing for detailed phylogenetics further analysis.

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32 **Ascorbic Acid Enhances Sonic Hedgehog Signaling between Prostate Cancer Cells and Osteoblasts: Implications for Prostate Cancer Bone Metastasis**

Maria Valdovinos, Northwestern University
Field: Developmental Biology, Cancer Biology Advisor: Marilyn Lamm, Ph.D.

The major cause of mortality from prostate cancer (PCa) is metastatic disease for which there are currently no effective treatments. PCa metastasis occurs preferentially in the bone for reasons that are poorly understood. The key to understanding this favorable response for the bone microenvironment lies in characterizing the interactions between PCa cells and the host bone stroma including bone cell response and extracellular matrix (ECM). Previous studies have implicated Sonic hedgehog (Shh) signaling in the upregulation of Gli1 expression leading to osteoblast differentiation (OD), a requisite step in the formation of metastatic prostate tumors in bone (Lamm et al., 2005). Additionally OD is promoted by Ascorbic Acid (AA), a requirement for collagen synthesis in the ECM (Franceschi and Iyer, 1992). The role that the ECM plays in PCa cell-stromal cell interactions is poorly understood as well. This study investigated the possibility that AA and Shh play synergistic roles in PCa cell-osteoblast cell interactions leading to collagen synthesis in the ECM and subsequently, OD. Using a co-culture of Shh over-expressing PCa cells, mouse osteoblasts, RT-PCR, alkaline phosphatase staining (ALP) and fluorescent microscopy (FM) this study was able to demonstrate that AA enhances Shh-Gli1 signaling between PCa cells and osteoblasts 2) AA enhances Shh mediated osteoblast differentiation and 3) AA and Shh result in increased collagen deposition, indicating ECM maturation in preparation for OD. This research is important because it tests the idea that a collagenous ECM facilitates Shh-Gli signaling and OD. The data thus far suggest that the combined actions of AA and Shh may be a mechanism to promote osteoblastic tumor growth of metastatic prostate carcinoma. If this is the case, Shh and AA are potential therapeutic targets against PCa bone metastasis.

33 **Soil decomposition rates following carbon amendment and the physical removal of an invasive shrub (*Rhamnus cathartica*) determined by cotton strip assay**

Ryan Wietholter, DePaul University
Field: Ecological Restoration Advisor: Dr. Liam Heneghan, PhD

The invasive shrub *Rhamnus cathartica* has been detrimental to native species restoration efforts in the Midwest region. Previous studies have indicated that areas invaded by *R. cathartica* are associated with modified soil ecosystem properties. To further investigate these underground processes, a cotton strip assay was used to determine soil decomposition rates under various restoration treatments, following the physical removal of *R. cathartica*. Cotton strips were removed periodically, and tensile strength was determined to measure the rate of soil decomposition under each treatment. Tensile strength of the cotton substrates determined that soil decomposition rates are elevated under restoration receiving carbon amendment. Data is used to better understand whether *R. cathartica* has altered soil conditions to favor its own persistence, and to better understand were ecosystem processes are functioning during specific stages of restoration.

CHEMISTRY

34 **Solution phase magnetism of Fe_8**
Ademola Adekola Jr., Illinois Institute of Technology
Field: Physical Chemistry Advisor: Brant Cage

The purpose of this project was to synthesize and characterize the thermomagnetic properties of the single molecule magnet (SMM) Fe_8 in aqueous solution. Fe_8 has been shown to be a versatile Magnetic Resonance Imaging (MRI) contrast agent. We felt that an understanding of the underlying physical properties of this SMM in water may assist in the design of new contrast applications. Characterization of the synthesized product and comparison to literary data showed that Fe_8 was synthesized. An anisotropic energy of 30K was determined. We compared this to 24 K in the literature. NMR results of Fe_8 in aqueous solution showed a chemical shift with respect to water. These results indicate that Fe_8 may be suitable for MRI Spectroscopy applications.

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35 **Isothermal calorimetric study of amyloid β peptide 1-16 interaction with copper and zinc**
Siavash Behbahani and Pawel Zbyszynski, DePaul University
Field: Biochemistry Advisor: Lihua Jin

Alzheimer's disease is characterized by extracellular plaques that cause neurodegeneration. The major constituent of the plaque is the fibrillar form of the amyloid β (Aβ) peptides of 39-43 amino acids long. Physiological levels of copper and zinc ions have been shown to cause marked aggregation of Aβ peptides. Spectroscopic studies have identified metal ion coordination sites on Aβ peptides, binding affinity and stoichiometry, although discrepancies exist among various studies. To complement spectroscopic approaches and to obtain binding energetics, we have used isothermal titration calorimetry to examine the interaction of copper and zinc ions with Aβ-(1-16), the N-terminal portion of the longer Aβ peptide that is known to contain all the coordination sites for the two ions. Titration orders of metal ion into peptide and peptide into metal ion were carried out at pH 5.5 and 6.5 at several temperatures. Two stoichiometries were obtained for each ion depending on the injection order: two metal ions bound per peptide when the peptide was titrated into metal ion and one metal ion bound per peptide when metal ion was titrated into peptide. Analysis of the result suggests that two different binding modes were employed by each ion depending on the injection order. Copper binds more strongly than zinc. For both ions, binding was enthalpically driven; affinity increases with increasing pH, suggesting deprotonation coupled to binding, a result consistent with histidine participates in metal coordination. It was also found that prolonged incubation of the peptide with copper or zinc induces an additional slow process that is best explained by a conformational change, possibly, aggregation of Aβ-(1-16) which in turn increased the affinity of the peptide for the two metal ions.

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36 **Mechanism of MRI probes for zinc detection**
Rene Boiteau, Northwestern University
Field: Bioinorganic Chemistry Advisor: Thomas Meade, Ph.D.

Zinc(II) plays a central role in the nervous system including gene expression, neural signal transmission, and protein function. Consequently, Zn(II) concentrations are tightly controlled. Disruption in Zn(II) concentrations has been linked to many neurological diseases including Alzheimer's, Parkinson's, epilepsy, and stroke making Zn(II) an excellent candidate as a marker for tracing the progression of these diseases. Magnetic resonance imaging (MRI) offers a non-invasive technique for obtaining

three-dimensional images of tissues and organisms. We have developed probes that selectively bind to Zn(II) and activate to give an increase in the MRI signal intensity. To investigate the mechanism of activation, we have created a series of probes by systematically varying the Zn(II) binding groups. Two trends were observed. The first is the requirement of at least one carboxylic acid binding group to create a "dark" complex in the absence of zinc. Secondly, at least two binding groups are needed to bind Zn(II) to create the "bright" complex. These findings are important for developing Zn(II) probes with improved sensitivity or creating new MRI probes for the detection of other secondary messengers.

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37 **Optical gold nanoparticle based glucose sensor**

Milagros Calizo, Vrudhdhi Patel and Salil Benegal, Illinois Institute of Technology
Field: Biosensors Advisor: Sandra Bishnoi, Ph.D.

Nanoparticle based biosensors are becoming very useful due to their many properties including their optical properties. Our group explored using different gold nanoparticle systems for use in an optical glucose monitoring system. Au colloid (30 nm) and THPC functionalized Au (2-3 nm) were two systems that were explored. The Au seeds were enlarged with the introduction of H_2O_2 and $HAuCl_4$ and were measured using UV-Vis spectroscopy. It was found that there was good linearity at 530 nm for concentrations at 0 to 795 μM and at 525 nm for concentration between 15 and 105 μM for Au colloid and THPC Au, respectively.

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38 **A Modular Approach to Small Molecule-DNA Hybrid Synthesis**

David Dillon, Northwestern University
Field: Biochemistry Advisor: SonBihn T. Nguyen, Ph.D.

Over the last two decades, aggregated DNA hybrids have become the materials of choice in the development of new strategies for genetic detection, templated synthesis, programmed self-assembly, and molecular computing. Hybridized mixtures of materials containing multiple DNA strands, such as DNA-functionalized comb polymers and DNA-functionalized gold nanoparticles, have notably sharpened dehybridization, or melting, profiles compared to unmodified DNA: DNA duplexes. This enhanced melting property can be used to improve the selectivity for single-nucleotide polymorphisms and has been attributed to cooperative melting of neighboring duplexes that are within 20-40Å of each other. In this model, the hybridization of complementary multi-DNA materials was proposed to result in a network of 'parallel' DNA duplexes where the condensed ion cloud around each duplex can appreciably overlap with those of its neighbors. Under these conditions, the coalesced ion cloud stabilizes the duplexes, causing them to melt as a *cooperative* unit over a narrow temperature range, instead of participating in partial melting over much broader temperatures. Although aggregated hybrid DNA materials possessing narrow melting transitions are currently used in commercial applications, the fundamental parameters underlying the sharpened melting behaviors of these materials are not well understood. This paper describes the modular, 'click' chemistry-based synthesis of a library of small molecule-DNA hybrids (SMDHs) that can be used to unravel the extent that DNA spacing, orientation, and density affect the melting behaviors of hybrid DNA materials.

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39 **Synthesis and analysis of spectrally active molecularly imprinted polymers for the selective recognition of penicillin G-procaine**

David Dillon, Northwestern University
Field: Biochemistry Advisor: Börje Sellergren

Molecular recognition elements in the form of molecularly imprinted polymers (MIPs) could one day allow rapid, inexpensive screening of infectious diseases to become a simple bedside reality. Recent investigations have also explored the use of MIPs in catalysis, drug delivery, chemical sensing and separation, and screening of drug candidates, among many other applications. Of particular interest in pharmaceutical and environmental applications is the use of MIPs as stationary phases for the selective extraction of specific biomarkers from blood or contaminants from polluted water. To successfully be used in commercial and large scale applications, a reporting system must be coupled to MIPs to report both the successful binding of the specified analyte and the amount of analyte present. With this in mind, monomers were created with the dual abilities to specifically bind a model Penicillin analyte and signal this binding event with changes in their UV-vis and fluorescent spectra. This paper reports the selection of these spectrally active monomers and their subsequent polymerization into MIPs.

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40 **Investigation of the unimolecular dissociation of CH_3SO_2**

Emily Jane Glassman, University of Chicago
Field: Atmospheric physical chemistry Advisor: Laurie Butler, Ph.D.

As coal-burning technologies expand, introducing sulfur-containing molecules into the atmosphere, it is increasingly imperative to understand the reactions of the CH_3SO_2 radical. While the radicals and their dissociation products, CH_3 + SO_2, play a significant role in the atmospheric oxidation cascade of sulfur, the relative energy barriers for the dissociation of CH_3SO_2 have never been definitively determined experimentally. In this study, we have investigated the generation of this important radical, CH_3SO_2, from an appropriate photolytic precursor, methylsulfonyl chloride, CH_3SO_2Cl. Studies of the unimolecular dissociation rates of CH_3SO_2 have been reported by Baronavski and coworkers. Our measurements of the velocity distribution of the Cl atom co-fragment have allowed us to determine the nascent internal energy distribution of the CH_3SO_2 radicals produced at 193 nm. This data allows us to reinterpret the previously studied ultrafast unimolecular dissociation rate of the radicals. Experiments with CH_3SO_2Cl show that the photolytically-produced radicals have a bimodal energy distribution. Further studies of the radical co-fragment, CH_3SO_2, at a range of internal energies promise a direct determination of the energy barriers for dissociation of each radical by determining the internal energy distribution of the radicals which are not able to dissociate. In this project, we have also sought to extend our understanding of these reactions from first-principle quantum mechanics. Electronic structure calculations at the CCSD(T) and G3/B3LYP levels of theory indicate that in order to get an accurate prediction of the energetic barriers and rates of unimolecular dissociation of sulfur-containing systems, it is necessary to use a larger basis set than had been previously used by Zhu and Bozzelli.

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41 **Dipolar magnetism in high-spin molecular clusters**

Sonia Goyal, Illinois Institute of Technology
Field: Physical Chemistry Advisor: Brant Cage, Ph.D.

Through experimentation we reported on the Fe17 high-spin molecular cluster and showed that this system is an exemplification of nanostructured dipolar magnetism. The resultant structure consists of a metal–oxygen core containing both octahedral and tetrahedral Fe(III) ions. Each Fe17 molecule, with

spin *S* of 35/2, is the magnetic unit that can be chemically arranged in different packing crystals. For every configuration, molecular spins are correlated only by dipolar interactions. The Fe17 molecules are obtained by dissolving either $FeBr_3$ or $FeCl_3$ in a coordinating base, e.g., pyridine (pyr), beta-picoline (b-pic), or isoquinoline (isoqui) that also acts as solvent. To crystallize the product (Fe17), we slowly diffuse a second (often noncoordinating) cosolvent such as diethyl-ether (Et_2O), acetone (Me_2CO), acetonitrile (MeCN). A family of similar compounds can be made by simply changing the base – that also acts as the solvent and terminal capping ligand. We have developed a synthetic strategy to prepare (Fe17) nanomagnets with varying crystal symmetry. This is therefore a new, simple and extremely attractive methodology for the synthesis of molecular magnetic oxides. Through experimentation we showed that the results from the interplay of the dipolar magnetic coupling between the molecular spins.

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42 **Influence of substrate stiffness on cell growth**

Evan Himchak, Illinois Institute of Technology
Field: Chemistry Advisor: Rong Wang, Ph.D.

Substrates with different stiffness exert different forces to cells in growth. Such physical stimuli play important roles in determining cell fates. In this research, the effect of cell-substrate interaction in beta cell growth was studied. I adjusted the substrate stiffness by varying the concentration of gelatin which were coated on the cell culture dish. The substrate stiffness was accessed by the atomic force microscopy. It was observed reproducibly that beta cells preferentially grew on a softer substrate. This is consistent with the reports by others that a softer substrate is preferred by round-shaped cells. The research provides the basis of choosing and manipulating the substrates for cell culture. In the case of stem cells, the choice of substrate may lead to polarized differentiation toward a specific lineage.

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43 **A novel bifunctional ligand for antibody-targeted radiation cancer therapy**

Hyun Beom Lee, Illinois Institute of Technology
Field: Organic Synthesis Advisor: Joy Chong, Ph.D.

The development of the adequate synthetic bifunctional chelates is a critical step for targeted magnetic resonance imaging (MRI) and an antibody-targeted cancer therapeutic technique, radioimmunotherapy (RIT). We previously reported the synthesis and biological evaluation of the structually new bifunctional ligand, C-NETA possessing both a macrocyclic cavity and an acyclic pendant binding group for use in MRI and RIT.1 We have developed a practical, efficient, and scalable synthetic route to amino acids having a linker for conjugation to antibody, a tumor targeting moiety. The amino acids are further converted to precursor molecules for bifunctional ligands. We will present the efficient synthetic route to amino acids and the progress towards the synthesis of new bifunctional ligand, 5p-C-NETA for targeted cancer therapy and imaging.

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44 **First intermolecular tandem Beckman/electrophilic aromatic substitution**

Chichi Lu, Loyola University
Field : Organic chemistry Advisor :Daniel Becker, Ph.D.

In the course of our work studying the supramolecular scaffold cyclotriveratrylene (CTV, hexamethoxytribenzocyclononene) we performed the standard Beckmann rearrangement on CTV oxime which provides, in addition to the expected ring-expanded amide, a helical pentacycle formed via an unprecedented tandem Beckmann/intramolecular aromatic addition process. We

wish to now report the extension of this work to the intermolecular case. Benzophenone oxime when treated with trifluoromethanesulfonic anhydride in the presence of veratrole (1,2-dimethoxybenzene) affords (3,4-dimethoxyphenyl)(phenyl)methanone in high yield, via electrophilic aromatic substitution of veratrole with the Beckmann-derived nitrilium ion to afford the N-phenyl imine which undergoes hydrolysis in the workup.

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45 **Effects of Half and Half Addition on Antioxidant Power of Coffee**

Brandon Merling, Northwestern University
Field: Food and Beverage Science Advisor: Shelby Hatch, Ph.D.

Recent research has shown that dairy products bind to chlorogenic acid, a major antioxidant present in coffee beans. Samples of coffee were brewed and mixed with half and half, and then high resolution ^{1}H NMR spectroscopy experiments were run on the samples and compared to results with reduction potential to test whether the binding of milk products and chlorogenic acids resulted in a drop of coffee's antioxidant power. The results show an initial drop in both chlorogenic acid NMR peak height and reduction potential with the half and half addition. With continued addition of half and half, however, a chlorogenic NMR peak with a shift around 7.4 ppm began to rise, corresponding to a similar rise in the reduction potential, implying the production of a novel chlorogenic acid isomer with antioxidant properties through the addition of dairy products to coffee.

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46 **Synthesis and electrochemical characterization of metal-modified monolayers**

Tracy Ooi, Northwestern University
Field: Chemistry Advisor: Thomas Meade, Ph.D.

The goal of my research is to observe how various sulfur-based linker groups affect the rate of electron transfer of metal-modified self assembled monolayers. Numerous experiments have been done to study the rate of electron transfer in monolayers with a thiol linker group as the attachment to an electrode. This study focused on the rate of electron transfer in monolayers of dithiocarbamates, thiocarboxylic acids, and dithiocarbonates as the linker group. Ferrocene-containing molecules with these different linker groups were designed in order to directly compare the electron transfer rates. Cyclic voltammetry and alternating current voltammetry are used to observe the rate of electron transfer.

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47 **The synthesis and characterization of multimeric MRI contrast agents**

Nader Tehrani, Northwestern University
Field: Organic Chemistry Advisor: Thomas Meade, Ph.D.

Contrast agents are being used in over 30% of magnetic resonance imaging (MRI) examinations in hospitals in the U.S. By decreasing proton relaxation time, T1 in human tissues, MR contrast agents can enhance the signal intensity and provide anatomical information of tissue and organ systems. The current clinical compounds utilize the paramagnetic qualities of the gadolinium ion [Gd(III)] to enhance image contrast. These contrast agents are small, single Gd(III) complexes that are limited in their functional diversity and effect on water relaxation. This project investigated the boost to proton relaxation by a Gd(III) agent in relation to the available number of water coordination sites on the molecule as well as its rotational correlation time—the speed at which the molecule rotates in its environment. These parameters were studied via the synthesis of benzene-derived, multimeric contrast agents possessing varied numbers of water coordination sites. The analysis of these novel, multi-Gd(III) compounds showed an increase to the overall molecular relaxivity as well as amplified

image contrast per Gd(III) unit. Common clinical MR agents possess relaxivities in the range of 3.5-4.5 mM-1s-1 whereas the macromolecular compounds that were synthesized demonstrated values around 10- 12 mM-1s-1 per Gd(III). The total molecular relaxivity peaked at 64 mM-1s-1 for the six-Gd(III) compound, significantly dwarfing the potency of anything that is clinically available. It was also revealed that the increased contrast efficiency of a more exposed ion can be mitigated and is not worth the potential decrease to consumer safety. The large effect of rotational correlation time on image enhancement leads to the conclusion that a macromolecular approach has a promising future for MR contrast agent design and synthesis.

ENGINEERING

48 **Assay System for Vascular Binding of Drug Delivery Systems**

Tetley Aguilar, Vibhooti Dev, Monique Brewer, and Sergery Segal, University of Illinois at Chicago
Field: Cell and Tissue Engineering Advisor: Richard A. Gemeinhart, Ph.D

Millions of people are afflicted with debilitating diseases each year that currently do not have any cures. One method in which treatments for these diseases is studied is through the use of flow chambers. These chambers are commonly used to study the behavior of different types of cells under many flow conditions. A limitation of common flow chambers is the inability to mimic the shape of a vasculature bed that is seen in vivo. Our novel fluid flow network that was designed by our group is composed of medical grade tubing and connectors to mimic the branching and shape of vessels. In order to have a better understanding of the interaction between cells and the drug solution that is introduced, the network system was also designed to be transparent so it can be placed under a microscope so one can observe the interactions in real time. With this fluid system, one can observe and compare the drug concentration differences in different areas of the network. It is hoped that our design will aid in the research of treatments of these disease. The fluid flow system is usable by facilities which research drug treatments for cardiovascular diseases and cancer studies.

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49 **Procoagulant Microparticle Binding To Artificial Surfaces**

Serena Chacko, Illinois Institute of Technology
Field: Cell and Tissue Engineering Advisor: Connie L. Hall, Ph.D

Microparticles (MPs) are membrane vesicles released from cells upon activation and circulate in the bloodstream. Specifically, monocyte-derived MPs (MMPs) contain tissue factor (TF), the initiator of the extrinsic coagulation pathway. Previous studies demonstrated that MMPs adhere to and *impart TF dependent procoagulant* activity to biomaterials. This study used THP-1 monocytic cell-derived MPs as a model system. MPs were tested for TF and tissue factor pathway inhibitor (TFPI) activity using FXa generation assays, and then specific vs. non-specific mechanisms of interaction between MPs and surfaces were evaluated by measuring FXa generation. The majority of FXa generation was TF-dependent as confirmed using anti-TF MAb and a lack of significant TFPI activity was confirmed using anti-TFPI MAb. Biomaterial-MP interactions were evaluated by incubating THP-1 MPs with bare or protein (BSA or fibrinogen) coated glass and polystyrene surfaces. MPs adhered to all surfaces, with a clear preferential binding to glass surfaces over polystyrene in all cases, regardless of specific protein coat. This behavior is in contrast to MMPs that exhibited increased adhesion to adsorbed fibrinogen. CD18/CD11b is the putative fibrinogen receptor involved and the CD18 sub-unit has been identified on the THP-1 MPs. Current work involves the evaluation of its role in specific adhesion to materials.

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50 **Matrix stiffness regulates antrum formation in a 3-Dimensional ovarian follicle culture system**

Yee Hoong Chow, Northwestern University
Field: Chemical engineering in cellular and tissue engineering Advisor: Professor Lonnie Shea, Ph.D

Formation of fluid-filled antral cavity has been a defining, yet not well understood characteristic of ovarian follicles maturation. It was hypothesized that antrum facilitates oxygen transport in follicle growth, and recent studies found antrum formation to be aided by aquaporin proteins. Using a novel 3-dimensional follicle culture system, we are able to regulate antrum formation via the physical

properties of the culture matrix, and study aquaporin and hypoxia-inducible factor alpha (Hif-1a) gene expression in the system. In this system, multilayered secondary follicles isolated from mouse ovaries were placed in droplets of alginate, which were then allowed to cross-link in calcium chloride solution. Studies were performed in 0.5% and 1.5% alginate concentrations, which have significantly different stiffness. RNA was isolated from the follicles after 2-8 days of culture, for RT-PCR analysis of aquaporin and Hif-1a gene expression. Only 5.5% of follicles cultured in 1.5% matrix formed antral cavity, but the follicles showed high expression of aquaporin and Hif-1a genes. Follicles cultured in 0.5% less stiff alginate matrix formed antra in over 85% of follicles, but showed low expressions of aquaporin and Hif-1a genes. It is thus proposed that stiffness of alginate matrix used in 3D in vitro culture system has regulating effects on antrum-regulating gene expression, due to induced hypoxic effect in follicles. Follicles cultured in stiffer alginate matrices are unable to expand in the growth process, and thus antrum unable to form, due to the external pressure of the stiffer alginate matrix. However, because of increasing tissue mass within the follicle, oxygen transportation into the follicle is impeded, causing hypoxic conditions within the follicle. Aquaporin proteins, particularly aquaporin 7 and 8, are then expressed to alleviate the hypoxic effect, thus describing the regulation of alginate matrix stiffness in gene expression related to antrum formation in in vitro cultured ovarian follicles.

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51 **Tin Oxide Patterning for High-Performance Gas Sensors via Dip Pen Nanolithography (DPN) and Sol-Gel Ink**

Kenneth D'Aquila, Northwestern University
Field: Nanopatterning Advisor: Vinayak Dravid, Ph.D

Direct fabrication of functional oxide nanostructures via Dip Pen Nanolithography (DPN) and sol-gel inks has the potential for advancing several important technologies including high performance solid-state gas sensors and next generation ferromagnetic/ferroelectric data storage. This cost-effective lithographic method offers high resolution patterning, excellent registry on the substrate, and amenability to a wide variety of compositions and dopants. While several researchers have demonstrated a proof-of-concept for DPN with sol-gel inks, a simplified and highly repeatable protocol is desired which would include: sol recipe, cantilever/substrate preparation, lithography parameters, and post deposition heat treatment. The protocol developed in this project, uses micro-inkwells to consistently coat the cantilever with a solution of tin (IV) acetate in ethylene gycol. Lithography is conducted at high humidity (~75% RH) on a hydroxylated substrate. Following this procedure, tin oxide lines (1x10 μm) have been fabricated on silicon oxide. However, the discontinuous, particulate morphology of the lines is a challenge which currently prevents their implementation as solid state gas sensors. Further development in the sol concentration, heat treatments steps, and humidity control are expected to bring significant improvements in the coming months.

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52 **Developing Affordable Water Solutions for the World's Rural Poor**

Blake Hellman, Tomomi Tsukioka, Daniel Hutchison, Joshua Bergerson, and Reema Paranthan, Illinois Institute of Technology
Field: Architecture Advisor: Daniel Ferguson

Around 3.1 million people died in 2002 as a result of diarrhea related diseases and malaria, which were contracted from polluted water, 90% of whom were children. One of the major sources of pollution is from fecal matter that has leeched into the groundwater from improperly constructed toilets. We have decided to address this problem with a design for a composting toilet. After researching a number of possible solutions such as the continuous composting method and the

chamber method, we chose the container system. Most composting toilets decompose the waste in place by having a large and expensive storage tank. In many cases it takes upwards of a year for the waste to decompose to where it is safe to handle. Our method discards the tank idea and instead has a small storage vessel that when filled can be carried to an alternate exterior composting site. The toilet is still conveniently located close to the inhabitants without having to worry about contaminating their water supply.

In many composting toilets both the solid and liquid waste is combined which creates an environment that has an excess of nitrogen which kills or at the very least limits the amount of helpful bacteria that do the composting. We have addressed this problem by creating a urine diverter that catches the liquid and diverts it to a tank. This liquid can then be diluted and used to irrigate plants.

We will be testing our design by teaching children around our community. This will help us perfect our teaching methods on the construction process that we hope to implement. We are going to gather kids who are not fluent in English, which will help us practice the language barrier we will have. We will also be developing a field manual, mainly pictures, so the villagers can follow along.

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53 **Bio-inspired chitosan hydrogel formation**

Kyle Holmberg, Northwestern University
Field: Biomaterials Advisor: Phillip Messersmith, Ph.D

This study investigates a new method for chitosan hydrogel formation using a catechol-analog crosslinker, 2,4,5-trihydroxybenzaldehyde (Tbz). Chitosan is a well-known polysaccharide with the disaccharide repeat of β-(1,4)-D-glucosamine and N-acetyl-D-glucosamine, from chitin deacetylation and has been widely applied for functional biomaterials. Chitin is found in the exoskeleton of arthropods and crustaceans. The use of Tbz to crosslink the chitosan backbone was inspired by the previous study in which dopamine was utilized as a material-independent, chemically active surface adhesive molecule. Dopamine combines the chemical functionality of 3,4-dihydroxy-L-phenylalanine (DOPA) and lysine found in mussel adhesive proteins, Mefp-3 and -5 (*Mytilus edulis* foot protein-3 and -5), that are specifically located at interfaces between adhesive pads and opposing substrates. Similarly, this chitosan hydrogel system features the amine group functionality in chitosan chains and a catechol-analog crosslinker. However, this system has been designed with multiple forms of chemical reactivity. Under acidic conditions, pH 5.5, the chitosan amine groups covalently bond to the benzaldehyde crosslinker through an imine formation mechanism. The imine is reduced to a secondary amine in the presence of the reducing agent of sodium borohydride. This forms the primary backbone of the hydrogel network. Oxidation of the catechol moieties over time results in further crosslinking between Tbz molecules, facilitating the hydrogel's unique dynamic phase transition behavior; the hydrogel is first formed in a hydrated phase, and subsequently exhibited a phase transition over time to a dry brittle state. It is hypothesized that the Tbz oxidation "collapses" the hydrogel network. The system can be optimized for different transition rates and has potential applications in drug delivery systems.

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54 **Release of Protein BSA from Alginate Microbead Encapsulation**

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

Alginate microcapsules have for many years been considered excellent immune barriers to cell transplantation. Although they serve a variety of biomedical uses, special interest has been focused on using alginate microcapsules as a method for the transfer of islet cells as a potential treatment

for Type 1 Diabetes. For it to be successful, however, alginate microcapsules must also promote neovascular growth to allow the cells to receive nutrients such as oxygen and glucose from blood. To do so, a protein must be encapsulated within the microbeads and its release must be both consistent and sustained in order to ensure the cells survive immobilization.

We aim to develop an effective technique for the encapsulation of the protein Bovine Serum Albumin (BSA) in alginate microbeads and to ensure that it releases after transplantation. We created solid spherical beads with two layers of alginate, and devised a new technique that creates a thicker outer layer. In addition, our methods allow for a greater amount of BSA to be encapsulated in the outer layer by crosslinking it with $CaCl_2$ in normal saline. The release of BSA was monitored and recorded over several days and the amount encapsulated was calculated using Beer's Law.

Current work includes obtaining a confocal image of fluorescent BSA in the outer layer of the beads, as well as developing ways to control the release of BSA at a desired rate by influencing various factors during the process of encapsulation.

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55 **Determination of Physical Properties of PEG-DA Hydrogels using a Transport Model for Diffusion**

Alok Patel, Illinois Institute of Technology
Field: Biomedical Engineering Advisor: Georgia Papavasiliou, Ph.D

Photopolymerizable hydrogels of Poly(ethylene glycol) diacrylate (PEG-DA) have gained tremendous interest as tissue engineering scaffolds. Cell response on these materials is dictated by two primary factors: hydrogel physical properties and availability of functional biomolecules within the crosslinked hydrogel network which can be readily controlled by varying the kinetic conditions during free-radical photopolymerization. Numerous studies have focused on swelling experiments as a primary means for predicting the resultant hydrogel physical properties (i.e., mesh size and crosslink density) using the Flory-Rehner equation. This model, however, assumes a perfect network which is disrupted when cell adhesion ligands (RGD) are covalently incorporated in hydrogels due to the fact that they form pendant groups. The purpose of this research is to quantify hydrogel crosslink density and mesh size based on a quasi-steady state transport model of diffusion of m-Nitroaniline (MNA) through PEG-DA hydrogels and compare obtained results to swelling experiments. PEGDA hydrogels were formed by exposing the hydrogel precursor to visible light (λ = 514 nm) at different exposure times (60 and 90 seconds) at an intensity of 100mW/cm^2 using an Argon IonLaser. After polymerization hydrogels were loaded in a diffusion chamber. The diffusion of MNA through the hydrogel was monitored for a period of 24 hours with periodic measurements every thirty minutes using a spectrophotometer (λ = 405 nm). The relationship between MNA concentration and diffusion time was then related to the effective diffusion coefficient. Based on the experimental diffusion coefficient the effective mesh size and Mc were calculated. The study shows a difference in results between the swelling and diffusion experiments. Current efforts are focused on extending these studies to quantify the physical properties of biologically active hydrogels with incorporated RGD moieties. These studies will provide insight to structure-function relationship of PEG-DA hydrogels which will contribute significantly to the development of tissue engineered substitutes.

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56 **Photochemical Oxidation of Formaldehyde by Titanium Dioxide (TiO_2) Nanotubes**

Kevin Schulte, Northwestern University
Field: Environmental Engineering Advisor: Kimberly Gray, Ph.D

The versatile applications of titanium dioxide (TiO_2) have been well established, however, this catalyst is typically used in granular form or as a thin film. Exciting developments in the field of nanotechnology have shown that it is possible to electrochemically etch nanotube arrays of titanium dioxide onto titanium foil. Titania nanotubes may offer several advantages over granular and thin film samples such as a more optimum surface area to perform photochemical reactions. The goal of this project is to synthesize titanium dioxide nanotubes and observe their physical and chemical properties. The nanotubes were characterized by X-ray diffraction to determine their crystal structure and their physical properties were observed with a scanning electron microscope (SEM). Also, the titania nanotubes will be evaluated on their ability to oxidize formaldehyde, a common indoor air pollutant and probable carcinogen present in many construction materials. A reactor containing titania nanotubes was fed with a formaldehyde/air mixture and irradiated with UV light. Gas chromatography was used to measure the conversion of formaldehyde. The nanotubes effectively catalyzed the photochemical oxidation of formaldehyde.

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57 **Surface Coil Intensity Correction in Cardiac MR Imaging**

Heather Selby, Illinois Institute of Technology
Field: Medical Imaging Advisor: Andrew Arai, Ph.D

T2-weighted MRI is used for differentiating edematous from normal myocardium. Edema formation secondary to myocardial infarction can be used to delineate the hypo-perfused area at risk and to differentiate acute from chronic infarcts. T2-weighted images should ideally depict edematous myocardium brighter than normal myocardium as a result of increased signal intensity within the edematous region. This image contrast should allow for discriminating between the two types of tissue. However, the pathology is not the only factor modulating signal intensity and therefore such discrimination is often compromised. One such factor is introduced as a result of how MR signals are acquired. Surface coils are antennas placed close to the body in order to improve MR signal reception. However, MR signals originating from tissue away from the receiver coils will be received with smaller signal intensity compared to MR signal originating from tissue close to the receiver coil. Such unwanted variations due to the receiver coil profile need to be compensated for so that the true tissue contrast can be properly displayed and evaluated. The objective of this study was to develop a computer algorithm to correct surface coil intensity variations in two dimensional cardiac MR images in order to restore contrast and more accurately display and measure the size of edematous myocardium.

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58 **Suction Control of Unsteady Separation on a 2-D Cylinder**

Christopher Ward, Illinois Institute of Technology
Field: Experimental Fluid Dynamics Advisor: Hassan Nagib Ph.D

Flow over bluff bodies like two-dimensional cylinders has a tendency to separate (i.e., no longer follows the contour of the object), leading to a significant increase in drag of the body. This flow separation can be partially or fully remedied with the help of various flow control methods. While suction at strategic locations around a cylinder has been used for nearly a century in such applications, no fundamental understanding has been developed regarding the critical parameters. For example, we do not know if the amount of flow removed or its momentum is more significant,

or alternatively the resulting surface pressure near the suction ports, and hence appropriate scaling of results is beyond our present abilities. The current experiment was set up with a cylinder mounted on a suction base and a force balance to measure the various applied forces. Several sets and arrangements of holes were drilled into the cylinder, and through these holes a suction pressure gradient can be created. The applied suction pressure gradient, located at critical angles, helped the cross flow stay attached longer, and led to a significantly reduced drag; i.e., up to 60%.. The results over the simple geometry of a circular cylinder have already provided the clues and foundations for similar flow-separation control on more complex geometries like road vehicles. Through the ongoing research, we have learned that there is an optimal angle for the suction holes to be situated at, and there is an optimal amount of suction to apply.

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59 **Corner-flow separation and delaying the onset of stall in an axial compressor**

Robert Whittlesey, Illinois Institute of Technology
Field: Aerospace Engineering, Fluid Mechanics Advisor: Candace Wark, Ph.D and David Williams, Ph.D

This research is focused on decreasing the negative ecological impact of aircraft engines by improving the performance of axial compressors. Axial compressors are a major component of turbofan and turbojet engines, as found in commercial and military aircraft. Axial compressor performance is limited by the onset of stall, that is, when the aerodynamic limits of the compressor have been reached and the compressor experiences a dramatic drop in compression. The fluid phenomena responsible for the occurrence of stall is not definitively known, however the aim of this research is to delay the onset of stall and permitting the compressor to run at a higher compression ratio. The method by which stall is delayed is by reducing flow losses in the compressor. Flow losses are primarily due to friction along the walls of the compressor and flow separation. Flow separation is when the fluid, instead of following the interior curves of the compressor, dramatically separates and creates eddies in the flow. The goal is that by reducing the separation within the compressor, the flow losses will subsequently be reduced as well. In particular, we are looking at fluid separation that occurs at the interface of stator blades and the casing of the compressor. This is known as corner-flow separation. Flow separation can be controlled by carefully injecting fluid, in this case air, through holes or slots in the compressor. This is known as flow actuation. By modifying the location, shape, frequency, and strength of these injections it is possible to control the separations, either creating or reducing them. By investigating the fluid flow through the compressor, we will gain a better perspective on how to design the flow actuation scheme to reduce the corner-flow separation and delay the onset of stall.

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60 **Evaporative Cooling for the Rural Poor of the World**

Abraham Akutagawa, Sara Wilde, Narciso Corral, Young Ju Joo, and Andrew Rust, Illinois Institute of Technology
Field: Applied Thermal Engineering Advisor: Daniel Ferguson

Malnutrition affects 792 million people around the world. This is largely attributed to the limited means to store food for extended periods of time. Research demonstrates that 20% of fruit and vegetable loss is due to improper storage. Our objective is to design and build an evaporative cooling structure that will allow for fruits and vegetables to be stored for extended periods of time. This will be done using materials that are indigenous to targeted regions and both easily maintained and self-sustainable by the region's inhabitants.

How evaporative cooling works is that in a hot environment, through the humidity of air and its temperature, liquid will begin to evaporate, typically into the surrounding air. As the water is evaporated, the surface in contact with it begins to cool down.

Our design team has decided to design, construct, and test a hybrid of two systems. Our outer structure will be made of bricks, which are more porous and provide for good evaporation, and the inner storage chamber will consist of an earthen pot, which is less porous thus minimizing the problems that are brought upon by water seepage into the food chamber and thus food contamination and ineffective evaporation.

We plan to simulate the conditions found in the areas we hope to implement the cooler, Nicaragua and Peru, by heating and humidifying or test site. We will test for the best cooling effect, best material to use for a lid, the difference in varying sand and water ratios, and the effect of wind on the evaporative process. Also varying temperatures will be considered for potential implementation to other world regions. In the end, we hope to travel to Peru or Nicaragua and implement the design that is found to be most efficient.

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61 **Conceptual Design of a Community Health Center of the Future**

Alex Bauer, Jessica Patera, Chris Heppel, and Jeremy Moore, Illinois Institute of Technology
Field: Civil engineering and architectural design Advisor: Daniel Ferguson

The quality of health care is progressing and as technology advances, new cures and medical practices are emerging, reshaping the approach of health care centers. However, the problem of utilizing these innovative practices to serve the underinsured or financially challenged households is still a significant problem. Access Community Health Network is the nation's largest network of community health centers operating in medically underserved communities in Chicago, greater Cook and DuPage counties. Access' mission is to provide quality, cost effective, and comprehensive primary and preventive health care to the community. The Illinois Institute of Technology's Interprofessional Project Program IPRO 340 is working with Access to develop a prototype design for Chicago area health clinics operated by Access. The design will utilize information gathered from process maps, state of the art research on health care centers and technology. Site visit observations, previous audits and an architectural program that will layout the actual design of the facility are also utilized in the design process. The design of the facility will focus on being ethical, maximizing the efficiency and effectiveness and quality of the services provided at the health center.

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62 **Optical Gold Nanoparticle Based Glucose Sensor**

Salil Benegal, Milagros Calizo, and Vrudhdhi Patel, Illinois Institute of Technology
Field: Biosensors Advisor: Sandra Bishnoi, Ph.D

Nanoparticle based biosensors are becoming very useful due to their many properties including their optical properties. Our group explored using different gold nanoparticle systems for use in an optical glucose monitoring system. Au colloid (30 nm) and THPC functionalized Au (2-3 nm) were two systems that were explored. The Au seeds were enlarged with the introduction of H_2O_2 and $HAuCl_4$ and were measured using UV-Vis spectroscopy. It was found that there was good linearity at 530 nm for concentrations at 0 to 795 μM and at 525 nm for concentration between 15 and 105 μM for Au colloid and THPC Au, respectively.

HUMANITIES

63 **Phenomenology as Critical Theory**

Michael Carlson, Loyola University
Field: Phenomenology and Critical Theory Advisor: Hugh Miller, Ph.D

Post-modern literary criticism has generally focused on the social construction of race, class and gender, while post-modern phenomenology has concerned itself with the social construction of the idea of God. This project proceeds from conventional critical theory to argue and demonstrate an original critical theory: art espouses a phenomenological agenda that belies the socially constructed terms of its inherent phenomena. An artist can engage in and espouse an ideology, philosophy or even theology just as relevant to strictly explicit discourses in the aforementioned disciplines. As a multi-disciplinary endeavor, these findings bear relevance for phenomenology, critical and cultural theory, literary criticism and post-modern theology.

George Eliot's fiction demonstrates the hypothesis because she rejected the majority of the epistemological terms and concepts of her time. This critical theory reads the terms she consistently uses in her fiction, such as "fellow-feeling" and "clairvoyance", in their textual context; my critical theory polemically systematizes extra-textually from intra-textual epistemological systems; demonstrated in Eliot, I extra-textually name what her fiction intentionally illustrates intra-textually. In proving an intentionally illustrative system, subjective intentions and motivations can objectively dialogue with other epistemological systems. Eliot intentionally illustrates an ethical philosophy of the consequences of self-divestment, alterity. Her ethical system involves the Ego encountering the Other, the disenfranchised; the Ego is so arrested by the Other's needs that it is only complete when divesting itself. After articulating this ethical system and its consequences in modern terms, the extent of this theory is demonstrated in deconstructing Eliot's personal claim to be an atheist; her ethics belies and protests mid-Victorian theological terms and concepts but can actually be seen as anticipating post-modern theology. Through the phenomenological lens of Jean-luc Marion, the axis of Eliot's extra-textual ethical system is a God beyond metaphysical reification.

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64 **A for Apology: Evaluating Historical Apologies**

Max Clarke, Northwestern University
Field: Sociology Advisor: Gary Alan Fine, Ph.D

Within the past several years, American universities have begun to follow in the footsteps of such institutions as governments, businesses, and religions by adding to what one scholar has called "a global frenzy to balance our moral ledgers." This frenzy, the "new culture of public apology," has been analyzed by many academics; scholars have written extensively on the institutional apologies of businesses, governments, and religious institutions. Excluded from this focus, however, stands the institution of the American university.

My project, researched on a month long trip to both the University of Alabama and Brown University, argues that the American university is able to offer an effective institutional apology for events that occurred in the distant past because it has the potential to engage in a process I call *active consideration*. Roughly, *active consideration* means the promise of ongoing debate. When a university actively considers a topic, the subject is both neutralized and ensured longevity via its inclusion in the university's discourse. I hypothesize that such a process of consideration has the potential to be a powerful ameliorating force for previously victimized groups deserving apology because such continued recognition is a powerful sociological incentive to forgive.

Both the University of Alabama and Brown have extensive ties to slavery, and each school has attempted to reconcile with this history. For reasons detailed in my research, the efforts of Brown can be described as successful while those at Alabama cannot be. My case studies suggest that the University, as an institution, is endowed with the ability to apologize differently than other kinds of institutions. Given these differences, the examples provided by Brown and Alabama offer a prescriptive framework for universities that are considering an apology in the future. My research outlines this framework, cautioning universities as to the correct way to perform an apologetic gesture that will be endowed with real sincerity and reconciliatory significance.

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65 **The African Defense Against the Hegelian: Reconciliation of Senghor and Diop**

Julian Hill, Northwestern University
Field: African Philosophy Advisor: Souleymane Bachir Diagne

This piece aims to reconcile the works of two esteemed Senegalese philosophers, Léopold Sédar Senghor and Cheikh Anta Diop through the use of themes as presented in Hegel's Philosophy of History. Most, if not all, scholars concerned with these two thinkers typically agree that the starting point for their individual projects is a rejection of the colonialist agenda that has inundated scholarship concerning Africa. However, it is commonly cited that the approaches that Diop and Senghor use, one very scientific, fact-based, systematic one and the other heavily philosophical, culture-based, observational respectively, diverge in defending against the exclusion of Africa from historical and cultural relevance. Current scholarship focuses on how Senghor and Diop differ in two ways: (1) the means through which they engage in their fight against colonialism and (2) their fundamental interpretation of whether the African has any essential differences from the European. I reject this theory of fundamental conflict, arguing that although the process of each is different, the ending principle they each exalt is the same. I chart out this eventual convergence by running the arguments of Senghor and Diop through five themes: Philosophy, Religion, Family Structure, Language, and Aesthetic Contribution. It is through these fundamentally cultural themes that Hegel philosophically attempts to disempower African culture and history. I aim to use these core components of culture not to prove Hegel wrong, but to show that the core parts of Senghor and Diop's arguments align much more than most are willing to admit.

MATHEMATICS AND ECONOMICS

66 **Lowering the Upper-bound on Ramsey 5,5**

Hannah Kolb, Illinois Institute of Technology
Field: Discrete Mathematics Advisor: Michael Pelsmajer, Ph.D, Robert Ellis, Ph.D

The study of Ramsey numbers deals with the coloring of complete graphs with two colors. The Ramsey number of *Ramsey*(*p,q*) gives the smallest vertex number n which will guarantee a coloring of either a clique of size *p* and color 1, or a clique of size *q* and color 2. While values for small numbers such as *Ramsey(*3,3), *Ramsey(*4,5) are well known, the exact value of larger numbers such as *Ramsey*(5,5) is unknown. There are established ranges for such values. *Ramsey*(5,5) is known to be between 43 and 49 inclusive. Using mathematics and computer experimentation I am attempting to lower the upper bound on this value.

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67 **'Shantipatha': A 100 Projects for Peace Initiative**

Manjari Ranganathan, Northwestern University
Field: Microfinance Advisor: Nathaniel Whittemore

The World Bank estimates India has nearly 260 million people in poverty with thirty-five percent of Indians living on less than one dollar a day. A quarter of its population is malnourished, with over forty percent of children underweight, and nearly fifty-five percent of women illiterate. Rural regions in particular, have not benefited from recent economic gains of technology outsourcing into India.

Project Shantipatha was funded by the 100 Projects for Peace Grant in 2007. Its goal is to increase social and economic empowerment in rural villages of south India using seed funds for building economic independence, and enhancing education and entrepreneurship. Shantipatha was accomplished in conjunction with the International Human Development and Upliftment Academy, an NGO in Mysore, India. A poverty scorecard was developed based on World Bank Indicators capturing information regarding social stratification, living standards and economic metrics. Over 200 women and 100 schoolchildren participated in detailed interviews. The scorecard garnered facts regarding economic status, sanitation, and healthcare. It captured monthly income, consumption patterns, schooling, agriculture, and other needs. For example, it was found that over 82% lacked sanitation facilities, 50% procured drinking water from the local river, and nearly 60% of interviewees did not own land.

Three seed funds were established to alleviate problems. The Book Fund helped to purchase school supplies, using accrued interest from the fixed fund. Two microfinance funds were established to encourage higher education and entrepreneurship. The Small Business Fund enabled allocation of micro-loans to start small businesses, or improve an existing business. Individuals created proposals, planned for finances and seasonal variations, partnered with city institutions to transport goods into rural areas. The Educational Fund provided underprivileged women with high test scores with a two year micro-loan for higher education. Based on current progress, Shantipatha funds are being successfully deployed and modulated with increasing efficiency.

PHYSICS

68 **The origin of double neutron stars**

Jeffrey Andrews, Northwestern University
Field: Theoretical Astrophysics Advisor: Vicky Kalogera, Ph.D.

The evolutionary history of the few known Double Neutron Star (DNS) systems has been the subject of much controversy over the past four decades. Due to their tight orbits and high velocities, DNS systems are some of the most exotic celestial objects. Since the discovery of the first DNS system, B1913+16, in 1974, DNS systems have provided astrophysicists with excellent laboratories to learn about stellar evolution. In this talk, I will present the results of a population synthesis study, which investigates a variety of parameters in the formation of neutron stars. I will place constraints on the supernova kick velocities, occurrence of electron capture supernovae, and mass transfer phases in the evolutionary history of DNS systems. Although the mechanics are not well understood, these factors play an important role in determining the characteristics of DNS systems. Finally, I will use these constraints to explain the evolutionary channels of several known DNS systems.

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69 **Jamming of a Binary Colloid Suspension in a Groove**

Rostislav Boltyanskiy and Sebastian Villarreal, University of Chicago
Field: Material Science Advisor: Binhua Lin, Ph.D

The purpose of this study was to explore the jamming transition in systems of particles of two different sizes in a quasi 2d space. The transition was studied by analyzing the trajectories and mean-square displacement of individual particles over a range of packing fractions (η). We also performed a qualitative comparison between a binary system and a one component case. A colloidal suspension of 3.56 μm and 2.56 μm diameter silica spheres (with a ratio of 1:1 by number) was placed in a silicon elastomer groove (25μm wide, 5μm deep). The spheres were then observed using optical microscopy and images were transferred to computer at a rate of 30 frames per second. Individual spheres were identified in the digital images and their motions were tracked from frame to frame for each set of 5000 frames. The resulting data were used to observe trajectories and calculate the mean-square displacement for the spheres. At concentrations with packing fraction η~0.58 the sphere trajectories indicated a jammed state. Trajectories for lower packing fractions (η~ 0.48; η~0.28) indicated fluid states. In contrast, the one-component case reached a crystal state at around η~0.90; no jamming was observed. The near-future goal is to identify the precise packing fraction at which jamming takes place for the 25μm system. Also, observing how varying the groove width affects the onset of jamming may be of interest.

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70 **EXAFS analysis of Ga Er doped glasses**

Mykhaylo Chavarha, Illinois Institute of Technology
Field: Physics, Material science Advisor: Carlo Segre, Ph.D.

The local structure of Ga and Er doped glasses was investigated using x-ray absorption. The data of Er and Ga was collected in the MR-CAT 10 beamline of Advanced Photon Source at the Argonne national laboratory. The EXAFS extracted parameters allowed us to determine the neighboring atoms around Ga and Er in glasses with different fractions of Er ions and degree of heat treatment. The results show separate Er and Ga clusters. The degree of crystallinity near Er was increasing as the fraction of Er^{3+} ions became larger . On the other hand Ga atoms remained in a the glass phase regardless of the Er composition and started to show ordering with change of heat treatment.

71 Scalar-Tensor Theory and High Frequency Gravitational Waves

Charles Cherqui, Loyola University
Field: Theoretical Physics Advisor: John Dykla, Ph.D.

The theory of general relativity is one of the most successful theories in all of physics. We consider that general relativity may be a limiting case of a still more general theory of gravity. In this Scalar-Tensor theory, the universal constant G is related to a scalar potential function. We expect that one important distinction between competing theories of gravity would be in their description of high frequency gravitational waves. Einstein's theory has been supported through its ability to explain and predict post-Newtonian effects in the weak static field of our Sun. However, no effects of strong dynamic gravity have been directly observed in a way analogous to the observation of electromagnetic waves. There are two experiments currently active (LIGO, VIRGO) and another set to go online in 2015 (LISA) whose sole purpose is to search for these waves as they pass through our solar system. This will provide the physics community with a unique opportunity to test Einstein's theory against a Scalar-Tensor theory. We consider gravitational waves to be of "high frequency" whenever their wavelengths are small compared to the curvature radius of the background geometry and the scale on which the background gravitational "constant" changes. This is the case for such conventional weak-field sources as binary systems or oscillating and rotating spheroids. We propose to expand the parameterized post-Newtonian (PPN) formalism to order 2.5 for a Scalar-Tensor theory. The PPN formalism is a tool used to compare predictions of classical theories of gravitation for present and future experiments. While previous research has expanded the PPN formalism to this order for general relativity, this has never been done for the Scalar-Tensor theory.

72 Shape invariance and the exactness of quantum Hamilton-Jacobi formalism

Charles Cherqui, Loyola University
Field: Theoretical Physics Advisor: Asim Gangopadhyaya, Ph.D.

Quantum Hamilton-Jacobi Theory and supersymmetric quantum mechanics (SUSYQM) are two parallel methods to determine the spectra of quantum mechanical systems without solving the Schrödinger equation. It was recently shown that the shape invariance, which is an integrability condition in SUSYQM formalism, can be utilized to develop an iterative algorithm to determine the quantum momentum functions. We have shown that shape invariance also suffices to determine the eigenvalues in Quantum Hamilton-Jacobi Theory.

73 Wilhelm Wien's Principle of Non-Thermal Zero Level Energy of Electrons in Metals

Charles Cherqui and Geoffrey Kremer, Loyola University
Field: Historical Physics Advisor: Asim Gangopadhyaya, Ph.D, Aleksandr Goltsiker, Ph.D.

At the turn of the twentieth century the classical "equipartition of energy" principle had become the major stumbling block in the development of modern physics. This principle inevitably led to both the "ultraviolet catastrophe" for thermal radiation and the "electron gas heat capacity catastrophe" for electrons in metals. Defense of the equipartition principle became increasingly difficult in 1911 with the discovery of superconductivity by Kamerlingh Onnes. This partly encouraged Wilhelm Wien to introduce his principle of non-thermal zero level energy of electrons in metals in January of 1913. He

soon lectured on his ideas at Columbia University and found support from Willem Keesom. However, Wien's new theory was immediately and furiously attacked by Hendrik Lorent, who did so first in Heidelberg and at again at the Solvay Congresses in 1913 and 1924. It was soon after the 1924 Solvay Congress that Yakob Frenkel began to support Wien's new principle. In 1925 Lorentz partly retreated from his fierce disapproval of Wien's theory and accepted the idea that the principle of equipartition was at best flawed. In 1927 Arnold Sommerfeld applied Fermi-Dirac statistics to electrons in metals; he reported his findings at the Como Congress that same year. Sommerfeld, when presenting his ideas in presence of the ageing Lorentz was cautious enough to omit references to Wien's 1913 paper. The numerical value of this zero level or threshold energy proposed by Wien was first calculated by Fermi in 1926 and in 1934 Wigner and Seitz coined the name "Fermi energy". The term "Fermi energy" became widely used by the Solid State physics community around 1936, as is evident from textbooks and reviews from around that time. Only a few researchers and historians appreciate Wien's achievement as a breakthrough and see it properly as the first manifestation of the Pauli Exclusion Principle as opposed to merely bold "speculation" as is often accused.

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74 **Fundamental Frequency of Fluidized Granular Beds**

Geoffrey Kremer and Joshua Wilson, Loyola University
Field: Fluidized Granular Physics Advisor: Jonathan Bougie, Ph.D and Aleksandr Golsiker, Ph.D

The principle objective of this study is to address the determining factor(s) of the fundamental frequency associated with the study of fluidized beds. A fluidized bed is created when a layer of grains is subjected to a gravity-opposing drag force, resulting in a particle flow similar to that of a fluid. Fluidized grains exist in such applications as oil refining, geo-technical engineering, and seismic analysis. Fluidized beds exhibit fluctuations with a characteristic natural frequency which depends largely upon the dimensions of the system. Dimensional analysis suggests frequency dependence that is proportional to $\sqrt{g/L}$, where *g* is the acceleration due to gravity, and *L* is a characteristic length scale. Possible values of *L* include the depth of the bed, the diameter of the bed or the diameter of the grains. The well-known hydrodynamic analogy of grain fluctuations to liquid surfaces, as well as vector co-linearity considerations, suggest bed depth as the dominant length scale. Although other length scales have been proposed, empirical evidence supports the bed depth dependency claim. In addition to drag force from gas flow, a variety of methods can fluidize grains by producing a force opposite gravity, including liquid flow, vibration, and electric or magnetic fields. Vibro-fluidized beds also exhibit scaling proportional to a characteristic frequency $\sqrt{g/L}$ with layer depth acting as the appropriate length scale. These results suggest further exploration of the role of layer depth in granular systems.

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75 **Nanoparticle membrane simulations**

Nicholas Laszlo Frazer, University of Chicago
Field: Nanomaterials Advisor: Heinrich M. Jaeger, Ph.D.

I model elastic membranes of a nanocomposite material with potential use as a novel pressure sensor. Gold particles with a radius of about 6 nanometers coated with dodecanethiol ($C_{12}H_{25}SH$) ligands can self-assemble into close packed arrays exactly one layer thick. An array on a chip containing a hole around a micrometer in diameter forms a self-supporting membrane spanning the opening. An atomic force microscope has been used to characterize the mechanical properties of suspended membranes (Mueggenburg et al., "Elastic membranes of close-packed nanoparticle arrays", Nature Materials 6, 656-660, 1 Sep 2007). Dodecanethiol acts like a spring between two

adjacent particles, giving membranes elasticity and surprising strength. In this presentation, I use computer simulation to compare a discrete, linear ball-and-spring model of the static mechanical properties of membranes to past measurements and analytic continuum theory. In particular, I calculate the geometry of a suspended membrane poked by an atomic force microscope and the force on the microscope tip, subject to various boundary conditions.

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76 **Arsenic adsorption and speciation in drinking water by GAC-based iron-containing adsorbents**

Yewon Gim, Illinois Institute of Technology
Field: Enviormental Science Advisor: Jeff Terry, Ph.D.

Granular Activated Carbon (GAC) with Iron adsorbents were developed for effective removal of arsenic from drinking water. The structure and proposed mechanism for As removal was studied using X-ray absorption spectroscopy. The oxidation state of As(III)GAC sample was calculated using XANES spectra and verified to be predominantly As(V). The structure was determined using EXAFS spectra of As(V) and Fe. The Fe spectra suggested thin layer of Fe oxide formation on GAC surface. As data showed As oxide formed bond on the Fe oxide surface. The spectra was calculated using multiple geometrically optimized models calculated using density functional theory. Further calculations were done to verify the structure, and further examine the structure.

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77 **Fiber readout of glass bead calorimeter**

Jennifer Hobbs, Northwestern University
Field: High Energy Physics Advisor: Heidi Schellman, Ph.D.

In conjunction with the study, design, and construction of a prototype glass bead calorimeter at Northwestern University, a fiber readout study is being performed. The original prototype glass bead calorimeter study measures the light output from cosmic ray muons passing through the bead-scintillator configuration via a phototube at the output edge of the apparatus. In this fiber readout study, a wavelength shifting fiber "wisk" eggbeater will be inserted directly into the calorimeter and read out by a DAQ written in LabVIEW. Understanding the efficiency of the two configurations will allow for the best application as a cost-effective active target in future neutrino experiments.

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78 **Methods for generating exactly solvable potentials in quantum mechanics**

Ben Idstein, Andrew Kim, Alex Mull-Osborn, Loyola University
Field: Theoretical Physics Advisors: Asim Gangopadhyaya, Ph.D.

In supersymmetric quantum mechanics (SUSYQM) interactions are described by a superpotential $W(x,\alpha)$. If this superpotential satisfies a constraint known as the Shape invariance condition, the problem becomes solvable; i.e., its spectrum can be determined via algebraic means. This condition is a difference-differential equation that connects the superpotential $W(x, \alpha)$ and its spatial derivative at two different values of a parameter α. Previously, it was shown that if these two values of the parameter were translationally related; i.e. $\alpha_1 = \alpha_0 + \hbar$, the shape invariance condition can be converted into a partial di_erential equation whose solutions are then the exactly solvable potentials in quantum mechanics. We hope to expand on this work by developing a similar method for other types of shape invariance: cyclic $\alpha_n = \alpha_0$ and multiplicative $\alpha_1 = q\,\alpha_0$ where $0 < q < 1$.

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79 **Habitability of planets in binary systems**

Ryosuke Kita, Northwestern University
Field: Astrophysics/Astrobiology Advisor: Frederic Rasio Ph.D.

Roughly 20% of the currently known planetary systems are within a binary stellar system. A higher fraction of such configurations are expected, because more than half of solar-type stars are found with a stellar companion. Secular, long-term, perturbations from a stellar companion can induce high eccentricities into a planet's orbit, diminishing its prospects for harboring life. As the search for habitable planets embarks, it has become important to understand the likelihood of finding a planet with a habitable orbit within these abundant binary stars. The orbital evolution of a single planet within a binary star is predictable, but because the addition of another planet to these systems increases the parameter space and the number of interactions, such configurations have not been carefully studied. Indeed, a study of multiple planets within a binary is more realistic and relevent because both observations and planet formation theories suggest that multiple planetary systems are more likely to form. To gain insight into the possible habitability of a planet within such a system, we investigated the orbital behaviors that an Earth-like planet could experience inside a binary stellar system with a gas-giant planet. Our results show that the Earth-like planet will exhibit numerous orbital behaviors, both habitable and unhabitable, that are strongly dependent on the location of the gas-giant planet. Furthermore, we find that these behaviors, and thus the possible habitability of the Earth-like planet, can be predicted by estimating the timescales of the perturbations involved within the planetary system.

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80 **Nano-thin membranes: Manipulating the structure of Langmuir-type monolayers.**

Brian Leahy, University of Chicago
Field: Physics Advisors: Binhua Lin, Ph.D

The purpose of our experiment is to probe the properties of nanometer thin membranes under stress. Compress a thin elastic membrane resting on a substrate and it forms sinusoidal wrinkles and localized folds. This behavior of thin membranes under compression can be understood by strictly geometric arguments. Thus, the deformation of thin membranes under compression should be a scale-independent phenomenon depending on the bending stiffness of the membrane, the interaction energy of the substrate, and the length of both the original system and the amount compressed. Our experiment explores the stability of nanometer thin membranes toward wrinkling and folding transitions. Gold-dodecanethiol nanoparticles were suspended on water and formed into a trilayer. Compression of this trilayer yields sinusoidal wrinkles of a uniform wavelength. Further compression leads to the simultaneous relaxation of the wrinkles and the appearance of large folds across the surface. The wrinkles are reversible under decompression, but the folds are not. We analyze these wrinkling and folding instabilities using generalized scaling laws for thin elastic membranes on substrates. This allows the calculation of the bending stiffness and Young's modulus of the gold nanoparticles on water. The mechanical behavior and stability of nanometer thin membranes under compression and the stiffness of the gold nanoparticles both have invaluable applications in the rising use of Langmuir monolayers in nanotechnology.

Abstracts - Physics

81 Using X-ray binary models to probe electron-capture supernovae

Tim Linden, Northwestern University
Field: Astrophysics Advisor: Vicky Kalogera, Ph.D.

X-Ray binaries are double star systems consisting of a dense compact object, such as a neutron star or black hole, in tight orbit around another star. Stellar material is transferred from the star onto the compact object, creating extremely bright X-Ray emissions which are easily detected by modern X-Ray telescopes such as the Chandra X-Ray Observatory. Due to their short lifetime, X-Ray binaries are highly correlated with recent star formation activity, and are thus the best tool for determining the recent star formation history of extragalactic sources. Here, I will show theoretical models of the X-Ray binary population resulting from a large burst of star formation activity, focusing on activity between 25-60 million years after star formation. During this interval, the X-Ray binary population is highly impacted by an event known as an electron-capture supernovae, in which electrons merge with the heavy elements inside a massive star to create explosions significantly different from traditional iron core-collapse supernovae. While electron-capture systems may form a significant portion of the observed neutron star population, existing theoretical models dispute both the percentage of systems which will undergo electron-capture, as well as the energetics of the electron-capture process. I will show how X-Ray binary observations uniquely allow us to constrain the population of electron-capture supernovae and use accepted values of these parameters to explain the overabundance of X-Ray binary sources in the Small Magellanic Clouds.

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82 Modern approach to the advanced undergraduate physics laboratory through the measurement system design

Glenn Lorentz, Loyola University
Field: Physics, Educational Experiment Advisors: Matthew Bone M.S., Thomas Ruubel M.S., Asim Gangopadhyaya Ph.D., Aleksandr Goltsiker Ph.D.

Most General, Modern and Advanced undergraduate Physics Major laboratory practicums are targeted to the phenomena observation and regularities proof through simple direct measurements at the given set-ups. In spite of their traditional useful educational and lecture supporting mission they lacks in supplying future pure and applied physicists with the real practical skills in experiments design and measurement system as a signal processing assemble.

We tried to design, make, introduce as a sophomore-junior year Intermediate Physics Laboratory course and run through 3 successive years such an innovative practicum based upon Environment Physics sample phenomena (Thermal radiation with "Cenco" standard equipment and Seismometry due to Jesuit Seismic Association at Loyola heritage observatory).We introduced sensor-transducer-calibration-identification conceptions for thermometry and seismometry, combined with the signal processing and conditioning both for analog and digital signal filtering and time/ frequency domain analyses. Students participate in elementary steps of decision making in measurement system design and equipment selection due to requirements.

Such an Intermediate Laboratory can be considered as a useful bridge from the traditional classical / modern physics heritage study to the contemporary experimental environment requirements.

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83 **Hydrodynamic interactions in colloidal systems during stratification in confined geometries**

Sergey Novikov, University of Chicago
Field: Statistical physics Advisors: Stuart Rice Ph.D., Binhua Lin, Ph.D.

Quasi-one- and quasi-two-dimensional colloidal suspensions can be used to model the behavior of some molecular and even atomic systems in various fields. Our study focuses on how the structure changes during the transition between quasi-one- and quasi-two-dimensional systems. The systems consist of aqueous suspension of 1.58 and 3.01 μm silica particles in silicone elastomer channels of varying widths. By use of digital video microscopy, we study the spatial distribution of particles in the suspensions, and characterize these distributions by pair correlation functions. As the packing fraction increases, stratification occurs, and the pair correlation function parallel to a wall, *g(x)*, is used to describe distributions of particles along each stratum. Different strata, even within one channel, are slightly different due to variance in confining geometry and wall effects. By comparing pair correlation functions for stratified channels, we can deduce colloid-colloid interaction differences among different strata. Ultimately, we aim to obtain experimental evidence for whether the effective colloid-colloid interaction in quasi-one- and quasi-two-dimensional systems is different.

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84 **Observations of linear polarization of water masers in star-forming regions**

Amanda Stenson, DePaul University
Field: Radio Astronomy/Astrophysics Advisor: Anuj P. Sarma, Ph.D.

We measured the linear polarization in water maser data from a star forming region known as OH 43.8-0.1, that has been observed with the Very Long Baseline Array (VLBA) radio telescope. We took the data through several elaborate procedures using the Astronomical Image Processing Software (AIPS). We then generated Stokes I, Q, and U images for the polarization calibrator (the quasar 3c454.3), and used these images to measure the linear polarization intensity for 3c454.3. We measured the linear polarization of 3c454.3 to be 255 milli-Jansky (= 4% polarization) from this initial run. This compares well with the 150 milli-Jansky measured at the VLBA about 10 days after this observation (~2%).

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85 **Design of multi-parameter nanoplasmonic structures using genetic algorithms.**

Joseph Yelk, Northwestern University
Field: Nanoplasmonics Advisor: Tamar Seideman, Ph.D.

Genetic algorithms are applied to design multiparameter nanoplasmonic devices with optical applications. Lens-like metallic structures are designed to spatially focus an incident plane wave to scales much smaller than its wavelength. First, a symmetric nanoscale metallic lens is designed to spatially focus an incident plane wave. The optimal structure resembles a dipole antenna. Next, a more complex asymmetric lens system is optimized and much greater field enhancement is obtained. Finally, various features of these optimal structures are analyzed to understand their interaction with the structure as a whole. Other methods in nanoplasmonics are also discussed.

SOCIAL SCIENCES AND PSYCHOLOGY

86 Social Support and Its Effect on Self-Reported Depressive Symptoms and Alcohol Use During the Transition to College

Lauren Acciavatti, Loyola University
Field: Clinical Psychology Advisor: Colleen Conley, Ph.D

During college, rates of major depressive disorder and depressive mood among students increase. For women and men, perceived social support is negatively correlated with depressive symptoms, and higher amounts of perceived social support tend to buffer depressive symptoms. However, depressive symptoms appear to be expressed qualitatively differently by male and female students. Among those diagnosed with major depressive disorder, men are more likely to abuse alcohol than women. One possible explanation for this is that social gender norms pressure men to mask depressive symptoms and instead seek emotional release through destructive means, such as heavy drinking). The current study aimed to explore perceived social support and its link with self-reported depressive symptoms and alcohol use, in a sample of 101 college students (33 men, 68 women, mean age = 18.5 years). It was hypothesized that social support would negatively relate to depression and alcohol use at the transition to college. Additionally, gender was expected to act as a moderator, such that men would be more likely to report alcohol use problems. Participants were assessed at two time points, while in high school (grades 11 or 12) and two years later. Measures of social support were assessed at Time 1 and Time 2. Depressive symptoms and alcohol use were measured at Time 2. The results supported the first hypothesis, in that students who perceived that they had more social support before college were less likely to report depressive symptoms during college. However, this analysis did not reveal a significant relation between social support and alcohol use, nor was gender a moderator of these relations. Overall, the results of this study replicate previous findings and further suggest the importance of social relationships and perceived social support for both males and females across the transition to college.

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87 Gender, Testosterone, and Risk Aversion in MBA Students

Nicole Baran, University of Chicago
Field: Biopsychology, Experimental Economics Advisor: Dario Maestripieri, Ph.D

Women are known to be more risk averse than men in a variety of contexts, including financial decisions. In this study, we investigated whether variation in testosterone levels in a sample of over 500 MBA students accounts for differences between and within genders in economic risk taking and risk aversion. We also investigated whether within-gender variation in testosterone is accounted for by social factors. We measured: 1) testosterone concentrations in saliva samples, 2) 2D:4D digit length ratio, the ratio of the lengths of the index and ring fingers, which is associated with prenatal testosterone exposure, and 3) facial masculinity , which is correlated with testosterone exposure during puberty. We collected extensive background information on the study participants and assessed their risk taking and risk aversion tendencies using computerized economic games and questionnaires. We found that men had higher salivary concentrations of testosterone and lower digit ratios than women. Within-sex variation in salivary hormone levels was not accounted for by 2D:4D digit length ratio, but instead by social factors. Individuals in a stable romantic relationship, especially men, had lower testosterone levels than single individuals. We found that higher levels of testosterone are associated with lower risk aversion among women but not among men. At low concentrations, however, testosterone predicts risk aversion in both women and men. In other words, in women and men with comparable levels of testosterone, the gender difference in risk aversion disappears. These results suggest that testosterone levels account for differences in economic risk

aversion between and within genders.

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88 **Characteristics of Successful Rural Development Projects in Aymara Communities in the Andes**
Miriam Bodenheimer, University of Chicago
Field: International Development Advisor: Alberto Simpser, Ph.D

Development projects must often struggle with gender inequality in their attempts to improve the well-being of rural communities. In an effort to gain a greater understanding of why some of these projects are more successful than others, I have analyzed two development projects in rural Aymara communities of the Andes that employ gender-focused strategies. My analysis is based on four criteria that I believe are essential in determining the success of such development projects. These four characteristics are as follows: (a) a strong and early focus on community formation and consciousness-raising with the aid of an exogenous change agent; (b) an understanding that development requires time and takes place in a progressive; (c) a conscious effort to make activities relevant to the needs and circumstances of the local community through active, participatory discussion with community members; and (d) an open, cooperative, and inclusive modus operandi that caters first and foremost to women, but nevertheless actively seeks to embrace all members of the community, including men and children. The case study analysis illustrates that these criteria are essential to determining the success of local community-based educational initiatives implemented as a means of community development. Understanding how these criteria can be used to evaluate and improve development programs in rural Aymara communities will hopefully help to provide a better approach to rural indigenous development all over the world.

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89 **Moments that Define Indigeneity: A Historical Look at Mexico's "Indigenous Problem"**
Zarah Carranco, University of Chicago
Field: Mexican Indigenous History Advisor: Emilio Kouri, Ph.D

Throughout Mexican history, indigenous peoples have been referred to as a problem, a hurdle standing between the country, in its current state, and its desire for modernity and social justice. This "indigenous problem" is hardly a new policy question. The "indigenous problem" traces back from the Colonial period, to the 19th Century, through the Revolution and Post-Revolution, and is still lingering now in Post-PRI Hegemony era. This problem, as it is understood, is what to do with a people that are hindering the progress of Mexican society.

Present-day scholars have worked on identifying the issues surrounding the "indigenous problem" and on understanding the socio-political need and possibility of jumping the hurdle that this problem poses to finally be able to achieve the goals of modernity and social justice. However, there is no scholarship that looks at the evolution of this "problem." My research provides this missing genealogy of the "indigenous problem." With this genealogy, we will be better able to understand why and how the marginalization of indigenous peoples in Mexico persists today. Furthermore, the policy questions that are addressed by the Mexican government within my "indigenous problem" genealogy will serve to inform future policy decisions such as how to cope with the challenges and demands presented by the present-day case of the Zapatistas. Without this knowledge we take the risk of neglecting an entire history of indigenous marginalization from which to examine Mexico's current socio-political climate.

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90 Motion and Its Simulation: The Effects of Motor Expertise and Roles of Cerebellar and Premotor Networks in Action Language Processing

Matthew Cieslak, University of Chicago
Field: Cognitive Neuroscience Advisor: Sian Beilock, Ph.D

The discovery of "mirror neurons" in nonhuman primates that respond during both the visual perception and production of an action suggests that regions traditionally associated with motor planning and execution may be active when one is merely thinking about or viewing actions. Functional magnetic resonance imaging (fMRI) studies in humans parallel these conclusions. Specifically, regions including premotor, parietal and limbic cortices are active both when individuals produce actions and when they simply view or hear sentences about an action3, suggesting the presence of a homologous mirror neuron system in humans. We used fMRI to explore the role that neural regions underlying movement-planning and execution might play in the processing of action-related language, and specifically whether one's experience performing these actions impacts processing. Expert ice-hockey players (N=12) and novices (N=9) listened to sentences about hockey activities. Afterwards, to localize the regions associated with motor execution, all subjects performed simple movements and subsequently imagined performing these movements without any overt motor response. For all subjects, left premotor cortex showed overall greater activity during movement simulation relative to movement execution. This region also showed significantly greater activity for experts relative to novices while subjects listened to the hockey-action sentences. In contrast, primary motor regions were overall more active during actual movement than imagined movements. These regions also showed greater activity for novices when listening to hockey-action sentences. This work provides further evidence that the processing of linguistic information such as verbal sentences may rely on motor-regions–with the specificity of these regions dependent on one's experience performing the actions in question. Greater expertise allows a higher level, goal-oriented representation of action language (i.e., premotor areas involved in action planning). Lacking expertise, novices rely more on primary movement-execution regions for action language processing (i.e., primary motor areas involved in overt movement).

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91 The Emergency Contraceptive Pill: Knowledge and Attitudes in a University Population

Julia Fedor, Northwestern University
Field: Sociology Advisor: Maryjane Osa, Ph.D

The emergency contraceptive pill, also known as the morning-after pill or Plan B, is a post-coital regimen used to prevent unintended pregnancy following unprotected intercourse, contraceptive failure, or sexual assault. This study employs the social-psychological Information-Motivation-Behavioral Skills Model as a framework for analyzing the use of the emergency contraceptive pill as a preventive sexual and reproductive health behavior. The purpose of the research is to measure pill knowledge and attitudes among young adults; to determine if sex, political affiliation, and religiosity influence knowledge and attitudes; and to connect the findings to the current socio-political context and discuss the implications of emergency contraceptive pill use.

A comprehensive online questionnaire was used to assess the knowledge and attitudes of a non-random sample of 428 undergraduate students at Northwestern University. While the results show a general lack of detailed, accurate knowledge about the pill, an overwhelming majority of students reported favorable attitudes toward pill use. In addition, chi-square testing found dependent relationships between biological sex and knowledge, political affiliation and attitudes, and religiosity and attitudes.

This study concludes that the emergency contraceptive pill is a safe, convenient, and effective contraceptive method that has the potential to reduce the high unintended pregnancy and abortion rates in the United States. To provide young adults with more knowledge about the pill for informed decision-making, the study recommends increased funding for comprehensive sex education, outreach and educational initiatives on college campuses, and strong federal and state policy implementation to promote accurate knowledge about and expanded access to the emergency contraceptive pill.

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92 **Multicultural Approaches to Learning: An Exploration of a British Academy's Religious Education Curriculum**

Priya Fielding-Singh, Northwestern University
Field: Educational Policy Advisor: Galya Ruffer, Ph.D

Among the educational policies directed at fostering social cohesion in England, the role and purpose of compulsory Religious Education for all British pupils has long been a topic of scholarly debate. This study seeks to examine the process by which a British Academy designs and enacts a Religious Education curriculum and the role of the surrounding community, local government, and school ethos in that procedure. Given the lack of empirical work on current school practices due to frequent changes in national legislation and expectations for schools over the last fifty years, this case study of a British Academy's Religious Education program fills the gap in research on present-day programs. Through textual research, interviews with students and staff, and classroom observations, this research aims to understand the political and cultural context within which the curriculum was conceived, how the curriculum is translated in the classroom, and the impact of its teachings on students. On-sight research was performed at Mossbourne Community Academy, one of the forty-seven co-educational secondary schools created in London since 2000. Data was analyzed qualitatively using a coding scheme developed from themes found in Religious Education literature as well as grounded theory. Analysis confirmed schools' freedom and lack of accountability in program development as Mossbourne conceived and implemented its curriculum independent of government or community oversight. This study concludes that there is a strong relationship between the curriculum's design, delivery, and effect on students and the school's ethos. Mossbourne's ethos, which enforces strict behavior management, discipline, and accountability, ensures student participation and competency in the course. This research is among the first to explore relationships between school ethos and Religious Education in the UK.

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93 **Possible Correlation between Small Business Economic & Crime Demographic in North Lawndale**

Allison Fitzpatrick, DePaul University
Field: Urban Geography Advisor: Maureen Sioh, Ph.D

I have conducted a local case study in regards to community safety in North Lawndale. This neighborhood caught my attention while researching the Chicago heat wave of 1995, a tragic event that resulted in over 700 deaths. Victims of this disaster tended to live in impoverished neighborhoods where high crime runs rampant. Seeking cool shelter or aid, obviously, was made near impossible or more difficult for residents living under these circumstances. One of my sources for this study, Eric Klinenberg's *Heat Wave: A Social Autopsy of Disaster in Chicago*, examined the social injustice of city authority and neighborhood aid. Klinenberg argued that though crime statistics and poverty levels were similar, neighboring North and South Lawndale fared different through the heat wave due to availability of local business and henceforth community outreach. Though this

was never proven to be a main contributor to the deaths in North Lawndale—or any of the other neighborhoods with high-death rates—it certainly raises interest for this issue and poses an interesting question for research: Do small businesses create a pocket of safety? By means of integrating local data with GIS technology, I examined the neighborhood of North Lawndale to see how/if small business impacts a community.

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94 **Buried by the Benta: Cemetery Patterning in Middle Bronze Age Hungary**

Julia Fraser, Northwestern University
Field: Anthropology, Archaeology Advisor: Timothy Earle, Ph.D

In burials lie the transition between life and death. The placement of the dead cross-culturally and throughout history often reflects idealized social stratifications, distributions of wealth and control of resources. Variations in the placement of the deceased and the ritual performed by the living fill the space between the worth of the living and the dead in the earth. Although interpretation of human remains and their mortuary contexts may be debated, the importance of mortuary analysis as a tool for advancing our knowledge of the past is generally accepted. In Hungary, Bronze Age cemeteries have been located near tells – gradually built up mounds or hills covering successive remains of ancient communities. At one such tell discovered near Százhalombatta, Hungary, the mortuary practices of the Vatya who occupied the area, and what those practices tell us about this Bronze Age people, remain largely unexplored. This research project focuses primarily on identifying and investigating the relationships between the cemeteries and settlements of the Vatya culture during the Middle Bronze Age in the Benta Valley, Hungary. Using existing research on Middle Bronze Age cemeteries, maps of the Benta Valley, and the current work on settlements conducted by the Benta Valley Project, I created a model to identify Vatya cemeteries in relation to settlements through topographic patterns and survey based on a Vatya burial site signature. Maps created using ArcGIS programs, that include both Middle Bronze Age settlement patterns and density with MBA cemetery patterns, will form a visual representation to develop spatial and topographic relationships of settlement size and location with cemetery size and location in the Benta Valley, to analyze further how the hierarchy of the settlements relates to the hierarchy of the cemeteries. Both located at high elevations transposed across stream beds, Vatya settlements of the dead reflect the settlements of the living with some distortion.

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95 **Effectiveness of Groupware Use on Team and Individual Achievements of Learning Outcomes**

Angela Gandhi, Illinois Institute of Technology
Field: Computer Mediated Communication Advisor: Margaret Huyck, Ph.D and Daniel Ferguson

Groupware is used to facilitate interactions among individuals who are geographically and/or temporally distributed apart. This research project explores relationships between the use of a groupware suite and learning outcomes in undergraduate project teams. The groupware being evaluated and used is iGroups, which was specifically built to enable undergraduate project teams at IIT to collaborate on multidisciplinary projects. The topic of groupware usage in undergraduate, multidisciplinary project teams is important because if there is a close correlation between how well students do in these programs and their use of groupware, it may bring more attention to schools in such program to either change their similar program or begin using related learning techniques. The learning objectives in this research include improving the use of iGroups among, which is evaluated by several outcome measures, such as project presentation day exhibition and presentation scores, a self assessment, peer review, etc. Usage data from iGroups, such as the number of e-mails sent and

files uploaded by each individual, is collected from semester to semester; these values are measures of how often a student uses the suite. This research started by completing a literature search, in which several relevant articles were found relating to groupware and learning outcomes, and explains why groupware is important and demonstrates it through empirical studies. I'm currently analyzing data that has been collected from previous semesters to assess the correlation between the use of iGroups and team and individual accomplishments. I hypothesize that the use of such groupware, like iGroups, enhances a student's overall performance because team members can be in constant communication with one another through e-mails, events, the distribution of files, and other similar actions.

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96 **Neural Basis of Social Perception of a Human versus Virtual Human**

Jessica Gayda, Northwestern University
Field: Social Neuroscience Advisor: Joan Chiao, Ph.D

Are virtual humans socially understood as human? To investigate this question, we used functional magnetic resonance imaging (fMRI) to measure the neural correlates of perception and social evaluation of two types of agents: an Embodied Conversational Agent (ECA or virtual human) and a real human. Fourteen participants viewed static images of both the human and ECA, rated each image for emotional valence, and completed a post-scan survey on social impressions of the two agents. No significant differences were found in behavioral measures of rating or reaction time, although the real human was rated as more socially relatable in three dimensions. Viewing either kind of agent relative to rest elicited neural activity in a network of brain regions previously associated with social judgments, including left superior temporal sulcus and right fusiform gyrus. Viewing the ECA relative to human resulted in increased activation in superior temporal sulcus, anterior cingulate gyrus, left precuneus, right angular gyrus, and left inferior frontal gyrus, areas associated with social perception, attention, and cognitive control. The condition of human relative to ECA revealed no areas of significant activation. Interestingly, this finding stands in contrast to previous research which suggests passive viewing of humans but not virtual humans elicits greater neural activation in regions associated with social judgment and mentalizing. Our results suggest that while accurate social judgments can be made of either real humans or virtual humans, it appears the latter might require heightened cognitive processing, perhaps because of the novelty and unfamiliarity of virtual humans.

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97 **Online Social Networking Sites: The Creation of the Virtual Identity and Utilizing Social Normatives of Sex, Gender, and Sexuality**

Amber Gibson-Knowlden, DePaul University
Field: Sociology Advisor: Melissa Bradshaw Ph.D, Tracy Lewis-Elligan Ph.D

In recent years consumer usage of the Internet has shifted from a read-only system to a collaborate network of social interactions and knowledge exchange, creating a necessity to understand the social implications of this type of communication within a sociological context. One of the fastest growing forms of communication of the Web are social networking websites, which allow users to create online profiles for the purpose of online social interaction. This project explores the growth of social networking sites, their function within society, user identities and communications, and the social consequences of the creation of a virtual identity that centers heavily around utilization of the users gender and sexuality as cultural capital for the purpose of gaining social capital within these virtual spaces. To explore this topic I utilized interviews, questionnaires, and content analysis research methods.

To represent their gender on these spaces users most often utilized their sexualized body as cultural capital to "prove" their gender and sexual preference in order optimize the amount of social capital they had access to. Beyond images of the member that typically identified their sex, users often choose to conform to problematic social stereotypes in order to "perform" their gender on these spaces. Women and girls were often shown with little to no clothing on, in sexually provocative poses, with the camera focusing on only one aspect of their bodies, and with hyper-feminine images with female gendered colors on their profile pages. To the contrary, men were shown in tank tops or tee shirts that emphasized their muscles, sometimes holding a gun or weapon, and with sexualized images of women or female friends on their profile pages.

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98 **Context-Based Origins of Racial Categories and Attention**

Pamela Kaye, University of Chicago
Field: Social Psychology Advisor: Josh Correll, Ph.D

Much research has shown that stereotyping and racial bias are still prevalent in the United States. Specifically findings have demonstrated that Blacks capture and hold attention faster than Whites, and that the association of aggression is stronger with Blacks than it is with Whites. The origins of bias, however, are unclear – researchers have identified at least three possibilities. First, there could be a possibly innate predisposition to fear outgroups, which would then hold true for any perception of a different race. Second, there could be culturally communicated stereotypes, which presumably would maintain the attitudes of previous generations. Third, early contact limited to ingroups might instill such a fear of outgroups. The current study was designed to test the possibility that early contact can ameliorate race-danger associations, the latter possibility, in terms of both implicit and explicit measures. Four- and five-year old children who attend school in the South side of Chicago were tested to measure their familiarity and bias. Implicit bias was measured by means of a dot-probe computer task, in which either a Black or a White face appeared before a dot on the screen, and reaction times measure the capturing and holding of attention. Explicit bias was measured using a modified classic ambiguously aggressive acts cartoon task with counterbalanced race and rating the meanness, playfulness, etc of the aggressor. In addition, the children's parents completed a survey regarding the child's familiarity with other races. The present study also attempts to replicate Sagar and Schofield's findings that young children rate Black aggressors as meaner than White aggressors. Using both measurements as well as the survey, it was predicted that as familiarity increased, bias would decrease.

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99 **Gazing at the emotionally expressive side of a face makes you appear more socially intelligent**

Claudia Lau, Northwestern University
Field: Social Cognition Advisor: Joan Y. Chiao, Ph.D and Steven L Franconeri, Ph.D

The face is a powerful indicator of emotional and social information. Some parts of the face appear to be richer sources of information than others. Previous research demonstrates that the left side of the face expressed emotions, such as happiness, sadness and fear, more intensely (Indersmitten & Gur, 2003).

We examined this effect from a new perspective, asking participants to rate digitally altered photographs that look toward the right or left of the participants' faces. If the left side of your face is more emotionally expressive, then people who are more socially intelligent might implicitly fixate their eyes toward that side of a face. If so, then eventually, you should implicitly learn that people who

fixate the more emotionally expressive side of your face tend to be more socially intelligent (i.e. less deceivable or less shy).

Results showed that for both female and male photos, a subtle 3.5 pixel leftward shift in the eye position of a face caused participants to rate faces as higher in ability to detect deception, and for female photos, this leftward shift caused the face to appear less shy. There were no significant effects of eye gaze direction on ratings for questions unrelated to social intelligence. Hence, these results suggest that gazing at the emotionally expressive side of the face makes a person appear more socially intelligent.

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100 **Establishing Its Position as an Oasis of Opportunity: Identifying the Key Components of Dubai's Branding Process**

HongJu Lee, Northwestern University
Field: Marketing Advisor: Dipak C. Jain, Ph.D

The purpose of this paper is to analyze Dubai's branding management in a macro level. This paper consists of branding Dubai as a destination with certain demographic groups. Dubai establishes itself at the upper echelon of markets including tourism, real estate, business hospitality, and learning centers. This study reveals that as opposed to replicating what other competitive destinations have already done, Dubai offers innovative products and services to investors and tourists alike; the indoor "skiing in the desert" facility, the luxury "seven star" hotel on the Dubai coastline, the world's largest man-made island, and the world's tallest building are only a few examples they have offered. This well-defined brand identity uses a clear strategy including unique value proposition, attraction, and brand promise. Developing Dubai's brand image is a key factor in distinguishing from in the highly competitive global environment. Dubai's strategic branding approach provides a rare case that demonstrates the importance of the brand identity and equity on the global stage. Dubai earned itself a track record for making every project a success, regardless of its ambitious conception. Dubai's 13% GDP growth every year since 2000, which is higher than both India and China, proves the realization of the city's successful branding process.

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101 **Discourse on the Origin of Religion and Magic**

Jarret Petrillo, University of Chicago
Field: Sociology/Anthropology/Religious Studies Advisor: Joe Feinberg

In *A General Theory of Magic* by Marcel Mauss and *The Elementary Forms of Religious Life* by Emile Durkheim, both authors attempt to disentangle the manifold collective and individual actions that are inherent in magic and religion. In a sense, it is very difficult to ascertain the exact role played by each. Both authors resolve this conflict in different ways. Mauss, on the one hand, studies magic as a universal phenomenon that requires societal belief. Durkheim describes religion as the root of societal organization. During his argument, he writes that magic "was born out of religion" (Durkheim 367). Yet this is never fully explored. Since magic and religion share the principles of mana and sympathetic association, it would seem that there are tremendous overlaps between the two ideas. It is in this overlap that we will focus our studies in order to discover and develop a true relationship between magic and religion. Through this study, we will show that mana is only *used* by the magician through the practice of sympathetic associations and religion cannot predate magic. Concluding, that elementary forms of religion and magic began as the same thing, and the current difference between them can be attributed solely to an arbitrary distribution of 'rites' assigned to each.

102 Give Thanks to the Chiefs

Carla Podrasky, DePaul University
Field: Geography Advisor: Maureen Sioh, Ph.D

This research examines two reservations that were established within the boundaries of Chicago in the late 1820's. Each reservation was granted separately to two Métis traders men who signed treaties. Part of this project involved digging through archival records in order to determine the boundaries of the Caldwell and Robinson Reservations. The end product consisted of a map of each reservation and the story of the lives of these two men.

103 Is Blood Lead Level an Indicator of Violent Crime in Chicago?

Susanne Rankis, DePaul University
Field: Geography, Environmental Health, Criminology Advisor: Maureen Sioh, Ph.D

In recent years environmental Lead (Pb) exposure has been studied as an indicator of aggressive behavior in children and for the potential of committing a violent crime later in life. My goal for this project is to try and answer whether a positive correlation exists between high blood lead levels and violent crime in the city of Chicago using spatial analysis. Data was gathered from a 2003 city-wide survey of blood lead levels (BLL) in children under six years of age conducted by the Chicago Department of Public Health, violent crime statistics from the Chicago Police Department, and a review of available literature on the subject. One very strong correlation appears to be the number murders committed by community area and elevated BLL. Of the eleven communities with ≥10% of children who tested positive for elevated BLL, ten of those community areas were ranked in the top eleven communities with the highest numbers of murders committed in 2006. While this study is fairly limited in is scope, there is some geographical evidence that warrants further research in determining whether a 'true' link exists between BLL and violent crime in Chicago. Further, while two of the main sources of environmental lead (leaded gasoline and lead based paint) are no longer used, organic lead is a very persistent and bioaccumulative element that remains a problem today in economically disadvantaged communities throughout Chicago particularly on the South and West side thereby also having the largest societal impact on African American and Latino groups.

104 From the Institution to the Individual: A Case Study

Elisa Ringholm, Loyola University
Field: Sustainability, Higher Education, Behavior Advisor: J. M. Eames Ph.D.

Institutions of higher education have a central role in reshaping the relationship between human activities and the environment. Ideas and practices regarding this relationship have generally focused on the concept of sustainability. As more colleges begin to incorporate environmentally sustainable practices into the fabric of their everyday workings, it becomes increasingly important to evaluate the successes and challenges of implementation. This research is a case study that merges the fields of Anthropology and Environmental Studies by evaluating the social and cultural repercussions of several sustainability initiatives that have recently been implemented at Loyola University Chicago. With the use of survey methodology, this project provides data on the level of awareness, knowledge and participation of sustainability initiatives among undergraduates and employees of Loyola. It explores members' perception of their own personal responsibility verses a social institution's responsibility with regards to environmentally sustainable practices and it provides

information about effective mediums of communication of sustainability between individuals and institutions. It also provides useful information about individuals' perspectives of their relationship with sustainability and demonstrates to other universities and institutions alike both successes and challenges associated with implementation of more environmentally aware practices.

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105 **The Family Grows: Beauty in Latin America**

Evelyn Salazar, Loyola University
Field: Philosophy/Political Science Advisor: Dan Vaillancourt, Ph.D

This paper argues that beauty in Latin America has evolved over the past one hundred years through three stages—Utopian Roots, Theoretical Constructions, Critical Parings—and that the stages betray the same constant, the ineffability of beauty. This thesis rests on two assumptions: beauty is not universal but rather a cultural construct, and the 34 countries and 540 million people in the region share at some level a common culture. In stage one, Utopian Roots, thinkers like José Enrique Rodó (Uruguay), Alejandro Octavio Deústua (Peru), Antonio Caso (Mexico) and José Vasconcelos (Mexico) break free of the positivism gripping the intellectuals of their countries in the early twentieth century and place aesthetic activity at the heart of society. Caso makes the case for this stage of beauty. In stage two, Theoretical Constructions, Osvaldo Lira (Chile), Alejandro Tomasini Bassols (Mexico), Radoslav Ivelic K. (Chile), construct in the last third of the century theories covering beauty in art and nature to beauty as a transcendent entity. Ivelic speaks on beauty for this group. In stage three, Critical Parings, Enrique Tames (Mexico) and Orlando Hernández (Cuba), for example, pare back beauty to its manifestations among regional and local cultures like the Regla de Ocha people in Cuba, who discover in their rituals the presence of an energy akin to a blessing. This beneficial energy is beautiful by more…in other words, ineffable. Hernández typifies he thinking of this group on beauty. The conclusion evaluates the strengths and weaknesses of beauty in Latin America, compares briefly the views of beauty from Europe-North America and Latin America, and identifies the significance of ineffable beauty for the peoples of Europe-North America.

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106 **Improving Inter-rater Agreement and Reliability of Learning Outcomes Evaluation**

Heling Shi, Illinois Institute of Technology
Field: Sociology and Organizational psychology Advisor: Daniel M. Ferguson and Margaret Huyck, Ph.D

Inter-rater agreement (IRA) and inter-rater reliability (IRR) are powerful measures of the consistency and quality of rating/judging programs in various fields, particularly during the evaluation of learning outcomes in an education setting. However, one of the fundamental obstacles in research of such topics is how to best improve the program consistency thus affirm the fairness of the rating system. The system evaluated in this study is that of the IPRO Day Project Conference at the Illinois Institute of Technology, which follows a multi-target assessment model. The objective is to investigate the effectiveness of past interventions implemented and identify those that significantly improve the inter-rater agreement and reliability of the mentioned problem context. Literature reviews suggested that for such an assessment model, analysis of IRA indices in addition to IRR + IRA indices analysis are sufficient. Both analyses are conducted on data collected from the IPRO Day judging data for five consecutive semesters, ranging from Fall 2005 and Fall 2007, to obtain IRA and IRR statistics. The results are then related to the history of judging interventions attempted during each semester to evaluate their corresponding effectiveness. Three major judging interventions are investigated in this study: 1) Changing the rating scale, 2) introducing and maintaining a consistent rubric, and 3) matching judges to their expertise. The results from the study will show the most effective and feasible method

to be implemented by the IPRO Program at IIT to achieve significantly improved IRA and IRR.

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107 **(Re)producing Masculinity: A Discourse Analysis of Medical and Lay Understandings of Male-Factor Infertility**

Rikki Stern, Northwestern University
Field: Medical Sociology Advisor: Amy Partridge, Ph.D and Laura Stark, Ph.D

Male-factor infertility seems to undermine cultural understandings of masculinity and medical markers of maleness itself. New reproductive technologies treat male-factor infertility and raise important questions about how doctors and infertile people make sense of male-factor infertility and treatment in relation to cultural understandings of masculinity and medical models of reproduction. To investigate these questions, I compared doctors' and lay people's experiences with male-factor infertility and assisted reproductive technologies. I performed a discourse analysis of a sample of 100 infertile person blog entries and 96 doctor blog entries. Infertility blogs were ideal sources of data because they offered candid reflections, unfettered by interviewer bias. First, I found that infertile patients and doctors understand reproduction as a biological urge on which fertile people act. An inability to physically reproduce strips infertile men of their capacity to act on their biological urges. Infertile men often turn to medical technologies for help. Second, I found that infertile people and doctors describe fertility in terms of chance and distinguish between diagnostic technologies, which assess chances for conception, and treatment technologies, which aim to improve chances for conception. Third, my research shows that infertile men are suspended between positions as responsible agents, who choose to use treatment technologies to conceive, and as mere reproductive objects, who are at the mercy of chance. Infertile men seem to respond to tensions between reproductive subjecthood and objecthood—or reproductive choice and chance—by expanding their notions of reproduction, family, and fatherhood. I conclude that infertile men and doctors re-inscribe existing ideological assumptions about innate gender, racial, and cultural differences in new understandings of family. In this way, infertile men and doctors silence alternative, and potentially liberatory, conceptions of reproduction, fatherhood, and masculinity.

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108 **White Students' Attitudes Towards Latino/a Immigrants**

Micah Uetricht, Loyola University
Field: Sociology Advisor: David G. Embrick, Ph.D

The nature of race relations and racism in the United States has changed considerably in the post-Civil Rights era. No longer is overt racism deemed socially acceptable: laws disallowing racial minorities from public places have been removed, practices preventing people of color from living in white neighborhoods and getting jobs in mostly white companies have been outlawed, and in most circles, racist statements can no longer be made without fear of opposition. Yet despite these changes in policy and rhetoric surrounding race---seemingly towards a more tolerant, equalitarian, and "post-race" society---racial inequalities persist, in many cases worse than they did before the Civil Rights movement. How is this incongruence possible? How has our racial discourse changed, yet many material conditions have stayed the same or worsened? Recent research has sought to explain this phenomenon, labeling the racism of the 21st century "color-blind racism." This project aims to apply the aforementioned new framework for examining racism to how whites justify inequalities between whites and Latino/a immigrants. Based on interviews with thirty white Loyola undergraduates, it examines students' conflation of "immigrant" and "Latino," the ways they justify or oppose immigration policy and on what basis, and the rhetoric white students use around what effect Latinas/os' presence in this country has on life for native-born citizens and for the character of

the country as a whole.

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109 **The Parallel Universes of Mental Health Care Professionals and Patients**

Jessica Wright, Shimer College
Field: Mental Health Care Advisor: Ann Dolinko, Ph.D and Stuart Patterson, Ph.D

The interpersonal relations between patients and professionals in mental health care create a social barrier that is oppressive to patients. This situation remains because many people deny or overlook the existence of these barriers. My experiences in mental health care, where I have seen this social barrier, parallel those of other patients and pseudopatients (mentally healthy people admitted for research purposes), indicating a real barrier that cannot be explained away by the mental ill health of patients. One possible origin for this oppressive social barrier is goal displacement, a process in which professionals create rules for the sake of goals, but forget the goals while still strictly enforcing their rules. This oppression lends itself to a possible solution in open, honest, and respectful communication between patients and professionals in mental health care and about mental health care with a goal toward reform.

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110 **Muslim Women Immigrants: Engaging Identity, Pursuing Social Change**

Laura Wulf, University of Chicago
Field: Cultural Anthropology Advisor: Kathleen Adams, Ph.D

The term "Muslim woman" describes numerous diverse individuals and constructs a social category that is both a source of agency and problematic for its members. This classification is utilized by its members through political and civil society organizations to further economic, social, and political interests, although in doing so reducing such individuals to their religion and gender. I have undertaken research to study Muslim women identity in the particular context of recent immigrants to the United States. I will examine both how social and political organizations act in constructing this identity and simultaneously how shared experiences as immigrants cement this experience of group membership. My research has shown that recent immigrants who identify as Muslim women share many characteristics other than religion and gender; they relate through common social, economic, legal, and political experiences in the United States. Although identifying as a woman or Muslim can carry powerful personal meaning, any reference to gender or religion also includes its social implications in particular contexts. What it "means" to be Muslim, a woman, and an immigrant is defined by the shared experiences individuals hold.

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.

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