2012 spring symposium & research conference

in Science, Technology, Engineering & Mathematics

LIGHTING the Path to OUR FUTURE WITH SCIENCE, TECHNOLOGY, ENGINEERING and MATHEMATICS

a multidisciplinary student research conference

Friday, February 3rd
Saturday, February 4th

RENAISSANCE
BLACKSTONE CHICAGO HOTEL
636 South Michigan Ave · Chicago, IL 60605

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DEPARTMENT OF EDUCATION
UNITED STATES OF AMERICA
NSF
2012
Spring Symposium in STEM
Science, Technology, Engineering & Mathematics

Message from Senator Richard J. Durbin

State of Illinois

COMMITTEE ON APPROPRIATIONS

COMMITTEE ON FOREIGN RELATIONS

COMMITTEE ON THE JUDICIARY

COMMITTEE ON RULES AND ADMINISTRATION

United States Senate
Washington, DC 20510–1304

February 3, 2012

Dear Friends:

Greetings! It gives me great pleasure to welcome all of you to the 2012 Spring Symposium and Student Research Conference in Science, Technology, Engineering, and Mathematics (STEM). As you gather for this year's conference, Lighting the Path to Our Future with STEM, faculty members and students have an opportunity to share results of research, information, and experiences.

For many years, The Illinois Louis Stokes Alliance for Minority Participation (ILSAMP) and the Center for STEM Education & Research have worked to increase the number of minority scholars earning degrees in the fields of Science, Technology, Engineering, and Mathematics. The central goals of ILSAMP are to provide programs to improve the academic preparation of STEM students, reinvent gateway courses to better educate students, and provide underrepresented students with more educational opportunities. I applaud your commitment to increasing the number of minority scholars earning degrees in STEM disciplines.

Again, I would like to extend my warmest wishes to all attendees for your dedication to the goals of ILSAMP and this conference. Congratulations on all your work and achievements, and I wish you best of luck in all your future endeavors.

Very truly yours,

Richard J. Durbin
United States Senator

711 HART SENATE OFFICE BUILDING
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durbin.senate.gov

Message from Governor Pat Quinn

State of Illinois

OFFICE OF THE GOVERNOR
CAPITOL BUILDING, 207 STATE HOUSE
SPRINGFIELD, ILLINOIS 62706

PAT QUINN
GOVERNOR

February 3-4, 2012

Dr. LeRoy Jones, II
Executive Director for STEM Initiatives
Chicago State University
9501 South King Drive
Chicago, Illinois 60628

Greetings!

As Governor of the State of Illinois, I am pleased to welcome everyone gathered for the 2012 Spring Symposium and Student Research Conference in Science, Technology, Engineering and Mathematics (STEM) sponsored by the Illinois Louis Stokes Alliance for Minority Participation (ILSAMP) and the Center for STEM Education & Research. This year's theme is *Lighting the Path to our Future with STEM.*

It is very important that we, as a state, work towards ensuring that everyone, regardless of race, ethnicity or gender, has access to the same opportunities for success. ILSAMP is committed to increasing the number of minority scholars earning degrees in the areas of science, technology, engineering and mathematics who are currently underrepresented in those fields. This two day conference will serve to further that noble goal by bringing together an intergenerational group of minority students, professionals and academics.

I would like to congratulate each student who is participating in this year's symposium. It is evident that you are extremely dedicated students who place a high value on education and have a strong drive to succeed. I hope you enjoy the chance to showcase your hard work to your peers and to the professionals in the scientific and technical fields. This experience will serve as a great stepping-stone to whatever career path you choose in the future.

On behalf of the people of Illinois, I offer my best wishes for an enjoyable and rewarding conference.

Sincerely,

Pat Quinn

Pat Quinn
Governor

RAHM EMANUEL
MAYOR

Message from Mayor Rahm Emanuel

City of Chicago, Illinois

OFFICE OF THE MAYOR
CITY OF CHICAGO

February 3, 2012

Dear Friends:

As Mayor and on behalf of the City of Chicago, I offer my warmest welcome to all those attending the Illinois Louis Stokes Alliance for Minority Participation and STEM Education & Research's annual Spring Symposium & Student Research Conference, *Lighting the Path to Our Future with STEM.*

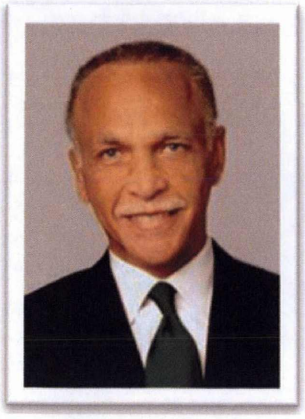
The Illinois Louis Stokes Alliance for Minority Participation and the Center for STEM Education & Research were formed in response to a nationally mandated request to increase the number of underrepresented minorities in STEM (science, technology, engineering, and mathematics) areas. The programs provide intellectually stimulating projects to enhance the scholarship of STEM students. The Annual Symposium provides a forum for students to share their research and a way to bring together students and professionals in these areas.

On behalf of the people of Chicago, I hope you have an enjoyable event and best wishes for much continued success in the future.

Sincerely,

Rahm Emanuel

Mayor



Message from Dr. Wayne D. Watson

President, Chicago State University

Telephone: 773 / 995-2400
Fax: 773 / 995-3849
E-mail: wwatson@csu.edu

9501 S. King Drive / ADM 313
Chicago, Illinois 60628-1598

February 3, 2012

Welcome Symposium Participants:

I am pleased to welcome you to the 2012 Spring Symposium & Student Research Conference in Science, Technology, Engineering, and Mathematics (STEM). The Illinois Louis Stokes Alliance for Minority Participation (ILSAMP) program has been an integral part of the student's science, technology and mathematics educational experiences since 1993, and the recently funded Center for STEM Education & Research (CSER) will develop new and exciting initiatives to enhance the recruitment, retention and graduation rates of underrepresented minority students in STEM.

The critical importance of research and teaching must go hand in hand. The more relevant research opportunities afforded our students as part of their academic preparation, the greater our retention and graduate rate will be. The ILSAMP students have accomplished this level of achievement and have demonstrated insurmountable academic challenges. The conference theme of *Lighting the Path to Our Future with STEM* is an important way to recognize how our students' current research will provide solutions for the future.

On behalf of Chicago State University, the lead institution for the ILSAMP and CSER programs, I am pleased to thank all of the many supportive professionals who have gathered for this praiseworthy occasion. It is your commitment and hard work that has enriched the lives of those to whom we dedicate our service, namely, our students.

Sincerely,

Wayne Watson

Message from Dr. Sandra Westbrook

Principal Investigator, Illinois LSAMP Program

Provost & Senior Vice President for Academic Affairs, CSU

Office of the Provost & Senior Vice President for Academic Affairs

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Chicago, IL 60628-1598
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February 3, 2012

The Illinois Louis Stokes Alliance for Minority Participation
2012 Spring Symposium & Student Research Conference in STEM
William Science Building, Room 101A
9501 S. King Drive
Chicago, Illinois 60628

Dear Symposium Attendees:

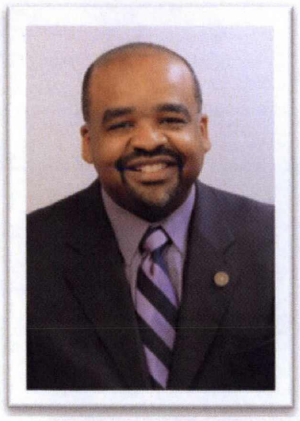
I am honored to welcome you to the Annual Student Research Symposium in Science, Technology, Engineering and Mathematics (STEM). Programs such as the Illinois Louis Stokes Alliance for Minority Participation (ILSAMP) and the Center for STEM Education & Research (CSER) provide our undergraduate students an opportunity to elevate their expectations as scholars, meet unexpected challenges and advance their overall understanding and contributions to the STEM disciplines.

The amazing role we serve as mentors and the collaborative problem solving activities we engage have helped to transform our student scholars into STEM professionals. The success stories we boast about attest to the profound impact ILSAMP and CSER have made on students' academic performance and professional journeys.

On behalf of the Illinois LSAMP community, I thank the many supportive professionals who have gathered to participate in this weekend of scholarly exchanges. It is through your collaboration that we have advanced the participation of students in STEM. Please know that you have enriched the lives of many students who once thought being a scientist, mathematician and engineer impossible. Take this opportunity to take a bow to the dreams fulfilled. I applaud you!

Sincerely,

Sandra Westbrooks, Ph.D.
Provost and Senior Vice President for Academic Affairs
Principal Investigator for the Illinois LSAMP Program



Message from Dr. LeRoy Jones, II

Executive Director for STEM Initiatives
Illinois LSAMP Program and the
Center for STEM Education & Research

9501 S. King Drive / SCI 101A
Chicago, Illinois 60628-1598

Tel/Fax: 773.995.3296/2966
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3 February 2012

Greetings Symposium Participants,

Welcome to the 2012 Spring Symposium & Research Conference in STEM! Our theme, "*Lighting the Path to our Future with Science, Technology, Engineering and Technology*," speaks to the exciting path forward for Illinois LSAMP and the Center for STEM Education & Research as we continue to develop initiatives to recruit, retain and graduate underrepresented minorities in science, technology, engineering, and mathematics (STEM) disciplines.

We are giving particular attention to student persistence toward the B.S. degree and transition to graduate studies; institutionalizing successful policies and procedures for attainment of the B.S. degree; reaffirming community college associations; and developing relevant international activities. In support of the aforementioned goals, this symposium will provide a dynamic environment for students, faculty and staff to share their research experiences, present their scholarly findings, attend information workshops, hear motivational speakers and be applauded for their commitment to STEM excellence.

As Executive Director, I would like to personally thank the Alliance coordinators, faculty and dedicated staff of the Illinois LSAMP program and the Center for STEM Education & Research for your tireless efforts in ensuring the success of this symposium. I would also encourage students to take full advantage of the opportunities that this weekend will offer and use the experiences as a launching pad for your future aspirations.

Best Wishes,

LeRoy Jones II
Executive Director for STEM Initiatives

AGENDA-AT-A-GLANCE

Friday, February 3rd

3:00 pm - 7:00 pm	Registration & Hotel Check-In *Ballroom Pre-Function Area*
	Poster Set-Up *Inspiration Studio*
7:00 pm - 9:00 pm	Dinner & Keynote Speaker *Crystal Ballroom*
9:00 pm - 11:30 pm	Student Networking Social *Historic Art Hall Pre-Function Area*

Saturday, February 4th

7:00 am	Registration Opens *Ballroom Pre-Function Area*
7:00 am - 9:00 am	Breakfast Buffet *Crystal Ballroom*
9:00 am - 10:15 am	Workshops *Concourse Level Event Space*
10:15 am - 10:45 am	Break/Hotel Check-Out
10:45 am - 12:00 pm	Poster Session *Historic Art Hall Pre-Function Area*
12:00 pm - 1:00 pm	Plenary Luncheon *Crystal Ballroom*
1:00 pm - 3:00 pm	Oral Presentations *Concourse Level and Art Hall Event Spaces*
3:00 pm - 4:00 pm	Closing Award Ceremony *Crystal Ballroom*

HOTEL FLOOR PLAN

Renaissance Blackstone Chicago Hotel, Chicago, IL

DETAILED PROGRAM AGENDA

Friday, February 3rd		
TIME	TOPIC	ROOM
3:00 pm - 7:00 pm	REGISTRATION & HOTEL CHECK-IN	Ballroom Pre-Function Area
	POSTER SET-UP	Inspiration Studio
7:00 pm - 9:00 pm	DINNER	Crystal Ballroom
	OPENING AND INTRODUCTION *Dr. LeRoy Jones, II* *Executive Director for STEM Initiatives* *Illinois LSAMP Program and the Center for STEM Education & Research*	
	WELCOME AND GREETINGS *Dr. David Kanis* *Dean, College of Arts & Sciences* *Chicago State University*	
	KEYNOTE SPEAKER *Dr. Isiah M. Warner* *Vice Chancellor for Strategic Initiatives & Boyd Professor of Analytical Chemistry* *Louisiana State University* *Baton Rouge, Louisiana*	
	SERVICE AND LEADERSHIP AWARDS *Dr. Marian Wilson Comer* *Executive Director Emerita* *Illinois LSAMP Program*	
	CLOSING REMARKS *Dr. LeRoy Jones, II* *Executive Director for STEM Initiatives* *Illinois LSAMP Program and the Center for STEM Education & Research*	
9:00 pm - 11:30 pm	STUDENT NETWORKING SOCIAL	Historic Art Hall Pre-Function Area

Saturday, February 4th		
TIME	TOPIC	ROOM
7:00 am	REGISTRATION OPENS	Ballroom Pre-Function Area
7:30 am - 9:00 am	BREAKFAST BUFFET	Crystal Ballroom
9:00 am - 10:15 am	STUDENT WORKSHOP WITH DR. ISIAH WARNER	El/Chicago/Alton/Metra

The Yellow Brick Road from Bunkie, Louisiana to Baton Rouge, Louisiana

In this workshop, Dr. Warner will highlight his path from a small country town (Bunkie, Louisiana) to a position as a faculty member at a major university (LSU in Baton Rouge, Louisiana), where he has attained the highest ranked Professorship in the LSU system (Boyd Professor). The hierarchy of the academic structure of a major university will be discussed and described. In addition, the many and varied elements of his life which have allowed him to successfully make this journey to Baton Rouge will be highlighted in detail.

FACULTY AND STAFF WORKSHOP WITH DR. RABIAH MAYAS	Barbershop

Baby Chicks and Big Explosions: Museums and STEM Professionals Re-Imagining Science Education

Science museums have taken a leadership role in advancing K-12 STEM education in the out-of-school setting. The Museum of Science and Industry, Chicago – the largest science center in the Western hemisphere – is making an impact on youth, families, teachers and communities through its Center for the Advancement of Science Education (CASE). Partnerships with the scientific community are critical to the success of CASE initiatives and are the focus of strategic planning efforts to sustain deeper and more meaningful relationships with STEM professionals. In this interactive workshop, faculty will learn about the Museum's approach to science education, model and share practices for engaging youth and lay audiences in scientific content and research, and discuss key values and strategies for connecting their own research with youth and the lay public.

CENTER FOR STEM EDUCATION & RESEARCH ORGANIZATIONAL MEETING (*for External Advisory Board and Steering Committee)*	Historic English Room

Saturday, February 4th continued		
TIME	TOPIC	ROOM
10:15 am - 10:45 am	BREAK/HOTEL CHECK-OUT	
10:45 am - 12:00 pm	POSTER SESSION	Historic Art Hall Pre-Function Area
12:00 pm - 1:00 pm	LUNCH	Crystal Ballroom
	RESEARCH EXPERIENCES ABROAD PLENARY A Fulbright Fellow and three Illinois LSAMP students will discuss their research and cultural experiences while abroad. They will share how their experiences allowed them to learn about other cultures, make new friends, and develop tangible career benefits. Moderator: Dr. Armin Roeseler Senior Vice President & Chief Technology Officer Global Infrastructure & Operations at RealTick LLC Student Panel: Ms. Karen Cossyleon Physics Undergraduate Student Chicago State University Ms. Kristen Jordan Zoology Graduate Student Southern Illinois University at Carbondale Ms. Sarah Lopez Biochemistry Graduate Student DePaul University	
1:00 pm - 3:00 pm	ORAL PRESENTATIONS - GROUP A Moderator: Dr. Mary Carrington Associate Professor of Biology Governors State University	El
	ORAL PRESENTATIONS - GROUP B Moderator: Dr. Dennis Kitz Professor of Biological Sciences Southern IL University at Edwardsville	Chicago/Alton

Saturday, February 4th continued		
TIME	TOPIC	ROOM
	ORAL PRESENTATIONS - GROUP C Moderator: Dr. William Hunter Professor of Chemical Education and Director of the Center for Mathematics, Science, and Technology Illinois State University	Metra
	ORAL PRESENTATIONS - GROUP D Moderator: Dr. Eric M. Brey Associate Professor of Biomedical Engineering Illinois Institute of Technology	Barbershop
	ORAL PRESENTATIONS - GROUP E Moderator: Dr. David Rutschman Professor of Mathematics and Associate Dean for the College of Arts & Sciences Northeastern Illinois University	Inspiration
	ORAL PRESENTATIONS - GROUP F Moderator: Dr. Edmundo Garcia Associate Professor of Physics Chicago State University	Historic English Room
3:00 pm - 4:00 pm	CLOSING AWARD CEREMONY AWARD PRESENTATIONS *Ms. Lezlie Thompson* *Associate Director* *Illinois LSAMP Program and the Center* *for STEM Education & Research* CLOSING REMARKS *Dr. LeRoy Jones, II* *Executive Director for STEM Initiatives* *Illinois LSAMP Program and the Center* *for STEM Education & Research*	Crystal Ballroom


UIC

SPEAKER BIOGRAPHIES

Dr. Isiah Warner

Vice Chancellor for Strategic Initiatives &
Boyd Professor of Analytical Chemistry
Louisiana State University
Baton Rouge, Louisiana

Isiah Warner, Ph.D., is an analytical chemist with more than 300 refereed publications in a variety of journals relevant to this area of research. He has particular expertise in the area of fluorescence spectroscopy, where his research has focused for more than 35 years. He is considered one of the world's leading experts in this area. For example, he is the corresponding author in the highly cited biannual reviews on "Molecular Fluorescence, Phosphorescence, and Chemiluminescence Spectrometry", for the journal, *Analytical Chemistry*. Over the past 20 years, he has also maintained a strong research effort in the areas of organized media and separation science.

Professor Warner has been performing research in the more specific area of analytical measurements using ionic liquids for several years. It is this research on ionic liquids which has lead to the conceptualization and implementation of a group of uniform materials based on organic salts (GUMBOS) as novel materials which can be exploited for a variety of analytical measurements. Novel nanoparticles (nanoGUMBOS) have been developed from these materials which can primarily be classified as frozen ionic liquids. However, some GUMBOS are not ionic liquids. Several publications in key chemistry journals (e.g. Nano Letters, ACS Nano, and another pending in JACS) and a pending patent have resulted from this new area of research. His talk will focus on related research in the area of developing and implementing the use of nanoGUMBOS for novel applications in biomedical imaging.

SPEAKER BIOGRAPHIES continued

Dr. Rabiah Mayas

Director of Science and Integrated Strategies
Center for the Advancement of Science Education
Museum of Science and Industry
Chicago, Illinois

Rabiah Mayas, Ph.D. is the Director of Science and Integrated Strategies in the Center for the Advancement of Science Education (CASE) at the Museum of Science and Industry, Chicago. Since beginning in this capacity at the Museum in Fall 2009, Rabiah's primary role is to oversee several initiatives that span multiple departments and program areas within CASE: design and implementation of program evaluation and research, development of digital learning initiatives, developing public programming for youth and adults, and facilitate the integration of cutting-edge scientific content throughout Museum programming. She also directs the programs and operations of the Museum's state-of-the-art Fab Lab, a digital fabrication laboratory for youth-driven design- and engineering-based innovation. Rabiah is also currently a co-Primary Investigator on an NIH Science Education Partnership Award (SEPA) grant (Award# 1R25RR026013), a 5-year, $1.285M project investigating the use of the Museum's human patient simulator for student exploration of community health issues and health-related careers.

Rabiah earned a Ph.D. in Biochemistry and Molecular Biology at The University of Chicago in 2007. Her graduate work was focused on investigating mechanisms by which eukaryotic cells establish fidelity in pre-mRNA splicing, a process which is estimated to be causative of up to 50% of heritable, mutation-derived human disease. This work has provided key insight into how errors in splicing are prevented and has significant potential to be adapted to the human system for the study of the genesis and treatment of disease.

Rabiah has been awarded numerous fellowships, honors and awards including a Ford Foundation Predoctoral Research Fellowship 2003-2006; a NIH Molecular and Cellular Biology Training Grant (2000-2003); and a Fogarty International Research Training Program Scholarship (1998). She also has B.S. in Biochemistry and Molecular Biology, and a Certificate in Modern Languages and Linguistics (French) from the University of Maryland Baltimore County.

SPEAKER BIOGRAPHIES continued

Dr. Armin Roeseler

Senior Vice President & Chief Technology Officer
Global Infrastructure & Operations at RealTick LLC
Chicago, Illinois

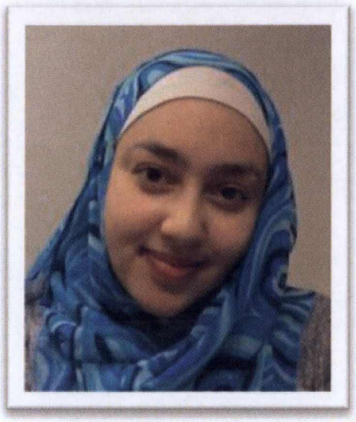
Armin Roeseler, Ph.D. is an experienced Information Technology leader with vision and ability to execute and influence at the business/technology intersection. His track record includes the delivery of technology solutions that solve business problems, instantiate business strategies and plans, and impact the bottom line. He has worked in multiple industries including Fortune 500, not-for-profit, and Internet start-up environments. Armin has published numerous articles on Information Technology management aspects and has lectured at international conferences. He is a US Patent holder and was a Fulbright Fellow at New Jersey Institute of Technology. His Ph.D. is in Computer Science from Illinois Institute of Technology.

SPEAKER BIOGRAPHIES continued

Ms. Karen Cossyleon
Physics Undergraduate Student
Chicago State University
Chicago, Illinois

Karen Cossyleon is a senior at Chicago State University. She will be graduating this spring 2012 with a baccalaureate degree in chemistry. During her undergraduate career she has been a part of the summer NIH RISE TILT and the Illinois LSAMP programs. She also does student research throughout the school year in particle physics with Professors Edmundo Garcia and Austin Harton. This past summer she was a part of an undergraduate international research program where she worked with physicists at Lawrence Berkeley National Laboratory in California and at the CERN in Geneva, Switzerland.

SPEAKER BIOGRAPHIES continued



Ms. Kristen Jordan
Zoology Graduate Student
Southern Illinois University at Carbondale
Carbondale, Illinois

Kristen Jordan obtained her BS in Zoology at Southern Illinois University-Carbondale with an interest in Marine Ecology. Thus far, she has received the prestigious recognitions of a McNair Scholar and a Green Scholarship recipient. As an undergraduate, she took on the challenge of researching global warming. From fall 2009 to spring 2010, she volunteered in labs to help address the effects of temperature change on metal contaminants in salamanders and the effects of temperature increases on extra cellular matrix secretions in phytoplankton and zooplankton. In the summer 2010, Kristen completed a project titled "The Sublethal Effects of Temperature Variations and Food Limitations on *Tigriopus californicus*" which she hopes to have published soon. Since then, she has presented her research at various undergraduate research forums as well as at the American Society of Limnology and Oceanography's 2011 National Conference in Puerto Rico. Kristen started a project in the fall 2010 through a Saluki Scholars Research Opportunity Award investigating oceanic Colored Dissolved Organic Matter. She has continued her investigations as a Master's student in the Zoology department at SIUC under the direction of Professor Marjorie Brooks.

SPEAKER BIOGRAPHIES continued

Ms. Sarah Lopez
Biochemistry Graduate Student
DePaul University
Chicago, Illinois

Sarah Lopez graduated from DePaul University in 2011 with a baccalaureate degree in Biochemistry. She always liked science but gained a lot from participation in a program similar to LSAMP known as CIRRUS (Chicago Initiation for Research and Recruitment of Undergraduates in Science). During this "AH HA" moment, Sarah enjoyed contributing to research and in particular the lab setting felt like another home because all the students had similar interests. Currently, she continues her studies at DePaul toward a Master's degree in biochemistry. Touched by the generosity of mentors in her life, she also spends a significant portion of her time involved in fostering a science community through the SACNAS chapter she founded at DePaul. During this involvement, she also had the opportunity to help plan the agenda of a SACNAS regional meeting involving other chapters. Upon graduation, she hopes to continue her interest in biomedical research by entering an M.D./Ph.D. program in the Fall 2014.

HONOREE BIOGRAPHIES

Dr. Peter Johnson

Professor (retired)
Department of Biological, Chemical & Physical Sciences
Illinois Institute of Technology
Chicago, Illinois

Former Institutional Coordinator for the Illinois LSAMP program at IIT.

Peter Johnson, Ph.D. prepared for his academic career with the completion of the B.S. Degree in Chemistry from the University of Illinois, Urbana with honors. He received the Ph.D. and was awarded a post doctoral fellowship from the Massachusetts Institute of Technology. He began his professorial career at Johns Hopkins University as Assistant Professor of Chemistry. He spent the greater portion of his career at the Illinois Institute of Technology where he was tenured and attained the position of Professor. Dr. Johnson has been honored as Faculty Member of the Year. He has guided 4 Post Doctoral Students, 14 Doctoral Students, % Master Degree Students, and 17 Undergraduate Research Students. He retired after thirty-five years of service to Illinois Institute of Technology. He was awarded "Professor Emeritus" status in recognition of his distinguished career.

Peter has a strong professional background as a chemistry professor, science researcher, university administrator and program manager. He is a leader in developing innovative educational programs and in acquiring external funding for the support of programs. He has attracted funding from federal, state, local government, foundations, and industry totaling almost $5 million over the last 10 years. He has administered a number of comprehensive multiyear university and cooperative grants under the auspices of the National Science Foundation, the Midwest Comprehensive Regional Center for Minorities, Chicago Systemic Initiative, Department of Education as well as programs from various foundations in support of urban education programs.

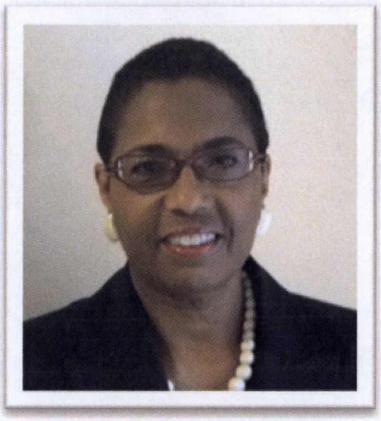
Dr. Johnson has published over 40 articles in refereed publications and has presented over 200 talks on subjects ranging from organic synthesis, the use of computers in chemistry, the use of expert systems in science, computer modeling of math and science, motivational talks on seeking a college education and succeeding in college, multicultural programs in the university environment, Chicago inner-city education, and the importance of student activities in the educational process.

He is or has been involved in a number of professional societies: the American Chemical Society; Sigma Xi; American Association for the Advancement of Science; American

Association of University Professors; Phi Lambda Epsilon Society; Chicago Council for Post Secondary Education; College Board Delegation; Council of Colleges of Arts and Letters; and, the American Conference of Academic Deans.

Dr. Johnson is celebrated tonight for his involvement in the Illinois Alliance for Minority Participation since its inception in 1993.

HONOREE BIOGRAPHIES continued



Dr. Rachel Lindsey

Dean (retired)
College of Arts & Sciences
Chicago State University
Chicago, Illinois

Former Institutional Coordinator for the Illinois LSAMP program at CSU.

Rachel Lindsey, Ph.D. served as Dean of the College of Arts and Sciences (CAS), a position from which she recently retired, at Chicago State University for most of her career. She was also a professor in the Department of Psychology. Before coming to Chicago State University (CSU), Dr. Lindsey taught at Northeastern Illinois University-Center for Inner City Studies and Loyola University. In 1976, she began teaching educational psychology and child development at Chicago State in the Department of Psychology where she was awarded tenure and was promoted to the rank of professor. She was a four time recipient of the Faculty Excellence Award.

Dr. Lindsey's early research focused primarily on the social development of preschool children with an emphasis on altruism. Working with Dr. Diana Slaughter at Northwestern University, she was also involved in a study of minority children in private schools. Other research interests included the evaluation of various Head Start programs and evaluation of reform projects in the Chicago Public Schools. Dr. Lindsey also led several projects focusing on teacher preparation, violence reduction, and social service.

For almost 20 years, Dean Lindsey was the administrative and educational leader for the largest college at CSU. The College houses seventeen undergraduate programs in arts, humanities, social sciences, mathematics and natural sciences, and nine secondary education and two professional programs (master in social work and master in counseling). During this time, the two professional programs received accreditation along with the program in music. The College also houses the Offices of Engineering Studies, PreHealth Professions, and Military Science. Finally, the College is responsible for offering the general education program.

As dean, Dr. Lindsey was a member of the multi-institution committee responsible for acquiring National Science Foundation funding for the Illinois Louis Stokes Alliance for Minority Participation (IL LS-AMP) and served as the coordinator for the AMP program at CSU. She also served as a reviewer for the Western Association of Schools and

Colleges, the National Science Foundation, and the Alfred Sloan Foundation. In 2000, she received a National Institutes of Health (NIH) Extramural Associate Research Development Award. In addition to spending five months at NIH, the award included a grant that provided pilot funding for research in natural and behavioral sciences. In addition to supporting research, these pilot projects provided opportunities for student researchers and contributed to a five-fold increase in the college's grant funding. Beginning in 2002, Dr. Lindsey became an active member of the Council of Colleges of Arts and Sciences (CCAS) presenting on panels, co-organizing post-conference leadership forums, and serving as co-chair of the Cultural Diversity Committee. In 2008, she was elected to the CCAS Board. She was also the co-chair of the CSU Institutional Review Board.

As a 17 year member of the Board of Trustees of Morgan Park Academy, a local independent school, Dr. Lindsey held several offices and served on several committees. She also was a member of the Community Advisory Committee of the Shedd Aquarium. From 1992 through 2006, she was a member of the Steering Committee for the Consortium on Chicago School Research at the University of Chicago where she served as co-chair for three years.

Dr. Lindsey received the B.A. in psychology from the University of Michigan, and the M.A. and Ph.D. in educational psychology from the University of Chicago. She continues to live in Chicago. She has two sons – an artist and an engineer.

Dr. Lindsey is celebrated tonight for her involvement in the Illinois Alliance for Minority Participation since its inception in 1993.


Chicago State University
A New Class of Dye-sensitized Solar Cells: Synthesis of Copper Phenanthroline Complexes
Abstract
Introduction
Big Question?

POSTER SESSION LIST AND ABSTRACTS

Historic Art Hall Pre-Function Area

1. Morphology of Cranial Musculature in Crocodile Shark, *Pseudocarcharias kamoharai*, and its Evolutionary Implications

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

2. Evidence for the Presence of Phosphate Groups on the Two Major Proteins of the Hamster Sperm Acrosomal Matrix and Their Potential Role in Acrosomal Hydrolase Binding Activities

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We previously isolated an acrosomal fraction, termed ALM, from hamster cauda epididymal spermatozoa which contains specific domains of the acrosomal matrix and an adherent detergent-insoluble complex, termed the acrosomal lamina; which is derived from the outer acrosomal membrane. By SDS-PAGE, the ALM fraction exhibited two major polypeptides of M_r=29,000 (ALM29) and M_r=20,000 (ALM20). Previously, we have shown that an ALM complex binds both acrosin and N-acetylglucosaminidase (NAGA) in a dose-dependent manner. We hypothesize that the acrosomal matrix-hydrolase interactions require biochemical modification(s) of ALM polypeptides; one of these modifications is involved with the phosphorylation of ALM polypeptides. The present study was undertaken to examine the presence of phosphate groups on both ALM29 and ALM20 polypeptides and to identify the binding competency of dephosphorylated ALM complex to acrosomal hydrolases. Diagonal gel electrophoresis was performed to investigate whether both ALM29 and ALM20 polypeptides are joined by disulfide bridge(s). Both polypeptides migrate on a diagonal line with a comparable R_f in both non-reduced and reduced conditions, suggesting that both polypeptides are not joined by disulfide bridge(s). Both respective polypeptides were stripped

out of the ALM complex by high pH (pH-11) extraction. Both respective polypeptides were treated with alkaline phosphatase followed by immunoblot analysis. Both ALM29 and ALM20 polypeptides showed a reduction in size (~3 kDa) by alkaline phosphatase treatment. A sedimentation assay was employed to determine whether alkanine phosphate treated ALM possesses acrosin and NAGA binding sites. There was a ~50% reduction in binding between the dephosphorylated ALM complex and acrosin/NAGA. Our studies conclude that both ALM29 and ALM20 polypeptides are phosphorylated and that the ALM complex-acrosomal hydrolase interactions require the phosphorylation of ALM polypeptides. This work was supported by NIH/NIGMS/ 1SC3GM096875-01 and NSF/HRD-0703326 CFDA:47.076.

3. Identification of Genes Involved in Degradation After Phagocytosis

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Phagocytosis is a form of endocytosis in which cells engulf large particles. Dictyostelium discoideum internalize and degrade bacteria for nutrition. Our goal is to identify genes that are necessary for degradation. Dictyostelium cells were mutagenized by random insertion of the pBSR1 plasmid into the genome. Mutants were screened for inefficient degradation of fluorescent bacteria. These mutants should have pBSR1 inserted into a gene necessary for degradation. Genomic DNA was isolated from several mutants, cut with EcoR1, ligated and transformed into E. coli. Eleven colonies representing 4 clones were grown overnight and DNA was prepared. A double digest with Xho1 and Sca1 showed that 9 of the 11 samples had bands in common with pBSR1. All four Dictyostelium clones were represented, but two clones each had different patterns in the double digest. An EcoR1 digest of these six clones confirmed that 5 contained an EcoR1 site. A PCR reaction using pBSR1 primers amplified DNA fragments of various sizes. These templates and primers were used to sequence the genomic DNA on each side of the EcoR1 site. The sequences obtained will be used to BLAST the Dictyostelium genome to identify the genes that have been disrupted.

4. Cubicin Can Influence Host Immune Response

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Cubicin *Cubist Pharmaceuticals*, also known as Daptomycin, is the first FDA-approved antibacterial drug in the cyclic lipopeptide class. Cubicin's mode of action is through depolarizing the membranes of gram-positive bacteria leading to inhibition of DNA, RNA and protein synthesis and to cell death. We tested the ability of cubicin to effect microbicidal activity of neutrophils and macrophages and T cell mediated DTH response of mice to the contact sensitizing chemical DNFB *Sigma*. Cubicin appears to have no stimulatory effect on neutrophils, but it significantly enhances microbicidal activity by macrophages. Cubicin also enhances the DTH response to DNFB. Such effects on immune response by this drug should be more fully understood to assist physicians in effectively prescribing antibiotics to a patient. *Funding: Max Baer Heart Fund, FOE and LS-AMP Research Scholar's Program, NSF.*

5. Fossil Marine Vertebrates from the Lincoln Limestone in Southeastern Colorado

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The Lincoln Limestone Member of the Greenhorn Formation is a mid-Cenomanian sedimentary rock unit deposited

under the Late Cretaceous Western Interior Seaway (WIS) in North America. Fossiliferous rock samples from the basal Lincoln Limestone, that formed sometime between 95 and 94.7 Ma, were obtained from a locality ('Table Mesa locality') in southeastern Colorado where its vertebrate contents have never been examined before. Vertebrate fossils were collected through acid treatment of the rock samples. Thirty marine vertebrate taxa are identified including chondrichthyan and osteichthyan fishes and reptilian taxa. The chondrichthyans consist of 14 taxa, including *Ptychodus occidentalis*, *P. rhombodus*, *Cretoxyrhina mantelli*, *Archaeolamna* cf. *A. kopingensis*, *Telodontapsis agassizensis*, *Megachasma comanchensis*, *Squalicorax curvatus*, *Rhinobatos* cf. *R. incertus*, Rajidae incertae sedis, and *Cretomanta canadensis*. Osteichthyan fishes consist of 14 taxa, including *Micropycnodon kansasensis*, Pycnodontidae indet., *Protosphyraena* sp., *Elopopsis* sp., *Pachyrhizodus minimus*, *Enchodus* cf. *E. gladiolus*, *Enchodus* cf. *E. shumardi*, and three additional unidentified teleosts. The reptilian remains are represented by two squamate taxa: an aquatic form *Coniasaurus crassidens* and a terrestrial form Scincomorpha indet. The fauna reported here is overall similar to other mid-Cenomanian marine vertebrate faunas from the Western Interior, supporting high taxonomic homogeneity in the WIS. The locality is thought to have been located at or close to the deepest part of the WIS during the mid-Cenomanian, and thus the occurrence of a terrestrial squamate is intriguing. Likewise, the occurrence of the Late Cretaceous megamouth shark, *Megachasma comanchensis*, is intriguing because its fossil record is so far confined to southeastern Colorado. *Funding: The Louis Stokes Alliance for Minority Participation Grant supported this research.*

6. Tree Seedling Regeneration in a Degraded Tropical Pasture: Barriers to Tropical Rainforest Restoration in Los Tuxtlas, Mexico

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The scale of deforestation and continuing decline of tropical forests underscores an immediate need to restore degraded tropical landscapes. Here we focus on highly degraded habitats, such as pastures, where natural regeneration may be impeded. Our study site, a former cattle-ranching pasture dominated by introduced African stargrass Cynodon plectostachyus, borders the tropical rainforest of Los Tuxtlas (Veracruz, Mexico). The purpose of this study is to evaluate the recruitment and establishment of 16 tree species sown in 16 four treatment plots: 1) no grass/no rodents 2) no grass/rodents 3) grass/no rodents, and 4) grass/rodents. This experimental set up, will answer: to what degree does pasture vegetation inhibit or facilitate recruitment in different woody species, what is the spatial and temporal variability in the intensity of rodent predation on seeds and seedlings and, are established seedling communities characterized by high, moderate or low levels of species diversity? *Funding: Provost and Hadley Awards in 2011 supported this research.*

7. Zyvox Can Influence Murine Immune Response

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Zyvox *Pfizer* is a linezolid type antibacterial antibiotic which has been used for treatment of gram positive bacterial infections, many of which are resistant to other drugs. Our studies were planned to see if zyvox was able to enhance certain immune responses. In our hands, the drug does not enhance neutrophil cidal activity for yeasts, but does significantly enhance fungicidal activity by macrophages. Zyvox also significantly enhanced the T cell-mediated DTH response to the sensitizing chemical dinitrofluorobenzene *Sigma.* Zyvox's effect on organ clearance of i.v. administered yeasts from organs was less clear, with yeast reductions in liver, spleen and kidneys, yet only the yeast reductions in kidneys were significant. These findings support the hypothesis that zyvox benefits the

host therapy by boosting certain immune responses. *Funding: Max Baer heart fund, FOE and LS-amp Research Scholar's Program, NSF.*

8. Polymerase Chain Reaction (PCR) of Leishmania nagt from an Unknown Isolate for Phylogenic Identification According to Sequence Database

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Southeast Asia has not been known until recently to have indigenous transmission of leishmaniasis. Promastigotes from a case of visceral leishmaniasis in Thailand were provided for species identification. DNA was isolated for PCR amplification of the 1.4 kb *Leishmania*-specific *nagt* that was previously used for phyogenetic analysis of different species/strain. The most variable region of ~600 base pairs was successfully amplified and sequenced in both strands. The sequence together with ~30 *nagt* database was subjected to phylogenetic analyses using 4 different algorithms in MEGA 2.1. The sequence under study is distant from all known species complexes examined and falls into an independent clade, suggestive of a new *Leishmania* species. *Funding: Elizabeth Morse Genius Charitable Trust supported this research.*

9. A Pharmacological Impact Study of Brassinosteroid Biosynthesis Inhibitors in Sorghum

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Brassinosteroids (BRs) are important regulators of plant development controlling processes as diverse as cell elongation and stress responses. Extensive knowledge about BR function has been gathered in *Arabidopsis thaliana*, which serves as an effective model to investigate BR biosynthesis and signal transduction. Most steps in the synthesis pathway as well as in reception and signal processing have been investigated on the molecular level using *Arabidopsis* knock-out mutants, whereas information about BRs in monocots and crops is not as developed. A smaller number of BR mutants are described in rice, but knowledge in important crops such as maize and sorghum is still sparse (1; 2). To investigate the phenotype of sorghum plants, which are deficient in BR biosynthesis we developed a BR inhibitor screen system that allows studying the effect of BR deficiency in wildtype plants that show a putative phenocopy of BR mutants.

10. Binding Affinities of Algal Extracts to $PPAR_{\gamma}$, ER_{β} and TR_{β} Receptors

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Tropical marine algae are a source of novel metabolites that exhibit interesting biological activities including antibacterial, antifungal, antiviral, toxicity, antitumor, as well as others. In this study, we screened the crude extracts prepared from tropical and subtropical algae from the Florida Keys and Guam, USA in a novel assay for the identification of hormone-mimicking compounds, which relies on an engineered multi-domain allosteric protein

expressed in a bacterial background. The engineered protein includes the ligand-binding domain (LBD) of the suspected nuclear hormone receptor (NHR) target as part of a modular design. Remarkably, this genetically simple bacterial sensor can differentiate agonist from antagonist activities and has been effective in detecting a wide variety of strong and weak estrogenic compounds. We used these strains to detect ligands for the human estrogen beta (ER_β), thyroid beta (TR_β) and $PPAR_\gamma$ receptors. Our preliminary data suggests that the crude extracts from four species of green algae collected in the Florida Keys exhibit high binding affinities in one of the three assays conducted in this study. *Avrainvillea elliottii* exhibited a high affinity for TR_β, *Caulerpa sertulariodes* exhibited a high affinity for ER_β, and *Neomeris annulata* and *Ulva fasciata* exhibited a high affinity for $PPAR_\gamma$ receptors. *A. elliottii* and *N. annulata* are calcified algae commonly found in the shallow seagrass beds (0-2 m), while *Ulva fasciata* and *Caulerpa sertulariodes* can be found at depths up to 6 m and are both known to be invasive species in tropical oceans around the world.

11. Utilizing Conductance Assay to Study Efficacy of Flavonoid Compounds on ΔF508-CFTR Recovery

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Cystic Fibrosis (CF) is a life threatening genetic disease affecting 1 in every 3,200 Americans, resulting from mutated, inactive Cystic Fibrosis Transmembrane Conductance Regulator (CFTR) protein channels. Flavonoids are plant-derived heterocyclic compounds that are found to have potentiative and corrective effects on mutated CFTR's. In this investigation, Fisher Rat Thyroid (FRT) cells transfected with ΔF508-CFTR mutation were treated with flavonoid test compounds to observe CFTR activity in the presence of flavonoids alone and in synergy with 951 corrector. The transepithelial conductance (ΔGt) of CFTR activity was measured following the addition of agonists (forskolin and PG01) and inhibitor (Inh 172) using a transepithelial current clamp and was used to evaluate the efficacy of flavonoids on ΔF508-CFTR. Flavonoids yielding high ΔGt's were screened at varying concentrations to determine the most efficacious concentration of each compound. Results indicate that cells treated in 951 corrector have an increased ΔGt compared to cells treated alone representing improved ΔF508-CFTR function. Synergistic effects are observed in cells treated with both flavonoids and 951, suggesting a future for flavonoids as a part of CF therapies. *Funding: Cystic Fibrosis Foundation grant funded research.*

12. Serum Amyloid a Can be Defined as a Chemokine

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Serum Amyloid A (SAA) is an acute-phase protein released predominantly from the liver during large scale inflammation. It is also secreted at local sites of inflammation by other cell types like macrophages and endothelial and epithelial cells. High SAA levels, up to 1000 times normal, are associated with autoimmune conditions like rheumatoid arthritis, atherosclerosis, and Crohn's disease. However, its precise role in inflammation and infection remains unclear. Studies have shown that SAA possesses cytokine-like activity and can stimulate the production of IL-8, matrix metalloproteinases, cytokines such as TNFα and IL-1β, cytokine receptor antagonists, including IL-1R antagonist, soluble TNFR type II, immunoregulatory cytokine IL-12 and IL-23, and G-CSF, etc. SAA can also induce migration of immune cells to site of inflammation and enhance adherence to epithelial cells. All these results let us hypothesize that SAA can be a chemokine. In order to understand the functions of SAA as a chemokine, we first used a mathematic method called "Natural Vector Method (NVM)" to classify almost all the reported human chemokines/cytokines (total 175) and SAA. We found that SAA can be clustered with chemokines CCL27, CCL 23, and CXCL9 using both DNA and protein sequences. Next, we wanted to check whether SAA indeed used these

chemokines' receptors to play its roles. We established two RBL (rat basophile leukemia) cell lines which over-expressed either human CXCR3 (the receptor for CXCL9) or human CCR1 (the receptor for CCL23). In the future, we will determine whether CXCR3 or CCR1 can mediate SAA's function using these cell lines. We will conduct (1) SAA-induced intracellular calcium mobilization assay; (2) SAA-induced MAPK activation assay; and (3) SAA-induced cell migration assay. *This work is supported by National Science Foundation Grant DMS-1119612 (R.L. He).*

13. Comparison of Strains of *E. coli* Transformed and Untransformed with Fluorescent Plasmids

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Much evidence supports the conclusion that dietary fiber lowers a person's risk of developing colon cancer. Thus, factors which reduce the amount of fiber in the colon increase cancer risk. Certain bacteria in the gut have the ability to break down and utilize dietary fiber for food; moreover, a diet rich in fiber might select for mutants which utilize it more efficiently. Our lab is investigating this possibility by competing wildtype and mutant strains of *E. coli* in tubes of nutrient broth. In order to distinguish the strains, mutants were transformed with plasmids containing Green Fluorescent Protein. We report here experiments to characterize these transformed strains in order to develop an efficient and reliable model system. *This work was supported in part by the LSAMP Research Scholar's Program NSF/HRD 0904024 and by a grant from the Fraternal Order of Eagles.*

14. Screening *Dictyostelium* Mutants for Inefficient Degradation after Phagocytosis

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Phagocytosis is a process by which cells engulf and degrade bacteria. Cells of our immune system, such as macrophages and neutrophils, use phagocytosis to destroy invading microbes. Phagocytosis has been studied extensively, but much remains to be learned about the molecular mechanics of phagocytosis and degradation. *Dictyostelium* are single-celled eurkaryotic organisms that feed on bacteria and are thus excellent model organisms for studying phagocytosis. To identify specific genes necessary for efficient phagocytosis, *Dictyostelium* mutants were generated by random gene disruption with a mutagenic plasmid. Mutants were then screened for inefficiency in degradation using a fluorescence assay. Wild-type and mutant *Dictyostelium* cells were fed red fluorescent bacteria for 10 minutes. Bacteria that were not internalized were washed from the cells, and the cells were incubated further for 45 minutes to allow for degradation. Binding, uptake and degradation of red fluorescent bacteria were assayed with a fluorescence activated cell sorter (FACS). Out of the 25 cell lines that were analyzed, 11 were determined to be inefficient at degradation. The gene that has been disrupted in each cell line will be identified by rescue of the mutagenic plasmid. *Funding: NIGMS/NIH Grant 1SC2GM098170-01 and NIGMS/NIH Grant S06GM008043 supported this research.*

15. Effect of Radio Frequency Radiation on DNA Degradation

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These studies are being conducted to evaluate effect of non-ionizing electromagnetic radiation on DNA. In the preliminary part of these studies the trials are being done to standardize the technique by exposing samples to 2.45 GHZ microwaves at different intervals of time. The results from these trials are helping to monitor thermal patterns as a function of time of exposure, which will subsequently be used to study changes in DNA molecules in relation to temperature. The changes in DNA samples will be investigated by using forensic DNA techniques to ultimately quantify and produce a genetic profile. Number of experiments are also under way by subjecting DNA samples to direct heat to temperatures achieved in microwave irradiation to evaluate thermal and non-thermal effects of microwaves on DNA molecules degradation. *Funding: NSF / HRD-0703326 CFDA: 47.076 supported this research.*

16. Improving a Developmental Assay for the Social Amoeba *Dictyostelium discoideum*

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The social amoeba *Dictyostelium discoideum* is a powerful model system for molecular and developmental biology. One of the key advantages of *Dictyostelium* is that when the individual *Vegetative* cells begin to starve a developmental process begins. Observing the timing of this developmental process give use important information about how mutant cell lines are altered. *Dictyostelium* development depends on a number of factors including the number of cells. If the cells are too widely distributed this could delay development. Uneven distribution of cells between experimental replicates makes comparing the timing difficult. To observe the timing of development, cells in buffer were placed on a wetted filter pad. To improve the reproducibility of the experiment I am testing the use of a mechanical barrier to create a standard area where the cell and buffer will wet the filter. For this experiment I created a barrier using a ring of sterilized tubing, the ring prevents the cells from spreading across the filter. After the buffer had absorbed for one minute I removed the barrier and the cells were localized in a defined area. I was then able to compare the timing of the developmental process between replicates. The ring technique improved reproducibility over just putting cells in a puddle on the filter. The ring cell development assay proved to be effective in standardizing the development assay producing reproducible results.

17. Ticarcillin Can Effect Murine Immune Response

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Ticarcillin is a carboxypenicillin antibiotic that is currently marketed as Timentin *GlaxoSmithKline* and used clinically in injectable form for treating the gram-negative bacterium *Pseudomonas aeruginosa.*As with all of the penicillin-class drugs, timentin's antibacterial activity resides in blocking the cross linking of cell wall peptidoglycans. Clavinic acid, a beta-lactamase inhibitor, is often included with timentin to block drug resistance. In this study, timentin was tested to see if there is any effect on neutrophils, macrophages or T cells in DTH response to the contact sensitizing chemical, DNFB *Sigma.*While many antibacterial antibiotics have previously been found to stimulate some immune responses, their activity seems to show activity through effects with the bacterial ribosomes and cytoplasmic membrane. Thus our hypothesis is that no effects on immune response by the bacterial cell wall

inhibitor will be observed. *Funding: Max Baer Heart Fund, FOE and LS-amp Research Scholar's Program, NSF.*

18. A Quantitative Analysis of Solids in Water Using X-Ray Crystallography

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The presence of crystalline structures in dissolved solids found in water, in conjunction with Bragg's Law, allows x-rays to diffract off the surface of these solids yielding a unique computerized powder pattern. This powder pattern consists of various components, or phases, which can then be identified and quantified using databases provided by the International Centre for Diffraction Data (ICDD). An X-ray Diffractometer was used to determine crystallographic evidence inside distinct water sources. Four subgroups sought to identify and quantify dissolved solids in 4 sources of Chicago water and 2 sources beyond Chicago: Lake, River, Tap, Fountain, Bottled and Well. *Funding: CIRRUS, funded by National Science Foundation Grant DUE-0653198 and DePaul University.*

19. In Search of Natural Tau Fibrillization Inhibitors: Preliminary Evaluation of Horse Apple Fruit

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The intracellular precipitation and formation of neurofibrillary tangles of tau protein in the human brain is one of the major etiological factors of Alzheimer's disease (AD). At present, no causative treatment exists for AD. However, inhibition of tau protein fibrillization represents a viable target for the discovery and development of potential anti-AD drugs. Estrogens have been found to inhibit the extracellular formation of amyloid beta protein, the other major etiological factor of AD. Since isoflavones have structural similarity to estrogens, they may also inhibit the formation of AD-specific plaques, mainly amyloid beta and tau proteins. In this work, an isoflavone-rich extract of the fruit of horse apple (hedge apple, osage orange, Maclura pomifera) was prepared and evaluated in vitro for its ability to inhibit the fibrillization of tau protein. Tau fibrillization was monitored by Static Laser Scattering (SLS) and Transmission Electron Microscopy (TEM). Although results of SLS were inconclusive, visual examination of the TEM samples clearly showed inhibition of tau fibrillization in comparison to the negative control. The obtained results warrant further investigation of the extract as well as its major isoflavones, osajin and pomiferin, which have been isolated and characterized during the course of this study.

20. The Computational Investigation of the Electron structure used in Polymer Fullerene Composite Solar Cells

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Polymer-fullerene composites possess the ability to revolutionize the solar cell industry by serving as the material for inexpensive and easy-to-fabricate solar cells. The goal of this research is to determine why changing the polymer more than doubles the device efficiency. Various sized oligomers of the electron-donating polymer 2-ethylhexyl 6-[4,8-bis(2-ethylhexoxy)thieno[2,3-f]benzothiophen-2-yl]-3-fluoro-6H-thieno[3,4-b]thiophene-2-carboxylate (PTB7) and poly(3-hexylthiophene) (P3HT) were constructed using PQSMol. The electron transfer observed by electron paramagnetic resonance (EPR) was modeled by first optimizing the oxidized structures of

PTB7 and P3HT using DFT and a 6-31G* basis. The g-tensors of the optimized, charged structures were then calculated using orca (DFT|tzvpp basis). The g-values for the pentamer P3HT model and the PTB7 trimer were in agreement with experimental EPR results. In fact, the g-values for the smaller oligomers varied by less than 0.2%. In agreement with experiment, the calculated g-values for P3HT were smaller (2.0019, 2.0022, 2.0030) than those of PTB7. The good agreement between calculation and EPR measurements allows the investigation of the spin density. Comparing the spin densities of P3HT and PTB7 allows the hypothesis that the difference in efficiencies is due to a fluorine atom in PTB7 to be rejected. *Department of Defense contract number W911NF-08-20039 Score Program NIH grant number 5-SC2-GM083717.*

21. Development of a Validated HPLC Method for the Determination of Horse Apple Isoflavones

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The fruit of *Maclura pomifera* tree is known as horse apple, osage orange and hedge apple, and is a rich source of the two isoflavones osajin and pomiferin. Osajin and pomiferin were shown to display a wide spectrum of biological activities, such as antioxidant, antiproliferative and other activities. The fruit extract may have potential as a viable source of the bioactive isoflavones and it also has potential as an herbal dietary supplement. A reversed-phase HPLC method was thus developed in order to identify horse apple samples of superior quality in terms of isoflavone content. Analytical run time was 8 min at a gradient flow rate of 1 mL/min (acetonitrile in H_2O), with UV detection at 274 nm. The method was validated according to FDA guidelines. Validation parameters included calibration curve, specificity, accuracy, precision, and limits of detection and quantitation (LOD/LOQ). Both method accuracy and precision exceeded 95% with LOD and LOQ of 0.98 and 7.81 ug/mL, repectively, for both compounds. The method was applied in the determination of osajin and pomiferin in extracts prepared from different samples of horse apple collected from Chicago suburbs.

22. Preparing Gram Quantities of Ruthenium Bidentate Schiff-Base Complexes via Microwave Irradiation

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Schiff-base substituted ruthenium carbon complexes were prepared by treating Grubbs' catalyst with various Schiff-base ligand salts that could potentially support chiral substituents. These complexes demonstrated high metathesis activity within polar protic solvents, as well as organic solvents such as, THF-d8, Ethanol and Hexanes. The complexes were prepared in three steps from moderate to outstanding yields but the final step required the use of Schiff-base ligands in the form of their thallium salts (*toxic!*). Using microwave irradiation, our lab recently prepared the aforementioned organometallic synthesized complex in NMR tubes using sodium salts for the purpose of successfully obtaining carbene peak results. However, scale-up of the reaction has been proven difficult. The goal of this study is to determine the best microwave method for producing gram quantities of Schiff-base substituted ruthenium complexes using nontoxic salts and scaling up the complex to a 1 mmol concentration in order to obtain 100% completion of the reaction. The determination of the percent recovery will be supported by qNMR studies using a DMF standard for quantitation methods. The methodology will provide a nontoxic route into ruthenium Schiff-base catalyst that possess chiral character, which in turn, opens the possibility for asymmetric catalysis. *Funding: DOD/AATD Grant W911W6-06-D-0012 supported this research.*

23. Synthesis of c-5 Modified 2, 3-Dehydro-2-Deoxyneuraminic Acid as Potential Neuraminidase Inhibitors

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Sialic acids are unique carbohydrates with a wide variety of biological functions. N-acetyl neuraminic acid is the most ubiquitous sialic acid and it is the target of many bacterial and viral enzymes, due to its terminal location in the glycoconjugates chain. For example, influenza virus binds sialic acid to initiate the infection as well as in the second step, where viral cells bud off from the infected cell. The latter process is mediated by the enzyme neuraminidase, and the knowledge of the modus operandi of this enzyme drove the design of one of the current antiviral drugs commercially available, Relenza, a 2,3 dehydroderivative of neuraminic acid with a guanidine group at C-4. As a part of a research goals directed to obtain a large variety of modified 2,3 dehydroderivatives to be eventually tested as neuraminidase inhibitors, herein we describe the synthesis of a variety of C-5 modified - 2,3-dehydro-2-deoxyneuraminic acid, in a few synthetic steps. *This work was supported in part by the LSAMP Research Scholar's Program NSF/HRD 0904024.*

24. Examinations of Antibody Structure Using Single Molecule Förster Resonance Energy Transfer

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The crystallizable fragment (Fc) region of IgG antibodies is of interest due to its interactions with a variety of molecules in the immune system. Antibodies contain oligosaccharides bound to their Fc region, and the removal of these oligosaccharides negatively impacts some of the interactions between the Fc region and molecules of the immune system. The structure of the Fc region of IgG antibodies is studied via single molecule Förster resonance energy transfer (FRET). We mutated a surface-exposed serine residue to a cysteine, which allowed the antibodies to be labeled with thio-reactive dye molecules so that structure and the distance between the antigen-binding sites of an antibody may be studied. Examination of photon bursts from freely diffusing donor-acceptor labeled antibodies constituted all measurements for FRET. FRET measurements were used to construct a histogram of the antibody conformations present. *Funding: DePaul Department of Chemistry and The Faculty Summer Research Grant from the College of Science and Health*

25. Analyzing a Dye Sensitized Solar Cell Database to Identify Quantitative Structure Property Relationships to Improve Overall Dye Performance

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Dye sensitized solar cells (DSSC) are an attractive alternative to silicon-based solar cells due to the prospect of high energy conversion efficiency and low production cost. However, their efficiencies remain low with the best all dyes exhibiting efficiencies of around 11%. One of the parameters controlling the efficiency of the solar cell is the open circuit voltage (V_{oc}). V_{oc} is a function of the band gap and thus should depend on to depend on the chemical structure of the dye molecule used in the cell. Descriptors such as hydrophobicity, rotatable bond count,

branching indices and absorption maximum have been proposed, however, no obvious linear relationship exists between these parameters and experimental values of V_{oc}. In this work, a quantitative structure-property relationship (QSPR) analysis of V_{oc} and 209 thiophene derivatives was carried out using artificial neural networks. Two hundred and nine thiophenes culled from literature sources were divided into training (149 molecules) and validation (60 molecules) sets that were chosen randomly. The Neural Network algorithm in Mathematica 8 with the feed forward routine was used to create a neural network with 1 hidden layer. A variety of descriptors including VDW area, hydrophobicity, and pKa were included. Initial results indicate that a more diverse group of descriptors is necessary to produce a model capable of predicting V_{oc} values. However, the created database is the most complete set of solar cell dye molecules compiled and will be of great benefit for future studies. *Funding: Department of Defense Contract W911NF-08-20039, Score Program NIH grant number 5-SC2-GM083717.*

26. A New Functionalized Resin and its Application in Flame Atomic Absorption Spectrophotometric Determination of Trace Amounts of Heavy Metal Cation After Solid Phase Extraction in Water Samples

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A new chelating resin was synthesized by functionalization of a polymer support, Amberlite XAD-4, with salicylic acid through an azo linkage (–N=N–). The products were characterized by scanning electron microscopy, elemental analysis, Fourier transform infrared spectroscopy and thermogravimetric analysis. The optimum conditions for the extraction of Pb(II), Cu(II), Ni(II), Co(II) and Zn(II) in aqueous samples were studied by batch and column methods. The determination of the metal ions was carried out by flame atomic absorption spectrometry. Their sorption equilibrium was reached within 30min. The sorbed metal ions were eluted by 0.5M HNO_3(10mL) within 10min with the desorption recovery of ≥90%. This new method gave a good accuracy in batch system with the recovery of ≥93% for the extraction of all metal ions with R. S. D. less than 1.36% (n=5) . *This work was supported in part by the LSAMP Research Scholar's Program NSF/HRD 0904024.*

27. The Development of Assays to Evaluate the Chemical Composition and Potential Toxicity of Commercial Tattoo Ink

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The lack of information on the possible hazards posed by tattoo inks, outside the factors contributed by the equipment used, has led to nominal government regulations on the pigments used in tattoo inks. To examine the composition and potential toxicity of tattoo inks, eleven colors were ordered from a commercial supplier. We were able to quantify the heavy metals by inductively coupled plasma mass spectrometry (ICP-MS) analysis and identify the bulk inorganic components from the elemental analysis performed via Scanning Electron Microscopy/Energy Dispersive Spectroscopy (SEM/EDS). We determined that the pigments were based on organic substances, heavy metal salts, and carbon black. We chose the four ink colors with the most interesting chemical composition to develop an assay to examine the toxicity of the ink particles to cells we chose four ink colors to develop an assay to examine the toxicity of the ink particles on *Dictyostelium*. The social amoeba *Dictyostelium* readily takes up particles by phagocytosis and is a good cell model to measure toxicity related cell death. We exposed cells to ink particles that had been washed in buffer to remove stabilizing agents. After a 24-hour incubation we measured the ratio of dead to living cells exposed to four different ink concentrations of each color. Cell death was assessed with trypan blue, which stains only dead cells. To help control for error, three replicates were made at each condition; two controls were used, one set containing cells killed by the known toxin Hydroxylamine and one set

received no treatment. We concluded that exposure to a higher concentration of ink particles produced more cell death, this was most pronounced in the green ink. While this preliminary work illustrates that the value of examining both the composition and potential toxicity of tattoo ink it is impossible to draw conclusions about the potential health effects of tattoo ink in human skin.

28. Dye Sensitized Solar Cells, Silicon Solar Cells, and Alternative Energy

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The purpose of my research was to learn more about solar power in order to assist Eden's Place Nature Center in developing an alternative energy program. In addition, I wanted to better understand how dye sensitized solar cells work, compared to silicon solar cells, in order to continue my research in this area in the future. I accomplished this first by making dye sensitized solar cells and then learning how to calculate the maximum power and efficiency of the cell. Using an Ocean Optics hand held, I tested a silicon solar cell and used the data to produce an I-V curve and a power curve. I was then able to calculate and compare the efficiency of the solar cell under different light conditions. Once I had developed a better understanding of solar cells, I was able to assist Eden's Place Nature Center in Chicago to expand their alternative energy program through the use of a solar-powered water pump. Next I plan to build on this research by continuing to work with dye sensitized solar cells in the hopes of making them more efficient and expanding their use.

29. Characterization of a Unique Bacterial Photoreceptor in the Light-Adapted State using Atomic Force Microscopy

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Our research utilizes an interdisciplinary approach which looks at unique family of signaling proteins known as bacteriophytochromes (Bphs), bacterial red-light photoreceptors. Bphs contain a photosensory module covalently linked to a signal effector domain, histidine kinase (HK). Upon absorption of a photon in the appropriate wavelength range, Bphs are proposed to undergo photoconversion with concomitant global structural changes. To date, limited structural information exists on Bphs due to protein size and current inability to obtain crystals of intact proteins in the respective dark and light-adapted states. Using atomic force microscopy (AFM) we have studied the structure of RpBphP3 (P3) from the photosynthetic bacterium *Rhodopseudomonas palustris* on mica. Most Bphs undergo reversible photoconversion between the red and far-red light-absorbing forms Pr and Pfr respectively; however, P3 undergoes photoconversion in the red and unique near-red light absorbing states Pr and Pnr respectively. Using a variety of approaches, such as manipulating the concentration of the protein and the ionic strength of the buffer, we have been able to image P3 through AFM in its light-adapted Pnr state. We have observed biologically relevant dimers as well as protein aggregates of various sizes on a mica surface in its light-adapted state. One future goal is to characterize P3 in Pnr state on a biocompatible surface, such as a functionalized poly-ethylene glycol (PEG), to reduce the number of aggregates. Finally, we plan to compare the light and dark-adapted structures P3 and related Bphs. *Funding: The Department of Chemistry, Northeastern Illinois University supported this research.*

30. Synthesis of Procaine and Lidocaine through Esterification

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The chemicals, lidocaine and procaine will be synthesized using knowledge from undergraduate chemistry. The starting molecule in the synthesis of procaine is 4-nitrobenzoic acid. The starting molecule will be reduced using iron powder and hydrochloric acid. Then it will be converted it to an ethyl ester using ethanol and sulfuric acid as a catalyst. Sodium ethoxide and N, N-diethylethanolamine will be used to form the target molecule procaine. The starting molecule for lidocaine is 2,6-dimethylaniline. The molecule will be reacted with acetylchloride. Then it will be brominated used bromine in acetic acid. Diethyl amine will be used to form the target molecule lidocaine. Once synthesized the products will be purified and characterized by nuclear magnetic resonance, infrared spectroscopy, gas chromatography and mass spectroscopy. *Funding: NSF / HRD-0703326 CFDA: 47.076 supported this research.*

31. Isolation and Yield Maximization of the Major Constituents of Horse Apple Fruit

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The osage orange fruit, also known as horse apple or hedge apple, contains relatively high concentrations of the biologically active isoflavones osajin and pomiferin. Due to their biological activities, osajin and pomiferin are potential candidates for development as therapeutic lead compounds for a number of diseases such as cancer and Alzheimer's disease (AD). In order to facilitate further investigation/biological evaluation of osajin and pomiferin our goal was to develop an efficient isolation procedure to maximize the yield of the two isoflavones extracted from osage orange. The developed procedure utilizes normal-phase flash chromatography as the major preparative technique and it includes a fast automated and reproducible method that can separate and provide osajin and pomiferin in high purity. Other techniques to monitor and verify the purity of osajin and pomiferin, such as thin-layer chromatography (TLC), high performance liquid chromatography (HPLC), and nuclear magnetic resonance (NMR) were also employed. *Supported by the NIH RISE training grant R25 GM059218.*

32. Computational Investigation of the Conformational Preferences of a Cytochrome c_7 Dimer

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Cytochrome c_7 from the *G. sulfurreducens* bacteria has been shown to undergo electron transfer (ET) when bound to a variety of molecules. Domains containing polymers of c_7-type proteins with up to nine repeats have been identified in the genomic sequence. The packing of the molecules in the crystal structure suggest that the polymers might form a "nanowire". However, the actual ET properties of the polycytochrome c_7-type molecules would be determined by the interactions of neighboring heme groups and thus more information of the actual conformational structure is necessary. The current work presents a computational investigation of the conformations of a cytochrome c_7 dimer. The program MOE was used to build the cytochrome c_7 dimer from the PDB entry 1RWJ and to create an appropriate homolog to complete the pair. Nanosecond scale NVE simulations

were run using CHARMM to simulate the dimer's conformations. During the simulation, the distance between the heme groups decreased from 25.53 Å to 20.5 Å. This significant decrease suggests electron transfer may occur. *Funding: Department of Defense Contract W911NF-08-20039, Score Program NIH grant number 5-SC2-GM083717.*

33. Induction of Hydrocephalus in Rats and a Novel Treatment Method

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Hydrocephalus, a medical condition affecting approximately 1 out of every 500 births, is an abnormal accumulation of cerebrospinal fluid (CSF) in the ventricles of the brain. This results in increased intracranial pressure (ICP), progressive enlargement of the head, convulsions, tunnel vision, mental disability, and even death. Existing CSF shunting procedures have been deemed inadequate because they withdraw CSF solely based on based on ICP measurements. This often leads to dangerous over- and under-shunting, because ICP varies due to posture, routine daily activity, altitude, and atmospheric pressure. Our laboratory has postulated that direct volume monitoring and feedback control as a promising strategy to improve the treatment of hydrocephalus. This novel treatment method involves using a volume sensor to aid pressure measurements to more accurately drain CSF in hydrocephalic patients. Electrodes on the sensor generate an electric field, which measure volume through changes in impedance.

Our recent experiments focus on the induction of hydrocephalus in animals with an assessment of sensor performance through post-implantation sensor testing by injection/withdrawal of CSF. We studied the juvenile onset hydrocephalus following kaolin injection in 15 rats, acquiring a 40% induction rate. Dynamic bench-top testing was completed using a silicone balloon model to successfully calibrate the sensor, and then an injection/withdrawal protocol was followed in hydrocephalic rats. Controlled CSF shunting in-vivo with hydrocephalic rats resulted in precise and accurate sensor measurements (R^2=0.98). A maximum error of 17.3% was found between measured volume and actual volume as assessed by a Bland-Altman plot. Ventricular enlargement consistent with successful hydrocephalus induction was confirmed via imaging as well as post-mortem analysis of brain tissue. We conclude that the intracranial volume sensor is a viable technique to measure intracranial ventricular volume change as evidenced by bench-top testing and animal validation. *Funding: Grant NIH-R21NS071144 supported this research.*

34. Aggregation and Transport of Nano-TiO_2 in Saturated Porous Media: Effects of pH, Surfactants and Flow Velocity

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In the last two decades the manufacturing and commercialization of nanoparticles has increased tremendously making their release into the environment inevitable. The present study explored the effects of pH, anionic (SDBS) and non-ionic (Triton X-100) surfactants and flow velocity on titanium dioxide nanoparticles (nano-TiO_2) aggregation and transport mechanisms in saturated porous media. This information is essential to create a coherent notion of the nanoparticles mobility through subsurface environments. Saturated laboratory-scale column experiments were performed with solution suspensions at pH 7 and pH 9. The single-collector efficiency for physico-chemical filtration in saturated porous media was utilized to compute nano-TiO_2 deposition and maximum transport distance. The experimental results revealed that as the pH of the solution suspensions approaches the point of

zero charge (pH_{pzc}) of nano-TiO_2 (6.7–7.0) the transport of the nanoparticles is limited. This is due to the reduction in electrostatic interaction forces which enhances nanoparticle deposition. The presence and concentration of surfactants favored the mobility of nano-TiO_2 through the porous media regardless of pH. SDBS and Triton X-100 contributed to the steric repulsion forces which permitted nano-TiO_2 to remain stable and dispersed in suspension resulting in an increase in mobility. By doubling the flow velocity, the transport of nanoparticles was also enhanced. The reversibility of deposition of nano-TiO_2 was observed due to changes in solution chemistry. This point requires further investigation to properly assess the potential threat that manufactured nanoparticles impose to groundwater pollution and public health.

35. The Development of G4 Polyamidoamine (PAMAM) Dendrimers as an Ideal Nanoscale Eelivery System for Islet Research

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Purpose: Islet transplantation is a promising therapy for T1DM, but shows variable success. A long-standing goal is to develop an efficient system for the delivery of molecules to islets. Common viral and non-viral systems can only deliver molecules to the periphery cells of an islet because an islet is composed of a cluster of 1000 cells. Furthermore, most of these systems alternate islet function, pose potential oncogenic risks, and increase immunogenicity. Polyamidoamine (PAMAM) dendrimers are macromolecular nanostructures with high biocompatibility containing void spaces in their interior regions and modifiable surface groups that allow conjugation of therapeutic drugs and proteins. Generation 4 (G4) dendrimers have been demonstrated to have high efficacy to enter cells without auxiliary agents with minimal cytotoxicity. We hypothesize G4 dendrimers will provide a unique vehicle to deliver molecular cargos uniformly to islets. ***Methods***: G4 dendrimers were conjugated with fluorescein isothiocyanate (FITC). The transfection efficacy of FITC-labeled G4 dendrimers was tested in rodent and human islets using confocal microscopy and optimal concentration for transfection was determined. Impact of G4 dendrimers on islet function was evaluated by measuring the calcium influx and insulin secretion in response to glucose. ***Results***: (i) Confocal images showed high uptake of G4 dendrimers including the core of the islets. (ii) 100 nM of G4 dendrimers and 48 hours of incubation was determined as the optimal condition for the transfection of dendrimer into the islets to take place. (iii) The functionality of G4 dendrimer-treated islets was well maintained. ***Conclusion***: This is the first time that G4 dendrimers have been tested as a delivery system in islets with high transfection efficacy. The development of G4 dendrimers as a functional *in vivo* and *ex vivo* system is under investigation.

36. Robot Assistants for the Elderly: Communication Through Physical Interaction

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Our goal is to develop an interface for older people to effectively communicate with a robotic assistant so that they can safely remain living in their home. We are devising a multimodal interface since people communicate with one another using a variety of verbal and non-verbal signals, including haptics, i.e., physical interactions. We view haptics as an integral component of communication, which in some cases drives the interaction between the user and the robot, and we study its relation to speech and gestures. The interaction of language, gestures and gaze has been well studied. However, the role of haptics has hardly been explored in the context of interpersonal communication, in particular with robots.

We are focusing on Activities of Daily Living (ADLs) that are relevant to the independent living of the elderly (Krapp 2002). We have settled on three ADLs: getting up from a bed or chair, ambulating in the apartment, and preparing a meal. Our data is collected in a fully functional studio apartment in the College of Nursing at Rush University. It has a complete kitchen, bathroom, and living space (with bed, sofa, table with 4 chairs, dresser). We have equipped the apartment with an 8 camera video system. To study physical interaction between the subject and the helper, we have developed a data glove in the Computer Vision and Robotics Laboratory (CVRL) at the University of Illinois at Chicago. For the glove, FlexiForce pressure sensors (Tekscan, USA) are attached to each segment of each finger and palm, while an inertia measurement unit captures overall hand motion. The glove is connected to a processor box based on Arduino Mega microcontroller board, which transmits the data wirelessly to a PC using XBee protocol.

37. Spatiotemporal Patterns of Dynein Shear Forces in the Flagella of *Chlamydomonas reinhardtii*

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Cilia and cilia-like organelles have critical roles in human physiology, ranging from maintaining the flow of mucus in the respiratory system to providing the motility of male gametes in the reproductive system. Deficiencies or mutations of genes associated with cilia-related proteins can cause male infertility and Primary Cilia Dyskinesia, a debilitating disorder associated with reduced mucus clearance in the lungs and corresponding predisposition to chronic, serious infections. Many cilia perform their action by producing a characteristic waveform, which is generated by axonemal structures arranged in a 9+2 microtubule doublet array. Dynein motor proteins influence flagellar and ciliary waveforms by exerting forces and producing bending moments on the outer doublets. Due to their similarities to cilia in waveform, cellular structure, and molecular composition, flagella of *C. reinhardtii* were analyzed in the present study. A combination of theoretical and experimental methods was used to evaluate the dynein shear force. Computer simulations of flagellar motion were used to model the effects of dynein activity, given experimental measurements of mechanical properties and behavior. The waveforms of *C. reinhardtii* were analyzed from experimental video data in MATLAB, which allowed for the determination of the flagellar shape, shear angle, and curvature throughout the beat cycle. Measurements of the passive elastic properties of the flagella in wild type cells, in dynein regulatory complex mutant (pf3) cells, and in central pair knockout mutant (pf19) algae were taken using an optical tweezer system. The viscous forces due to the surrounding fluid were then estimated using experimentally-determined values for the resistive coefficients C_N and C_T.

The dynein shear forces were subsequently evaluated for each group of algae by solving the equations governing the bending of a thin beam in viscous fluid. We expect to show comparisons of dynein activity from theoretical simulations and from experimental data, and to evaluate the effectiveness of the simulations in detecting differences in dynein activity between normal flagella and those of various mutants. *Funding: The Children's Discovery Institute & the Federation of American Societies for Experimental Biology supported this research.*

38. Construction Progress Monitoring Using 3D Laser Scans

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Many constructability issues experienced by contractors occur due to the absence of accurate as-built drawings or errors in field measurements. Using 3D laser scanning technology, we can mitigate these problems as well as

develop comprehensive documentation of large environments, provide construction quality control, and track and monitor the progress of construction.

Laser scanners can be used to collect detailed three dimensional coordinate data about the built environment. Each laser scan produces a point cloud, which is composed of thousands of points in 3D space, corresponding to objects in the line of sight of the laser scanner. The data captured can be used to model as-built conditions, as well as to provide a chronological record of the progress of construction over time.

In this project, we tracked the progress of an ongoing construction project at weekly intervals using a FARO Focus 3D laser scanner. This point cloud data can then be converted to models of three dimensional building components to demonstrate construction progress and to support accurate measurements at given points in time in a construction project's history. *This work was supported in part by the LSAMP Research Scholar's Program NSF/HRD 0904024.*

39. Using Aquaponics Effluent as a Plant Fertilizer

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The Urban Science, Technology, Engineering and Mathematics Talent Expansion Program (USTEP) joins Chicago State University (CSU) and two City Colleges of Chicago (CCC), Kennedy-King and Olive-Harvey in a partnership to increase the number of students who graduate with degrees in science, technology, engineering and mathematics. The goal of this study is to determine if the effluent produced at the CSU Aquaponics center could be used as a liquid fertlizer for plants in the greenhouse, and ultimately, field situations such as community gardens. During summer, 2011, liquid effluent collected from the tilapia fish tanks was collected and applied twice weekly to plants growing in the greenhouse. Four plant species were included in the study because they are grown commonly in urban agriculture and are currently being tested at the aquaponics center:basil (*Ocimum basilicum),* fodder beets (*Beta vulgaris*), oregano *(Origanum vulgare*), and pepper *(Capsicum annuum*) . The fish effluent was tested at full and half strength against a commercial fertilizers diluted as indicated on the label, and water as a control Each treatment was applied to 10 ?? plants of each of the four species. Plant growth and vitality ratings on a scale of 1-5 data were collected over a period of six weeks and indicated 1) fodder beet appearance was best when treated with the effluent, but all other plants appeared best when treated with water alone; 2) all plants grew similarly (30-45 mm) for the first 3 weeks, but thereafter plants treated with commercial fertlizer showed a steep decline, and plants treated with effluent showed greatest growth. It is important to note that data dispersion suggests no significant difference in growth between the treatments, and suggests additional experimental data are needed.Students also compared pH and nutrient levels of 40 different collection vessels to asses uniformity of the effluent and showed substantial variation in nitrogen. Collectively, the data indicate that the effluent can be used as an effective fertlizer, but species differences should be considered and quality control measures are needed to ensure uniformity in different collections of effluent. *Funding: NSF DUE STEP - Award No.0856827.*

40. Isolation and Identification of Pathogenic Bacteria on Chicago's Mass Transit

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The purpose of this project was to isolate and identify pathogenic bacteria growing on the seats of the Chicago Transit Authority. Preliminary results indicate rapid lactose fermenters, various gram negative and gram positive organisms, and possibly an environmental bacillus. Several samples are likely to be enteric pathogens as well.

Funding NSF Grant CHE-0629174 supported this research.

41. Development of a Compact Aquaponics System to Grow Herbal Dietary Supplements

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With the increasing problem of limited or no access to quality nutrition in low income areas in inner city neighborhoods, the development of residential herbal dietary supplement agriculture may be of great benefit. Home production of popular herbal plants can be challenging due to limited agricultural land, cost, and inadequate space in small living accommodations. Community gardens are a viable alternative to personal gardens when land is available, however, the benefits of these gardens may not fully be realized by individuals with limited mobility due to age or serious health problems. An in-home aquaponics system can be a suitable means of producing herbal products that may prove beneficial for patients suffering from nutritional deficiencies to help enhance their general health and/or quality of life. Aquaponics is a bio-integrated system that links recirculating aquaculture with hydroponic vegetable, flower, and/or herb production, eliminating the need for soil. In this project, we designed an aquaponics system featuring a space saving stackable design that allows for minimization of space required for the system while providing sustainable herbal production. It features a self-sustained method of herbal production by using the wastes provided by the common goldfish (*Carassius auratus auratus*) in the system. The wastewater is used as irrigation to sustain the herbal plants and naturally filtered back to the tank. For families or individuals with limited mobility, maintaining an aquarium with may also serve as a hobby. The aim of this project is to determine if the herbal plants grown in an aquaponic system contain the same beneficial compounds as the soil based controls. The herbal products to be used include *Arctostaphylos*, *Hypericum perforatum* (St. John's Wort), *Matricaria recutita* (Chamomile), *Rosemarinus officinalis* (Rosemary), and *Tanacetum parthenium* (Feverfew). Funding: CSU-COP start-up funds.

42. Variations of Soil Physical Properties Within a Soil Series Across Prairie and Woodland Ecosystems

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This research compares soil physical properties within the same soil series in different ecosystem types, specifically prairie and woodland. Soil probe samples were taken to determine depth of soil horizons, soil color, and soil texture. Bulk density and infiltration rate also were measured. Results were compared between samples taken from the different ecosystem types and also to the official USDA soil series description of this soil, a silty clay loam. Any large differences in soil physical properties between the two areas would indicate a relationship between the soil properties and ecosystem type. Of the commonly accepted soil forming factors, the relevant variables in this research include biological activity and position in the landscape. Human activity also may be a factor based on evidence of previous development in the area. The expected results are that differences will be exhibited in the depth of the organic layer, soil horizon color, and in bulk density. Once the data was collected the main difference was found in the ecosystems bulk densities. Bulk density in the woodland ecosystem was higher than that of the prairie ecosystem. This suggests that there may be a relationship between ecosystem type and soil physical properties in this soil series. *Funding USDA-NIFA Hispanic-Serving Institutions Higher Education Program, Award Number 2010-02071 supported this research.*

43. Variations in Ecologically Important Nature Preserves

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Nature preserves and parks contain a wide range of ecosystems and species, and play a vital role in protecting indigenous plants and animal wildlife. Some of these ecosystems have been protected in national parks for many years and were not subjected to broad scale clearance for agriculture, commercial establishments, housing stock, or timber harvesting. Other ecosystems, protected in parks relatively recently, have been severely depleted and many of their species are now rare and at risk of extinction. In addition, some areas have been misused for years by industrial commercial establishments. Students in the USTEP Summer Research program at Chicago State University, Kennedy-King College and Olive-Harvey College have been investigating a protected prairie garden for two summers. This report compares characteristics of several local nature preserves with the prairie developed at Chicago State University. *Funding: NSF DUE STEP Award No.0856827.*

44. Urban Prairie Management: Controlling Invasive Thistle and Increasing Native Species at an Urban Prairie Garden

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The Urban Science, Technology, Engineering and Mathematics Talent Expansion Program (USTEP) joins Chicago State University (CSU) and two City Colleges of Chicago (CCC), Kennedy-King and Olive-Harvey in a partnership to increase the number of students who graduate with degrees in science, technology, engineering and mathematics. A 1.2 ha prairie reconstruction on CSU campus (est. 2003) was used to study population density and distribution of native species threatened by invasion of Canada thistle (*Cirsium arvense*. In 2010, six, 3X4 m plots were established on the border of the prairie using 6 native prairie plants: Purple Prairie Clover (*Dalea purpreum)*, Little Bluestem (*Schizachyrium scoparium),* Switchgrass (*Panicum virgatum),* Prairie Dropseed, (*Sporobolus heterolepis*), Ohio Spiderwort (*Tradescantia ohiensis*), and Western Sunflower (*Helianthus occidentalis*). Total plant biomass was sampled by clipping the vegetation within 3, 1/10th m^2 quadrats prior to the establishment of each plot to determine the initial vegetative composition prior to management. Seven linear transects were also used to sample vegetation throughout the prairie garden. Total plant biomass within 1/10th m^2 quadrats was clipped to the ground every 15 meters, then bagged and later sorted into forbs, grasses, thistle or woody categories. Sampling locations were identified through GPS to allow resampling at future dates. Biomass samples from the 18 border plot quadrats and 23 transect quadrats were oven dried at 65°C, and weighed. Based on the 2010 data, during the Spring of 2011 the prairie was reseeded manually with over 30 native species, including several native grasses that were found to be underrepresented in the vegetation, and allowed to establish themselves during the 2011 growing season. The 2010 data provides a baseline to determine how plant demographics may be changing in the prairie in response to manual introduction of species and annual mowing which is done during November of each year. Resamapling the border plots and transects during 2012 will help determine if native species have been able to withstand invasion by thistle, or if additional management techniques are needed. *Funding: NSF DUE STEP Award No.0856827.*

ORAL PRESENTATION LIST AND ABSTRACTS

GROUP A EL ROOM

45. From Genes to Ecosystems: Using Microsatellite Markers to Identify Problematic Invasive Plants

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Invasive plants pose a threat by disturbing ecosystem function and native biodiversity. Cattail plants grow in wetlands where they thrive in highly disturbed environments. *Typha latifolia* is a native species not considered to be a threat. In contrast, exotic *T. angustifolia* is a highly invasive species. Their hybrid, *T. x glauca,* is even more aggressive than *T. angustifolia.* These three *Typha* species are common in wetlands, but their identification in the field is difficult based on morphological characteristics alone due to significant overlap in phenotypic traits. This problem hinders efforts to control invasive species. Current efforts will remain unsuccessful if we cannot effectively recognize which species are problematic. In this study we are developing molecular techniques to identify species-specific polymorphisms as a more promising alternative to morphological identification. Qiagen DNeasy® Plant Mini Kits were used to extract DNA from five identified samples of each cattail species. We optimized amplification of 11 previously described microsatellite loci using polymerase chain reaction (PCR). These microsatellites were visualized in a Beckman Coulter gene sequencer and analyzed using the sequencer software to determine if they were polymorphic. Preliminary results indicate that out of the 11 microsatellite loci, at least 5 show important differences among the three cattail species, making them good diagnostic molecular markers for species identification. These protocols will be useful to environmental managers when attempting to restore areas heavily invaded by invasive cattail species. *Funding:US DOE CCRAA HSI Program and USDA's CREAR Award # 2010-38422-21240 supported this research.*

46. Utilization of Microbial Biology in Aquatic Sediment for Microbial Fuel Cell Energy Production

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There are many different types of conditions that exist with one ecosystem. The one that this experiment will focus on will be that of a water ecosystem of Thorn Creek, in particular, the anaerobic sediment. Within the aquatic sediment are bacteria, that due to the fact there is no oxygen, utilize other elements to complete enzymatic processes that are required for life. The bacteria of interest for this experiment will be *Geobacter metallireducen*. The bacteria have the ability to oxidize Fe (III) and have two results. The first is that it works as a bioremediation agent in the aquatic sediment by using elements deemed contaminants and through enzyme processes makes these contaminants less harmful to the environment. The second result is that as a result of the enzyme processes, it produces electrons. These electrons can be harvested via means of a Microbial Fuel Cell and produce electricity. A Microbial Fuel Cell is an instrument where *G. metallireducen* gather on an anode and release electrons that are the result of enzymatic processes. The objectives of this experiment were to introduce different materials in the aquatic sediment as cathodes and anodes to maximize the power output due to the *G. metallireducen*. The second objective of the experiment is once power is able to be observed and recorded is to

confirm the presence of the bacteria by means of PCR analysis. *Funding: Governors State University supported this research.*

47. Differential Affects of Folinic Acid and Folate on Embryonic Development in D12 and D17 ICR Mice

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Neural Tube Disorders (NTDs) include a wide range of developmental conditions which may be categorized as morphological, such as in spina bifida and cleft lip, or behavioral, as in disorders in the autism spectrum. It is now common practice for diets to be fortified with folic acid as a preventative measure in the incidence of NTDs, demonstrating a close involvement between the two along a developmental pathway.

Folic acid possesses a significant involvement in developmental pathways, especially in migration of embryonic neural crest cells, which play a major role in development of the neural tube, brain, and facial structures. More recent studies have shown an epigenetic link between folic acid metabolism and the IGF2/H19 locus, confirming a link between folic acid and neural tube development. While folic acid has reduced the development of spina bifida in some populations, its supplementation has been linked to an increase of other NTDs, including cleft lip/palate and autism spectrum disorders.

Teratogens such as alcohol and nicotine are known to have varying effects in utero dependent on time administered as well as dosage. The goal of this work is to investigate the possibility of folic acid supplementation exhibiting similar time and dosage sensitive behavior.

We exposed pregnant imprinting control region (ICR) mice to varying levels of folinic acid at different stages of pregnancy. The offspring were then tested for cognitive function using standard empirical measures of behavior for ICR mice. T-mazes, Morris Water Mazes, and Light-Dark boxes were used for behavioral measurements. The findings show a range of spontaneous alternating behavior that is dependent on both dosage of folinic acid administered to the mother and the specific stage of pregnancy during treatment. Funding: Extramural Associates Research Development Award (EARDA) from National Institute of Child Health and Human Development, Department of Education c/o SCSE (NEIU), M. Kimble, T. K. Puryear, D. Davis.

48. Role of Brassinosteroids in Salt Stress Tolerance of Sweet Potato Under *in vitro* Conditions

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Brassinsteroids are a class of plant steroid growth substances that regulate the growth and development of plants. These regulatory functions include elongation; cell division, proton pumping, and source sink relationships along with modulation of stress. Sweet potato is an important crop plant that is useful not only as a food source but also as a source of bio-energy. In present work, we report on the preliminary results on the effects of e-brassinolide on tolerance of salt of sweet potato varieties Commensal and Salyboro under *in vitro* conditions. Two salt levels, low (50mM) and high (200mM) - were used with 10nM 24-epibrassinolide. Eight week old plantlets were used for experiments. Initial results show that 10mM epibrassinolide alleviated salt stress both at low (50mM) and high (200mM) salt levels as evidenced by the morphological characters and proline levels. These results will be discussed in relation to overall salt tolerance in sweet potato.

49. Movement patterns in two closely-related species of Topminnow in a Southern Illinois Contact Zone

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Individual movement dynamics can influence species interactions in contact zones between closely related species. The purpose of this research was to determine if observed movements of two species of Topminnow (*Fundulus olivaceus* and *Fundulus notatus*) in a contact zone are influenced by individual sex, species and overall abundance. Fish were marked and fin clips collected for genotyping along a 2.2 km reach of Prairie Creek in southern Illinois where both species are present throughout. The stream was divided into downstream (0m-1370m) and upstream (1370m-2000m) regions. In total 254 fish were marked, including 153 females and 101 males. Genotyping efforts confirmed the species identity of 92 *F. olivaceus* individuals (38 males 54 females) and 137 *F. notatus* individuals (62 males, 75 females). Several re-sampling expeditions were carried out to recapture marked fish and note their new location in the stream. Fish movements were generally restricted but with some long distance excursions. The longest recorded movement was 794 meters for a female *F. olivaceus,* and the longest movement for a *F. notatus* individual was 132 meters for a female. An analysis of variance demonstrated that movement rates differed significantly by species ($P < 0.001$) and by region ($P < 0.001$) but not by sex ($p = 0.225$). There was also a significant interaction effect between species and region ($P = 0.004$). *F. olivaceus* exhibited greater movement overall and was numerically less abundant in both the upper and lower reaches. *F. olivaceus* also showed significantly greater movement in the downstream site than in the upstream site. This supports the hypothesis that the less abundant species exhibited greater movement. *F. notatus* did not show significantly greater movement in the upstream site vs. the downstream site. *This work was supported in part by the LSAMP Research Scholar's Program NSF/HRD 0904024, the NGRREC summer internship program and NSF DEB 0716985.*

50. The Big Ripoff: Lifting of the Cell Membrane Using Adhesive Tape for 3D Imaging of Cell Ultrastructure

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Understanding the spatial relationships between cellular components is challenging. The thin sections of cells used in transmission electron microscopy provide high resolution images of cell structures, but make it difficult to interrupt the cell's ultrastructure as a whole because material above and below the section is lost. Techniques that preserve the three dimensional relationships between components could lead to a better understanding of the spatial relationship of the cytoskeleton and other ultrastructure components. Three dimensional imaging of the ultrastructure of cells is difficult to obtain without altering the cell's structure. We have tested one possible technique that preserves the three dimensional structure of single cells. Cells are grown on glass cover slips, fixed and critical point dried. Adhesive tape is then briefly placed on top of the fixed cells and the removed so that the top layer of the membrane is stripped away. The removal of the top of the cell membrane allows us to image the inside of the cell by a scanning electron microscopy without completely altering the cell structure. We find that the technique is most beneficial in revealing information about the cytoskeleton networks. This technique will allow us to study changes in the cytoskeleton in wildtype versus mutant cells. The technique's success appears to depend on the cells ability to adhere to the coverslip. Modulating the amount of pressure applied with the adhesive tape seems to be a viable solution to address the

differences between cell lines. *Funding : NSF Major Instrumentation Grant DBI 0820958 supported this research.*

GROUP B CHICAGO/ALTON ROOM

51. Design of an Infrared Fluorescent Marker for *In Vivo* Tissue Imaging in Mammals

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Infrared fluorescent proteins (IFPs) are ideal for in situ imaging in mammalian tissue because IFPs are less prone to absorbance and light scattering by hemoglobin and water. Bacteriophytochromoes (Bphs) are bacterial red light photoreceptors that have been modified to fluoresce in the infrared (IR) range. Bphs require an organic cofactor, biliverdin (BV), which is naturally found in the mammalian body, in order to fluoresce. Recently, a heavily engineered Bph from *Deinococcus radiodurans* (DrBphP) was successfully expressed in mice as an IR fluorescent tissue marker. DrBphP exhibits classic Bph photoconversion because it has the ability to photoconvert between red-light and far-red light absorbing forms, Pr and Pfr respectively. Recently, we found that a Bph from *Rhodopseudomonas palustris*, RpBphP3 (P3), is naturally fluorescent in the near-IR range. P3 exhibits unique photoconversion due to the formation of an unusual near-red light (Pnr) absorbing form. A P3 mutant carrying a single substitution of a highly conserved aspartate-216 to histidine (D216H), introduced in the chromophore-binding pocket has the same fluorescent quantum yield as the heavily engineered DrBphP. We used site-directed mutagenesis to create a monomeric variant of P3 D216H that will be suited for expression in mammalian cells. Single mutations were introduced along the P3 dimer interface: threonine-142 to arginine (T142R), glutamate-315 to arginine (E315R), and tryptophan-323 to arginine (W323R). Our goal is to ultimately express monomeric P3 in mammalian cells and eventually in the mammalian body as IR tissue markers for whole body imaging. *Funding: NIH EARDA pilot grant 5G11HD049644 – 04 to E.A.S.*

52. Photodynamic Therapy for Prostate Cancer

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The objective of this research is to utilize existing non-toxic, photoactive molecules as well as novel synthesized lanthanide metal complexes to treat different stages of prostate cancer. Photodynamic therapy (PDT) is a technique that uses light and nontoxic drugs to destroy specific targeted tumor cells. After the inactive, nontoxic drug is applied topically or injected, it localizes in tumor tissue and can only be activated by irradiation with certain wavelengths of light. When these photosensitive drugs are "switched on" by light, they can produce highly reactive intermediates. In this manner, the irradiation of tumors with low energy light can ultimately lead to the selective death of cancerous cells without affecting normal tissue. Traditionally, radiotherapy and chemotherapy are the two major non-invasive techniques used for the treatment of cancer. Both methods can induce disabling and life threatening side effects, as they can indiscriminately destroy normal tissue as well as tumor tissue. Therefore, selective tumor destruction has become a major goal in oncology research. According to our data, well known antibiotics such as rifampicin, vancomycin, clindamycin and amphotericin B are photoactive molecules. They absorb visible light and have the ability of conducting energy transfer with DNA. Their cytotoxicity toward humans has been well studied; however, their photophysical, phtochemical, and photobiological characteristics have not yet being explored. Furthermore in this study, trivalent lanthanides such as europium, terbium, and gadolinium will be used to synthesize novel metalloporpyrin complexes to examine their capabilities as PDT agents. For all the

potential PDT agents, their molecular and electronic structure, bonding, reactivity, photo- and cyto-toxicity, and the ability of binding to nucleic acids will be well characterized and tested on the malignant prostate cancerous cells *in vitro*.

53. Development of New Dendrimer-Based Drug Encapsulation Polymeric Materials

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This paper describes a new approach to loading cisplatin onto dendrimer drug carrier. Hydroxy-functionalized dendrimer (Boltorn H20 and H30) was converted to acetoacetoxy (AcAc) functionality by transesterification reaction. Cisplatin, an anticancer drug, was loaded onto the dendrimer using enamine chemistry. Enamine formation and chemical stability of cisplatin after encapsulation into the dendrimers was confirmed by FTIR and UV.,studies were made on drug-loaded dendrimers to investigate the crystalline nature of drug after encapsulation. Scanning electron microscope confirmed smooth a relatively smooth surface morphology. Drug release studies were performed at low pH (gastric fluid environment), neutral pH (intestinal fluid environment).

54. A Quantitative Analysis of Solids in Water Using X-Ray Crystallography

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The presence of crystalline structures in dissolved solids found in water, in conjunction with Bragg's Law, allows x-rays to diffract off the surface of these solids yielding a unique computerized powder pattern. This powder pattern consists of various components, or phases, which can then be identified and quantified using databases provided by the International Centre for Diffraction Data (ICDD). An X-ray Diffractometer was used to determine crystallographic evidence inside distinct water sources. Four subgroups sought to identify and quantify dissolved solids in 4 sources of Chicago water and 2 sources beyond Chicago: Lake, River, Tap, Fountain, Bottled and Well.
Funding: CIRRUS, funded by National Science Foundation Grant DUE-0653198 and DePaul University.

55. Efficient One Pot Synthesis of Alkane Thiol Using Potassium Thioacetate and Microwave Assisted Irradiation

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Faster synthesis in less steps are cost effective by reducing both time and material used to complete the reactions. This study investigated the use of microwave energy to drive chemical reactions. Potassium thioacetate is an inexpensive thiol source and under microwave conditions a one step synthesis was developed with several different alkyls. Departing from previous synthetic routes using both thermal and microwave assistance which require multiple steps along with purification and isolation, this one step synthesis allows the conversion of the alkane thiol to the corresponding thiol. Our method was found to be applicable to straight, branched, and dihalide alkyls, and also with perflourinated alkyl halides, and benzyl halides. The reactions all take less than 60 minutes, even with chlorinated starting materials. Each reaction requires very minimal preparation leaving the corresponding thiol in good to excellent yields.

56. Studies on the Use of β- Cyclodextrin to Enhance the Solubility and Efficacy of Silybin

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Silybin, an active constituent of silymarin has been reported to show anti-cancer and anti-oxidant properties. However, it has poor water solubility and bioavailability. In this report, we describe the effect of β-cyclodextrin on the aqueous solubility and rate of dissolution of silybin. The results of phase solubility studies show that the solubility of silybin is enhanced by the presence of β-cyclodextrin. The stoichiometry of the complexation was to be a 1:1 ratio, and the inclusion complex was found to be very stable. The complexes were prepared by four different methods: physical mixture, kneading, precipitation, and co-evaporation. The inclusion complex was characterized by Fourier Transfer Infrared Spectroscopy (FTIR), Nuclear Magnetic Resonance (NMR), Ultraviolet Visible Spectroscopy (UV-Vis), Differential Scanning Calorimetry (DSC), and Scanning Electron Microscopy(SEM). Finally, the in-vitro studies indicate that the water solubility of silybin was greatly improved by the presence of β-cyclodextrin. *Funding: NIH/NIGMS Grant GM59218 supported this research.*

GROUP C — METRA ROOM

57. Adopting a Traditional Phytochemical Approach to Solve the Riddle of Nutmeg

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Nutmeg is the seed of *Myristica fragrans* (family Myristicaceae) that is commonly used as a kitchen spice and that is also reputed to have an effect on the central nervous system (CNS). Despite its reputed psychoactive effects in humans, the neuropharmacological activities of nutmeg have neither been fully evaluated nor completely characterized. Based on our preliminary work with prepared nutmeg extracts we are adopting a traditional phytochemical approach to isolate and identify the major constituents of different nutmeg fractions and to subsequently evaluate their *in vitro* binding to selected CNS receptors. This presentation describes the use of successive solvent extraction and normal phase flash chromatography to separate the major constituents of the dichloromethane fraction of total nutmeg extract. Purity assessment of the isolated compounds by two analytical techniques will also be described.

58. AFM Imaging Analysis of pUC19 DNA on Modified Mica

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The supercoil structure of DNA is thought to play a key role in the genetic process in cells. Microscopy has the potential to explain the detailed structure of the supercoiled DNA when the resolution of the microscope is high enough to observe DNA strands. One of the most useful techniques for imaging DNA in air and in aqueous solution is atomic force microscopy (AFM), which has the possibility to image the dynamics of DNA at the nanoscale. Since this microscope generates an image by probing the surface of the sample with a sharp tip attached to the end of a flexible cantilever, it is essential that the sample is adsorbed onto an ultra-flat surface. Modification of the mica surface allows reliable and reproducible imaging of supercoiled pUC19 DNA. The growth, isolation, and purification of pUC19 DNA will be reported, as well as AFM imaging of pUC19 DNA on modified mica. *This work*

was supported by National Science Foundation grant DUE-0633186 and the LSAMP Research Scholar's Program HRD-0904024.

59. Synthesizing Diamine and Diacid Oligomers which Promote Parallel β-sheet Structure

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Recent studies have provided evidence that Parkinson's and Alzheimer's diseases involve some form of protein aggregation that generates parallel β-sheet structure. The majority of β-sheet literature focuses on anti-parallel β-sheet strands. Our group seeks to study the stability of parallel β-sheet structure. To analyze parallel β-sheet thermodynamics, we have made minor changes to various peptides. These non-natural peptides have been produced to test how small changes to side chain structure, such as disulfide bridges, affect stability. Initially, we synthesized a 'diamine linker,' which promotes parallel β-sheet structure by connecting two strands at their C-termini. Two peptides were compared, one containing a disulfide bridge between the two strands, and the other containing two thiols. NMR analysis by chemical shifts and NOE signals suggest that disulfide bridges promote parallel β-sheet structure. We have recently synthesized a 'diacid linker,' which can promote parallel β-sheet structure by connecting two β-strands at their N-termini. By combining the diamine and diacid linkers, we hope to study how strand number affects global stability of parallel β-sheet structure. By exploring fundamental features of parallel β-sheet structure, such as disulfide bonds and strand number, we intend to gain further insight into the forces which influence protein structure as well as gain insight into protein folding diseases such as Parkinson's and Alzheimer's. *Funded by a generous gift from 3M, The University of Wisconsin-Madison Graduate School and the National Science Foundation (NSF) through the University of Wisconsin-Madison Materials Research Science and Engineering Center (DMR-0520527) and Nanoscale Science and Engineering Center (DMR-0425880).*

60. Synthesis of Gold Nanoparticles: A Comparison of Chemical and Microwave Synthesis

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The use of nanoparticles in research and industrial applications relies heavily on the physical properties of these structures. At the nano-level the physical properties are dependent on the size and shape of the structures. Thus, it is important to employ synthetic methods which produce nanoparticles that are not only stable but more are also monodispersed. In order to conduct a comparison of chemical and microwave synthesis, we have focused on the synthesis of gold nanoparticles. Gold nanoparticles of different size and shape were produced by both a chemical means and a microwave-assisted route. The synthesized nanoparticles were characterized via Transmission electron microscopy (TEM) to determine size, shape, and monodispersity. The comparative studies will be discussed along with the recipes developed to create desired structures using microwave-assisted chemistry. *Funding: U. S. Army Research Office Grant W911NF-07-1-0595, W911NF-08-1-0407, W911NF-05-1-0443 supported this research.*

61. Open-Top Compartmentalized Cell Culture Chamber for the Study of Fast Axonal Transport in Neurons

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Intracellular transport of molecules plays a critical role in both the survival and function of neurons. However, the lack of culture systems optimized for manipulation and observation has limited relevant investigations. In this work, we report a novel open-top compartmentalized microfluidic primary culture chamber suitable for efficient loading of cells near microfluidic barriers that isolate cell bodies from neuronal processes, and optimized for both fluidic isolation of different compartments over a long-term period and live imaging analysis of neuronal protein transport and subcellular localization. The performance of the device has been validated with fluorescent micro-beads and dyes loaded in the different somatodendritic (SD) and terminal compartments of the device, demonstrating efficient cell loading and fluidic isolation over a long period of time (more than 120 h without adding additional liquid to any compartment). Moreover, motor, cortical, and hippocampal neurons from E17 embryonic mice have been loaded into the SD compartments and successfully isolated from chemical microenvironments of axonal terminals. The cultures have been prepared for immunocytochemistry by using Dapi satin for cell bodies and Anti-Tubulin (DM1A) stain for axons. Additionally, genetic manipulations with recombinant pmaxGFP, APP-YFP and GFP-Tubulin have been carried out and then analyzed by fluorescent microscopy to visualize the structural conformation of different neuronal subcellular compartments within the different chemical microenvironments of the microfluidic chamber. Currently, we are using our platform to perform genetic and pharmacological manipulations to study neurological disorder-impaired trafficking of fluorescently labeled proteins such as BDNF-GFP, proBDNF, and synaptophysin (P38-mcherry and P38-orange) by using life cell imaging for differences in organelle packaging, and targeting to cellular domains. Our microfluidic device allows us to manipulate the fluidic microenvironment of at least three different populations of neurons at the same time to unravel molecular mechanisms of fast axonal transport of selective neuronal proteins. *This study has been supported, in part, by a* Chancellor's Graduate *Research Fellowship to Hector Hugo Caicedo, Ph.D student and by a grant from the CBC (Chicago Biomedical Consortium) to Dr. Scott Brady, Ph.D, Professor and Head, Department of Anatomy and Cell Biology, University of Illinois at Chicago, Chicago, IL.*

62. Induction of Hydrocephalus in Rats and a Novel Treatment Method

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Hydrocephalus, a medical condition affecting approximately 1 out of every 500 births, is an abnormal accumulation of cerebrospinal fluid (CSF) in the ventricles of the brain. This results in increased intracranial pressure (ICP), progressive enlargement of the head, convulsions, tunnel vision, mental disability, and even death. Existing CSF shunting procedures have been deemed inadequate because they withdraw CSF solely based on based on ICP measurements. This often leads to dangerous over- and under-shunting, because ICP varies due to posture, routine daily activity, altitude, and atmospheric pressure. Our laboratory has postulated that direct volume monitoring and feedback control as a promising strategy to improve the treatment of hydrocephalus. This novel treatment method involves using a volume sensor to aid pressure measurements to more accurately drain CSF in hydrocephalic patients. Electrodes on the sensor generate an electric field, which measure volume through changes in impedance.

Our recent experiments focus on the induction of hydrocephalus in animals with an assessment of sensor performance through post-implantation sensor testing by injection/withdrawal of CSF. We studied the juvenile

onset hydrocephalus following kaolin injection in 15 rats, acquiring a 40% induction rate. Dynamic bench-top testing was completed using a silicone balloon model to successfully calibrate the sensor, and then an injection/withdrawal protocol was followed in hydrocephalic rats. Controlled CSF shunting in-vivo with hydrocephalic rats resulted in precise and accurate sensor measurements (R^2=0.98). A maximum error of 17.3% was found between measured volume and actual volume as assessed by a Bland-Altman plot. Ventricular enlargement consistent with successful hydrocephalus induction was confirmed via imaging as well as post-mortem analysis of brain tissue. We conclude that the intracranial volume sensor is a viable technique to measure intracranial ventricular volume change as evidenced by bench-top testing and animal validation. *Funding: Grant NIH-R21NS071144 supported this research.*

GROUP D BARBERSHOP ROOM

63. Isolation of Circulating Tumor Cells Using an Improved Micro Device

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Circulating tumor cells (CTC) are present in the bloodstream of patients suffering from different types of metastatic cancer. These cells are important not only for diagnosis, but also for measuring the efficiency of a particular treatment. The micro device used consists of a pattern of channels which contains antibodies (anti-EpCAM) that will be attached to the CTCs. Shear stress and the capture of impurities such as the leukocytes are potential problems for the current devices. Several publications have demonstrated an effectiveness of 93% in the capturing of CTCs using this micro device. However, recent studies have shown that new improvements can be made to the device such as the use of nanoscale poly (amidoamine) (PAMAM) dendrimers and a chaotic pattern of the channels. It has been shown that with a chaotic pattern and the use of seventh-generation PAMAM dendrimers, the micro device can solve some of the problems stated before while maintaining its effectiveness in the acquisition of CTCs. *Funding: This work is supported by NSF grant CBET-0931472, NIH-NCI (U54 CA151880), and the Chicago Biomedical Consortium with support from the Searle Funds at The Chicago Community Trust.*

64. Medical Simulations of Intrathecal Morphine for Pain Control and Management

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Intrathecal drug delivery is used for administering drugs to the central nervous system by injecting into the cerebral spinal fluid. It is more efficient than oral and intravenous because it requires less of the drug and allows drugs composed of macromolecules to bypass the blood brain barrier. Additionally, certain drugs have greater therapeutic effect when administered intrathecally because they are able to reach their specific binding site in the brain and spinal canal. The infusion, distribution, and binding of morphine to the μ-opioid receptors were investigated. The purpose of morphine is to treat chronic pain. Current treatments with morphine are not patient specific and either result in over dosage or repeated dosage to achieve the desired therapeutic effect. First, the intrathecal injection of morphine in the spine using a 3-dimensional computational model created from patient images of the spine investigated the species transport of morphine. Second, the intrathecal injection of morphine in an axial section of the lumbar region of the spinal cord and spinal canal using a 2-dimensional computation model also created from a patient image and included binding, reaction rates, and kinetics of morphine.

65. Protein Expression Transformation Analysis System (PETAS)

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The Midwest Center for Structural Genomics (MCSG) at Argonne National Laboratory develops and optimizes new, rapid, integrated methods for highly cost-effective determination of protein structures through X-ray crystallography. The MCSG has been organized around seven highly integrated core-technology units. One of these units is Gene Cloning and Protein Expression, which is responsible for generating well-characterized protein expression systems for structural analysis. In the Gene Cloning and Protein Expression core, a LapChip instrument from Caliper Life Sciences is being used to analysis from 96- and 384-well plates. Data results are viewed as a virtual gel view, graph, or summary table. The major areas of work during this project are to design and develop systems for extracting data such as migration time, concentration, molecular weight, and purity from the LapChip output, transform them to fit operational needs, and automatically load them into MCSG databases. The project also includes an algorithm to provide analytical support for protein expression and solubility. The results of this project will allow the user to:

- Extract data from the LabChip output and Transform it to fit operational needs, and load the data into the MCSG databases,
- Schedule transformations to run at certain times,
- Upload a transformation file from the LabChip to be run on the web-based applications,
- Observe an expected protein by changing a variance interactively on the web-based applications, and
- Calculate filtered contents for pMCSG7 and MBP fusion vector tags.

66. DC Village: The Self-Sustainable Village of the Future

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AC is found to be most common form of energy to be utilized nationally. The concept of AC implementation stems from an inventor by the name of Nikola Tesla. After Nikola Tesla proved that it was possible to harness the power of Niagara Falls for AC generation efficiently, George Westinghouse produced funding necessary to implement this concept in various other cities and states. The generation of AC was based on stages or phases which were controllable by transformers. AC when used in this fashion is manipulated by either being stepped up or stepped down based on the necessary usage of the consumer.

DC did not prove initially to be a source or method in which could cost-effectively generate the supply need due to the nature that power would be produced in over abundance. Edison's powerhouses could only supply power in a two mile radius of a particular community. Also, direct current could only travel in one direction constantly. This method would require expensive implementations not just on the external level but also on the internal. Vast expensive copper transmission lines would be needed for travel of current. Also, various power plants would have to be built within close proximity and in radius in order to constantly or sufficiently supply the intended customer.

Currently, DC methods have been modified and modeled into more scalable uses. DC power connections now offer various advantages for the commercial and residential energy demands. In this presentation, the 'DC Village' model will be revisited but in this case updated to fit the presidential innovation of a smarter-grid refined by the citizens whom are connected to a 'cloud' of off-the-shelf technology.

67. Development of an Affordable Membrane System for an Ambient Hydrogen-Oxygen Fuel Cell

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An affordable, pollution-free alternative energy source is needed to replace the present obtainable pollution prone energy sources. In order to help the environment, renewable alternative energy sources, friendly to the population are imperative for future endeavors. This is essential economically if most of the society will benefit and live in the 21st century standard. Some of the applications include robotics, computers, cars and other sources. Fuel cells become one renewable source of energy that can be utilized in these different applications. A fuel cell is a device that converts the chemical energy from a fuel into electricity through a chemical reaction with oxygen and other oxidizing agents. Our focus is alternative electrolyte membrane systems for fuel cells. We have developed novel proton electrolyte membranes as an alternative to the costly Nafion membranes currently used for fuel cells.

68. Isolation and Identification of Pathogenic Bacteria on Chicago's Mass Transit

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The purpose of this project was to isolate and identify pathogenic bacteria growing on the seats of the Chicago Transit Authority. Preliminary results indicate rapid lactose fermenters, various gram negative and gram positive organisms, and possibly an environmental bacillus. Several samples are likely to be enteric pathogens as well. *Funding NSF Grant CHE-0629174 supported this research.*

GROUP E INSPIRATION STUDIO

69. Can Native Prairie Plants Remediate Soils in an Urban Setting?

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The Urban Science, Technology, Engineering and Mathematics Talent Expansion Program (USTEP) is a collaboration between Chicago State University (CSU) and two City Colleges of Chicago (CCC), Kennedy-King and Olive-Harvey. The goal is to increase the number of students who enter to pursue advanced degrees in the math and sciences. The program is utilizing a prairie reconstruction with adjoining turf grass on the CSU campus and a nearby abandoned gas station (brownfield) owned by the City of Chicago as ecological study sites. Prior observations suggested that the prairie soil was superior in quality compared with adjacent soil underlying turf. In 2010 USTEP students set out to help compare soil quality in the different study sites, and assess whether CSU prairie plants could act as remediators of the brownfield site. Twenty-four samples were collected from both the prairie garden and turf along 7 east-west transect lines. Seven samples were collected in the brownfield site and the soil was homogenized and divided into 3 subsamples. All the soil samples collected from the 3 sites were analyzed for carbon, nitrogen, soil moisture, pH, electroconductivity and earthworm density. Six native prairie species, Purple Prairie Clover (*Dalea purpreum)*, Little Bluestem (*Schizachyrium scoparium),* Switchgrass (*Panicum virgatum),* Prairie Dropseed, (*Sporobolus heterolepis*), Ohio Spiderwort (*Tradescantia ohiensis*), and Western Sunflower

(*Helianthus occidentalis*), were also evaluated for their ability to grow in soil collected from the brownfield as well as the *in* situ in the prairie. Some of the species were planted as mature specimens in the brownfield site in 2011 by the City of Chicago. In the upcoming 2012 season, plant survival in the brownfield and prairie sites will be assessed, and additional turf and prairie soil samples will be assayed to build upon data from 2010 and determine if the soil chemical and physical properties underneath the prairie are superior to underneath the turf. *Funding: NSF DUE STEP Award No.0856827.*

70. Water Filtration for Global Usage at an Individual Level

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A variety of crises' annually threatens the environment and result in compromise of water supplies worldwide. The immediate response by most countries is to ship bottles of water, which provides a quick but inefficient fix to a very serious problem. Plastic bottles take a lot of fossil fuels that pollute the environment. The resources that are necessary to create a water bottle consumes 50 million barrels of oil annually. In fact, Americans buy more bottled water than any other nation in the world, contributing 29 billion water bottles a year to the problem. Although products which help filter virtually any liquid into clean water have been developed, the associated costs are often prohibitive for sustained periods or large scale crises. This may eventually result in outbreaks of disease such as the cholera epidemic now devastating Haiti do to contaminated water supply. Project Purity is the task of creating a water bottle which would be able to purify a large amount of water over an extended time frame, while remaining affordable for crisis victims and the relief associations that seek to help them.Our product has the potential to bring a new avenue of affordable water filtration to the general public. More importantly, we hope to broaden development of this project to influence the lives of residents of distraught areas and impoverished countries. We believe that this can be accomplished by researching and testing the processes necessary to fully implement a Water Filtration Access project. As shortages of basic necessities are often more appropriately recognized as symptoms of deeper social disintegration, we believe that our interest in this aspect of service will ultimately lead to involvement in addressing other social problems.

71. Microbial Analysis of Runoff from Governors State University Retention Ponds and Potential Impact on the Thorn Creek Watershed

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There are many factors that influence the diversity and concentration of microbial populations in freshwater ecosystems due to building and parking lot runoff. The main objective of this study was to monitor general microbial types in building roof runoff leaving Governors State University's main buildings and entering a series of retention ponds before being discharged into the Thorn Creek Watershed as direct runoff or though seeps. Sediment and water samples were collected from eleven sites over a three-month period where wastewater enters the retention ponds and at the sites where it leaves as well. Samples were also taken form sites outside the ponds on route to Thorn Creek. The microbial load was investigated to determine if the numbers and types organisms were decreasing before entering the Watershed. Microbial counts were done using 3M™ Petrifilms with a focus on total aerobic counts, coliform/*E. coli*, and Mold. Statistical analysis was performed which resulted in a variety of data patterns. Results revealed in general that the microbial load was decreasing as it leaves Governors State University Campus on all sites except one. More research and analysis of all sites is needed, but this site is of particular interest since the microbial load is increasing at the exit, which could affect Thorn Creek. In conclusion, more extensive testing of the chemistry of the water and sediment will prove beneficial. *Funding:*

Governors State University supported this research.

72. Characteristics of Local Protected Land Resources

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Protected land areas are secured because of their natural, ecological and/or cultural values. There are several kinds of protected areas which vary by level of protection. The protected areas include land masses that contain a wide range of ecosystems and species and play a vital role in protecting indigenous plants and wildlife. They are managed by different federal, state, and local authorities and receive varying levels of protection. Students in the Urban Science, Technology, Engineering, and Mathematics Talent Expansion Program (USTEP) from Chicago State University, Olive- Harvey College and Kennedy-King College have become part of a movement that seeks to protect the environmental natural resources including plant and animal species. This report seeks to explore contrasts between several local protected land resources that have similar missions. *Funding: NSF DUE STEP - Award No.0856827.*

73. Prediction of Travel Times for CTA Buses

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Prediction of bus arrival times is an important element for travel planning. Using three weeks of Chicago's CTA bus route GPS data, we compare the performance of several commonly used methods, including linear models, support vector regression, k-nearest neighbors, and neural networks. Implicit assumptions in the literature concerning bus scheduling are challenged and are made explicit. The practical concern of computation times for the different algorithms is also considered. *Funding: NSF IGERT Grant 0549489 supported this research.*

74. The Costs for Using Loops in Programming Languages

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Both in high-level and low-level programming languages, the loop instruction is used to group instructions together and execute them continually. However, there are efficiency costs for using loops. In this presentation, we will review current research results in reducing these efficiency costs of using loops. We compare the performances of using loop controlled code and the code without using loop control to compute small dense rectangular matrix-matrix multiplication operation in targeted platform (AMD 64 processor based systems). Information such as instruction counts, stalls, cycles, cache access information, and conditional branching will reflect the increase in efficiency while using code without loops as opposed to code with loops.

GROUP F HISTORIC ENGLISH ROOM

75. On Tzitzeica Curve Equation

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Tzitzeica curve equation is a nonlinear ordinary differential equation whose solutions are called Tzitzeica curves. Briefly, a Tzitzeica curve is defined as a spatial curve for which the ratio of its torsion and the square of the distance from the origin to the osculating plane at an arbitrary point of curve is constant. Although these curves have appeared sporadically through the mathematical literature, Tzitzeica curve equation has not been studied so far. Moreover, at the moment, there are known only a few curves that satisfy this property. In this talk, I am going to present the Tzitzeica curve equation along with new Tzitzeica curves. *Funding: NSF/HRD-0703326 CFDA: 47.076 supported this research.*

76. VHMPID: A Proposed New Detector for the ALICE Experiment

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CERN (European Center for Nuclear Research) is a global laboratory that studies proton and heavy ion collisions at the Large Hadron Collider (LHC). ALICE (A Large Ion Collider Experiment) is one of four large experiments being of the LHC. ALICE is dedicated to the study of proton proton collisions and the transition of matter to Quark Gluon Plasma in heavy ion collsions. The Very High Momentum Particle Identification Detector (VHMPID) is a proposed upgrade to the ALICE experiment. This detector performs charged hadron identification on a track-by-track basis in the 10 GeV/c < p < 25 GeV/c momentum range and provides ALICE with new opportunities to study parton-medium interactions at LHC energies. This capability will be unique to all LHC experiments and it builds on the existing particle identification in the lower momentum range. In this talk, we will describe the detector, some results from beam tests performed at CERN in June of last year, the physics possibilities that this detector will bring to the ALICE experiment, and the status of the project. *Research funded by NSF grant PHY-0968903.*

77. Modeling the Effects of Mirror Misalignment in a Ring Imaging Cherenkov Detector

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The High Momentum Particle Identification Detector (HMPID) detector identifies charged hadrons in the range of 5 GeV/c to 10 GeV/c momentum range for the ALICE experiment at the Large Hadron Collider (LHC). An upgrade is considered necessary to study jet-matter interaction at LHC energies. The Very High Momentum Particle Identification Detector (VHMPID) detector is a proposed upgrade to study jet-matter interactions at high energies. This detector identifies charged hadrons in the range of 5 GeV/c to 28 GeV/c momentum range. The VHMPID uses a Ring Imaging Cherenkov (RICH) detector to determine the particle velocity. The Cherenkov photons emitted in the radiator are collected by spherical mirrors and are focused onto a photo-detector plane forming a ring image. The radius of this ring is related to the Cherenkov angle and, thus, the particle's velocity. This velocity information coupled with the particle momentum allows the particle mass to be calculated. A major issue in the RICH detector is that environmental conditions can cause movements in mirror position. In addition, chromatic dispersion causes

the refractive index to shift, altering the Cherenkov angle. We are modeling a twelve mirror RICH detector taking into account the effects of mirror misalignment and chromatic dispersion using a commercial optical software package. This will include quantifying the effects of both rotational and translational mirror misalignment for the initial assembly of the module and later on particle identification. *Research supported by National Science Foundation Grant #0968903 and NASA- Illinois Space Grant Consortium.*

78. A Cosmic Ray Muon Tracker and its Applications to Astronomy and Archaeology

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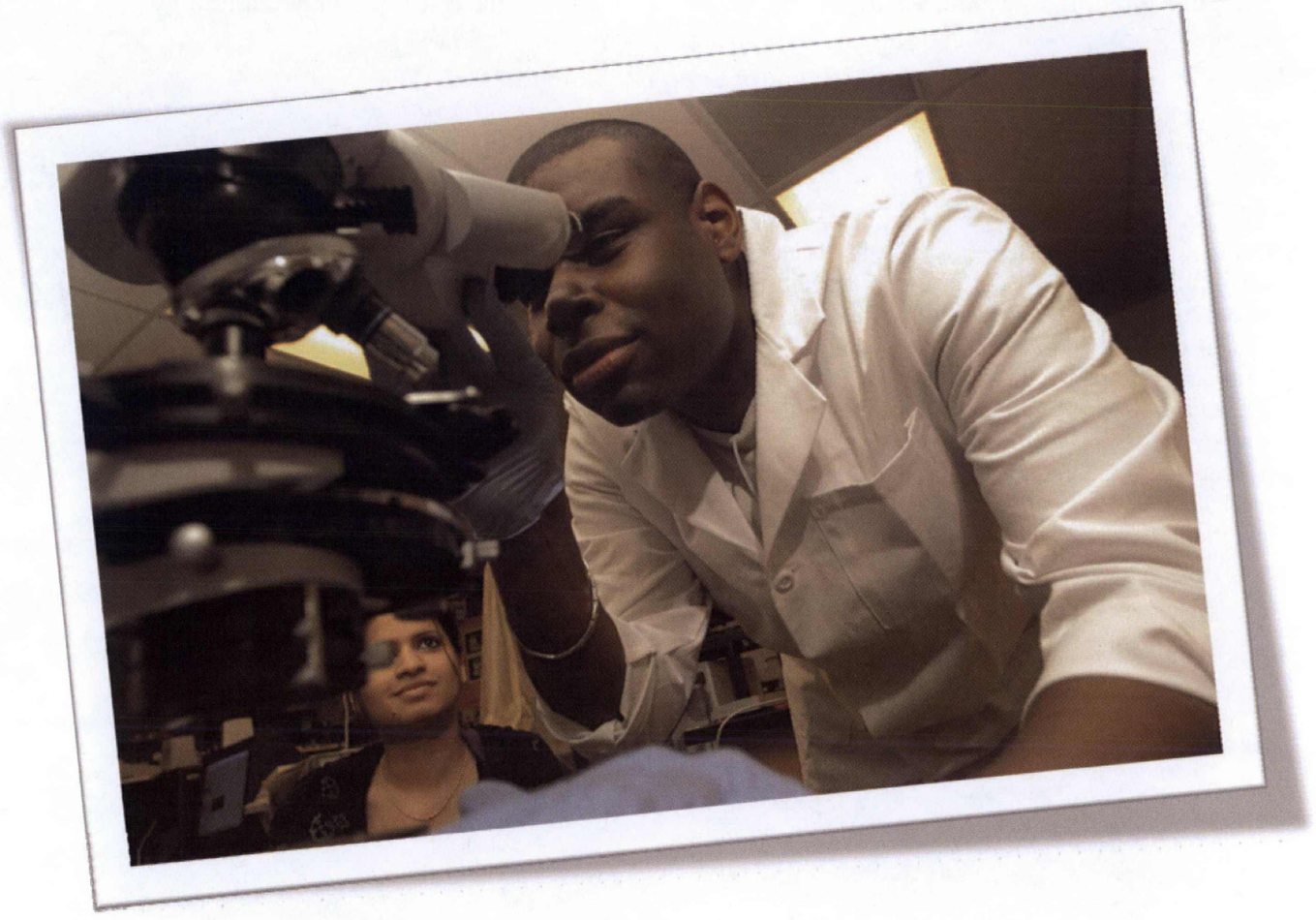
This research focuses on compiling the design parameters to build a muon tracker detector to support an ongoing effort to measure cosmic ray events as part of a network of detectors based on the QuarkNet program. Currently the individual detectors used in the QuarkNet network are capable of measuring cosmic ray flow but not the direction of the tracks. If instead we use a network of trackers (that will measure the direction of the muon showers) we will increase the probability of detecting high energy cosmic ray events. In addition, cosmic ray trackers can also be used for other interesting applications. In this talk we delineate the general characteristics of the proposed tracker detectors and its applications. We show the results of the experimental work done so far to define the design characteristics of the detector: experimental determination of the optimal linear dimensions the proposed tracker detector and preliminary results of the amount signal that reaches the phototubes when an optical fiber is used carry out the light from the scintillator. *Research supported NASA – Illinois Space Grant Consortium.*



ILLINOIS LSAMP OVERVIEW

The Illinois Louis Stokes Alliance for Minority Participation (Illinois LSAMP) program was established in 1993 and is funded by the National Science Foundation (NSF). Illinois LSAMP is one of a number of consortia of colleges and universities in the United States and Puerto Rico with the goal of significantly increasing the number of undergraduate and graduate degrees awarded to underrepresented populations in Science, Technology, Engineering and Mathematics (STEM).

Illinois LSAMP consists of nine (9) universities, five (5) regional community colleges, and one (1) government laboratory. Together this group participates in a collaborative effort to provide programs that improve the quality of STEM education for students. Each of these organizations has made a commitment of faculty, staff, research facilities and technical assistance to ensure successful opportunities for students participating in Illinois LSAMP programs. NSF has established five Illinois LSAMP "Bridge to the Doctorate" programs. Two of these programs are located at Southern Illinois University at Carbondale and the other three are located at the University of Illinois at Chicago.

Illinois LSAMP activities are comprehensive and multidisciplinary, focused specifically on STEM education. Great effort is expended to address transition points in a student's academic career and to provide intervention at junctures crucial to preventing withdrawal from the STEM pipeline. Consequently, critical transition points along the STEM education pipeline; high school-to-college, 2-year to 4-year college, undergraduate study, and graduate study-to-careers, are addressed in various and innovative ways.

The efforts include: Hands-on Research Opportunities, Scholarship Programs, Science Conferences, Facilitated Study Group Sessions, Professional Development, Peer Mentoring Activities, Summer Bridge Programs, Tutoring Programs, Internships and Graduate Activities.

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CENTER FOR STEM EDUCATION & RESEARCH OVERVIEW

The Center for STEM Education & Research (CSER) was established in 2011 and is funded by the U.S. Department of Education (DoED). The purpose of the CSER is to connect existing Science, Technology, Engineering & Mathematics (STEM) programs, align them with the various STEM disciplines at Chicago State University (CSU), and provide support to student-faculty research collaborations as well as grant-funded research projects and programs, and to help research faculty to better prepare students for STEM challenges of the future.

The goals of this Center are to:

- Increase America's Talent Pool by Improving STEM Education for Students in Grades 6-12,
- Enhance Student Awareness of and Motivation for STEM Education and Careers through Improved Information, Mentoring and Outreach, and
- Provide Resources and Professional Development to Boost Faculty Research and Proposal Writing Productivity.

Establishing links between the STEM grade 6-12 activities, training and research grants, Centers, faculty and students at CSU is a central component of the CSER. To accomplish these goals, the CSER concentrates its efforts on four specific areas to promote STEM advancement at CSU:

- **Environment:** Provide positive surrounding influences that encourage and promote STEM learning.
- **Experiences:** Foster the acquisition of knowledge and skills by engaging CSU students in STEM K-12 and undergraduate research activities.
- **Evaluation:** Promote continual assessment and evaluation using rigorous formative and summative research methods and design.
- **Exposure:** Disseminate information and introduce students to new STEM events and activities such international fields trips, conferences & speakers.

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The Illinois LSAMP and Center for STEM Education & Research Programs would like to thank the following people for their contributions and assistance in organizing the conference.

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Cover *designed by Saul Rivera, Graphic Communications, Chicago State University;* ***Printing*** *by OfficeMax Impress, Tom Wojtyszyn, Strategic Account Manager; and* ***Photography*** *by Brent Jones, Photojournalist.*

The U.S. Department of Education

The Center for STEM Education & Research gratefully acknowledges the support of the U.S. Department of Education

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The Illinois Louis Stokes Alliance for Minority Participation gratefully acknowledges the support of the National Science Foundation

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