Louis Stokes Alliance for Minority Participation /
Alliance for Graduate Education and the Professoriate

"League of Extraordinary Students"

Purdue University-West Lafayette
LSAMP/AGEP
Fourth Annual Joint Research Conference
Friday, November 7 and
Saturday, November 8, 2008

Fourth Annual Joint
Indiana LSAMP and Midwest Crossroads AGEP
Student Research Conference
Purdue University - West Lafayette

LSAMP INDIANA

WELCOME

Welcome, everyone, to the Indiana LSAMP and Midwest Crossroads AGEP Fourth Annual Student Research Conference sponsored by National Science Foundation (NSF) alliance grants programs.

These programs are committed to enhancing the quality and excellence of science, technology, engineering, and mathematics (STEM) education and research through broadening participation by underrepresented groups. Our joint research conference objectives are to provide undergraduate and graduate students in the STEM disciplines:

- The opportunity to present their research and receive constructive feedback enhancing their research interest.
- Intentional, effective retention strategies focusing on academic and professional skills development, and
- Expand the intellectual community of scholars within the two alliances.

Registration and Refreshments

Registration with refreshments, on Friday, November 7, 2008 from 8:30 to 11:30 a.m.

Registration on Saturday, November 8, 2008 is from 8:00 a.m. to 9:00 a.m.
Breakfast on Saturday

Luncheon

Lunch, for Friday, will be held in the ***Garden Atrium*** from noon to 1:30 p.m., featuring: Dr. Randy Woodson, Provost - Purdue University

Lunch, for Saturday, will be held in ***Suites I & III*** from 12:30 – 2:00 p.m.
Featuring: Dr. Monica Cox, Assistant Professor of Engineering Education - Purdue University

Poster Session

Posters will be up for display on Friday, November 7 from 11:00 a.m. and located in the ***Hotel Hallways.***

Presenters may set up posters on Friday morning from **9:00 a.m. to 11:00 a.m.**
An alphabetized list of poster and oral presenters with titles is attached.

Welcome to Purdue University, West Lafayette
***** The PU AGEP Program and the PU LSAMP Team *****

PURDUE
UNIVERSITY
West Lafayette, Indiana

Pamella P. Shaw, D.M.D., M.P.H.
Assistant Provost
Alliance Director, LSAMP Indiana
Director, Midwest Crossroads AGEP

November 2008

Greetings Everyone!

Welcome and congratulations on another successful year of LSAMP and AGEP! As we complete our sixth year of the Indiana Louis Stokes Alliance for Minority Participation *(LSAMP)* and begin our fifth year of the Midwest Crossroads Alliance for Graduate Education and the Professoriate *(AGEP)*, I am excited and overwhelmed by the progress of our two alliances. This conference will be our Fourth Annual LSAMP/AGEP Joint Research Conference and it promises to be another one that you will never forget.

With an expected attendance of approximately 200 students, faculty, staff and administrators, this will be our biggest conference to date. I applaud those of you who continue to work hard to support students seeking undergraduate and graduate degrees in science, technology, engineering and mathematics (STEM). I am very proud and delighted with the progress of each alliance and, as we look ahead to the future, I hope our goal to help increase the numbers of professionals in the STEM fields and in the professoriate will be validated by your success.

Above all, I would like to thank the students, faculty and staff for your continuous efforts. Without your support and dedication, our programs could not continue. We are especially honored to have the unrelenting support of our dedicated research faculty. Your commitment to the students and the programs are most appreciated.

For our students, I hope your experience at our conference will help support the development of your research skills, enhance your scientific knowledge and promote the development of strong connections with faculty and other students in your chosen STEM fields. The hard work and dedication you have shown will provide you with the skills needed for a successful completion of your degree programs and set you on a course of success as you prepare to meet the challenges of science, engineering and technology for the future.

Congratulations and Sincere wishes for a bright future!

Pamella P. Shaw, D.M.D., M.P.H.

Message from the National Director
Louis Stokes Alliances for Minority Participation (LSAMP)
National Science Foundation

I am pleased to welcome you to the 4th Annual Joint Research Conference of the Louis Stokes Alliance for Minority Participation (LSAMP) – Indiana and the Midwest Crossroads Alliance for Graduate Education and the Professoriate (AGEP) hosted by Purdue University on November 7-8, 2008. You will be provided with wonderful opportunities to interact with graduate school representatives, research faculty, and other organizations with opportunities in the Science, Technology, Engineering, and Mathematics (STEM) disciplines.

As a participant at the student research conference, there will be something for all conference participants. I strongly urge you as students, faculty and exhibitors to fully engage in all of the magnificent program activities. The conference will play host to oral and poster research presentations, academic enhancement workshops, professional development seminars, exciting laboratory tours and eager exhibitors looking for talented students to join their respective organizations.

Indiana is one of 39 LSAMP alliances, funded by the National Science Foundation (NSF). This valuable partnership alliance and AGEP allow NSF to assist in the education and training of future scientists and researchers. Towards this vision, our endeavors will shape and make significant contributions to the scientific enterprise that will mark the upward surge of humanity.

We, at NSF, are happy to express our excitement about and express appreciation for the achievements of the Indiana-LSAMP, and AGEP Alliances. Please take the time to capitalize on all of the wonderful conference activities. Again, welcome to the LSAMP – Indiana /Midwest Crossroads AGEP Joint Research Conference.

James Hicks
Director
National LSAMP Program

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LSAMP Indiana & Midwest Crossroads *AGEP*
"League of Extraordinary Students"
Fourth Annual Joint Conference

Friday, November 7, 2008

8:30 - 11:30 a.m.	**Registration and Refreshments** – Hotel Lobby
8:00 a.m.	**Student Transportation from Campus** **Also available 11:30 a.m. and 5:00 p.m. *Friday Only***
9:00 - 11:30 a.m.	***LSAMP* Governing Board Meeting** – Suite IV Dr. A. James Hicks, NSF Program Director
9:00 - 11:00 a.m.	**Poster Presentation Set-Up** – Lobby Halls
9:30 – 11:00 a.m.	**Networking for Grads & Undergrads** – Atrium
10:00 – 11:00 a.m.	**Graduate Fellowship** – University Salon A Dr. Marcus Huggans, The National GEM Consortium
11:15	**Presentation Volunteers Meeting** – Alumni Room Jamelle Williams, Graduate Student, Department of Chemistry, Purdue University
11:30 – 12:00 p.m.	**Judge's Meeting** – Alumni Room
12:00 - 1:30 p.m.	**Luncheon** – Garden Atrium Dr. Beverly Davenport Sypher, Associate Provost, Purdue University **Welcome** by Dr. Randy Woodson, Provost, Purdue University
1:30 - 3:30 p.m.	**Oral Presentations** – University Square Salon A-C & Suite IV See list of presenters attached ***All Audience***
3:30 - 5:30 p.m.	**Poster Session** – University Lobby Halls See list of presenters attached ***All Audience***
5:30 - 6:00 p.m.	**Judge's Meeting Wrap Up** – Alumni Room
5:30 - 6:00 p.m.	**Students *LSAMP Alliance* Meeting** – University Square Salon A-C Dr. A. James Hicks, NSF Program Director
5:30 – 6:00 p.m.	**Graduate Student "Wine & Cheese" Reception** – Grand Ballroom Dr. Penny Warren, Assistant Dean of Student Life & Multicultural Affairs, the Graduate School, Northwestern University

6:15 - 8:30 p.m. **Dinner and Award Banquet** – Grand Ballroom
Dr. A. James Hicks, NSF Program Director

Awards Presenter:
Dr. Pamella Shaw, Assistant Provost, Purdue University
Statewide Director, LSAMP Indiana
Director, Midwest Crossroads AGEP

7:00 p.m. **Music Provided by:**
Purdue University Salsa Team

8:30 – 10:00 p.m. **Dance and Entertainment by:**
Wendell Ferguson

Saturday, November 8, 2008

8:00 - 9:00 a.m. **Registration** - Hotel Lobby
Strategies for Success & Breakfast – Suites I & III

9:00 – 10:15 a.m. **Professionalism & Social Network with Facebook** – Salon A-C
Facebook: Enter at Your Own Risk
Featuring: Dr. Pablo Malavenda, Associate Dean of Students, Purdue University
Undergraduates and Graduate students

10:15 – 11:30 a.m. **Dr. Daniela Bortoletto,** Professor of Physics – Salon A-C
and **Dr. Ian Shipsey**, the Julian Schwinger Distinguished Professor of Physics, Purdue University
"Pixel Detector for CMS" and "LSST Camera"
All Audience

11:30 – Noon **Hotel Check Out**

12:00 – 12:30 p.m. **Video Showcase** – Salon A-C
"Interdisciplinary Research Successes at Purdue's Discovery Park"
All Audience

12:30 – 2:00 p.m. **Luncheon** – Suites I & III

Dr. Monica Cox: Assistant Professor of Engineering Education
Purdue University
"Demystifying Engineering"

2:00 – 2:30 p.m. **Wrap Up Conference Concludes** – Suites I & III
Dr. Pamella Shaw, Assistant Provost, Purdue University
Statewide Director, LSAMP Indiana
Director, Midwest Crossroads AGEP

Thank you for Attending and Have a Safe Trip Home!

DR. A. JAMES HICKS

Program Director,
Louis Stokes Alliances for Minority Participation (LSAMP)
National Science Foundation (NSF), Washington DC

Received his B.S. degree in biology from Tougaloo College, earned a Ph.D. in Botany at the University of Illinois-Urbana and received postdoctoral training, at the Missouri Botanical Garden, St. Louis. He acquired administrative training by attending the Institute for Educational Management for College and University Administrators, Harvard University, Cambridge, MA; the Executive Development Seminar for Senior Federal employees at the Western Management Development Center, Denver CO; the Extramural Associates Program at the National Institutes of Health in Bethesda, MD; the Lilly Foundation's Liberal Arts Program for College Administrators in Colorado, Springs, CO; and the Christian A. Johnson Foundation's Leadership Program in New York City.

Prior to becoming the LSAMP Program Director, Dr. Hicks served as Chairperson and Professor of Biology from 1977 to 1988, and, later, Dean of the College of Arts and Sciences from 1988 to 1997 at North Carolina A&T. Under his leadership, the research capacity of the Department of Biology was enhanced by the acquisition of major research grants and equipment including two electron microscopes, along with renovations of the facilities to include more research space. As a scientist, his research focus has been in the area of plant taxonomy and he has reported his work at various scientific seminars and in peer review journals. While serving as Dean, major renovations for the Physics (Fort Research Building), Chemistry (Hines Hall), and Fine Arts (Crosby Theatre Complex, and Dudley) buildings were completed, and plans for a $34 million dollar General Classroom Building were approved. The construction of the latter building was completed and scheduled for occupancy in the fall of 2003.

Dr. Hicks is well known at the local, state and national levels for his service on numerous committees and advisory boards. In North Carolina, he served on the Greensboro Bog Garden Advisory Board, the Plant Conservation Board (NCPCB), the Guilford County Advisory Board for Environmental Quality, the Natural Areas Advisory Committee of the Department of Natural Resources and Community Development and the Biotechnology Center (NCBC), and the Facilities and Infrastructure Review Committee in Research Triangle Park. On the national level, he was an elected official on the Board of Trustees of the Lady Bird Johnson Wildflower Research Center, headquarters in Austin Texas; a member of the Task Force on the National Agenda for the Council of Colleges of Arts and Sciences (CCAS), headquarters at Ohio State University, Columbus Ohio; and a trustee of the Charles B. Arzeni Foundation for Tropical Research, headquarters in Anchorage, Alaska.

Also, at the national level, Dr. Hicks has served on several panels of proposal evaluators for the National Academy of Sciences, Washington, D.C; the Directorate for Science and Engineering Education/NSF, Atlanta, GA; the Department of Education/Minority Institutions Science Improvement Program (MISIP), Washington, D.C; the NSF Minority Graduate Fellowship Program, and NSF's Research Apprenticeship for Minority High School Students Program. In 1995, he was a member of the North Carolina delegation to Baden-Wurttemberg, Germany, which negotiated a Memorandum of Understanding to allow student and faculty exchanges between North Carolina and Germany.

Dr. Hicks and his wife Mrs. Pearl are the proud parents of two daughters: Dr. Roselyn M. Hicks, and Ms. Renee Hicks-Mitchell, and a granddaughter, Sasha.

Dr. Hicks has received numerous honors and awards for his achievements in science and for his efforts in promoting the advancements of underrepresented groups in science, technology, engineering and mathematics. Most notably, in 1988, he received the White House Initiatives Faculty Award for Excellence in Science and Technology with a letter from President Ronald Reagan. In 1981, his biographical material was displayed at the Black History Exhibit at the National Agricultural Library in Beltsville, MD. He received the Director's Award for Administrative Excellence in 1998 at NSF, and, in 2001, the United States Department of Agriculture's Group Honor Award for Excellence for establishing a national awards program honoring outstanding teachers and research scientists at Historically Black Colleges and Universities. A bevy of Certificates of Appreciation are in his portfolio from such groups and organizations such as: Council of Colleges of Arts and Sciences (1997), the Extramural Associates Program/NIH, the University of Texas System – LSAMP and South Carolina-LSAMP (1999), USDA (2001), the North Carolina Biotechnology Center, NSF, Washington-Baltimore-Hampton Roads-LSAMP (2002), Florida/Georgia – LSAMP (2003), and, notably, in 2001, the Lifetime Service Award from the national project directors of the LSAMP Program. In 2005, Dr. Hicks received three major recognitions for long- term achievements in broadening participation of underrepresented minorities in science, technology, engineering and mathematics at the national level. The awards are:

- ***Congressional Recognition for the 2006 Educational Technology Think Tank (ET 3) TEC Champion Leadership Award.*** National Education Association Headquarters, Washington, DC, September 8, 2006
- ***Emerald Honors Award (Career Achievement)***. Spectrum Magazine. Baltimore Convention Center, September 17, 2005
- ***Torch Bearer Award for Distinguished Service to the Field of Student Retention.*** National Symposium on Student Retention, Wyndham Dallas Hotel, Dallas, Texas; Consortium for Student Retention Data Exchange, University of Oklahoma, October 3-5, 2005
- ***Tougaloo College Alumni Hall of Fame Inductee.*** Mikhail's Center & Restaurant, Jackson, MS, October 14, 2005

Keynote Speakers

William R. (Randy) Woodson

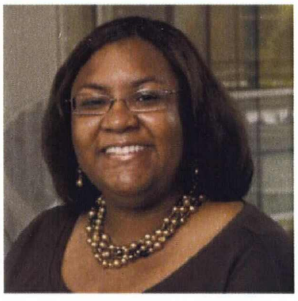
Provost, Purdue University

Dr. Randy Woodson was appointed Provost of Purdue University on May 1, 2008, where he is the chief academic officer of one of the nation's largest and most highly respected institutions. Dr. Woodson's responsibilities include oversight of all academic programs on the West Lafayette campus and on the four Purdue-affiliated regional campuses. He is also a distinguished researcher and teacher, specializing in the field of Plant Science.

Beverly Davenport Sypher

Associate Provost, Purdue University

Dr. Sypher is the Susan Bulkeley Butler Chair for Leadership Excellence and associate provost at Purdue University where she is responsible for faculty affairs, leadership development, change management, administrative searches, various strategic plan initiatives and special initiatives including AGEP and LSAMP. She recently received the MIRA Award for educational contributions to technology for her work on serious gaming and learning.
Dr. Sypher, also a professor in the Department of Communication, has authored three books and numerous articles on the contemporary American workplace. Dr. Sypher has been the PI or CO-PI on more than $18 million in external funding and has won numerous awards for teaching excellence.



Monica F. Cox

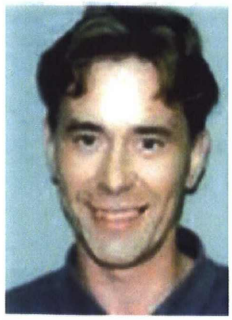
Assistant Professor of Engineering Education, Purdue University

Dr. Cox's research interests include development and validation of engineering education assessment tools; assessment of engineering doctoral education; undergraduate and graduate students' acquisition of engineering norms, skills, and attributes within academia and industry; and assessment of pedagogy within engineering classrooms and laboratories. She is the Director of the Pedagogical Evaluation Laboratory Group at Purdue, is the Co-Director of Assessment for Purdue's Institute for P-12 Engineering Research and Learning (INSPIRE), and is a recent recipient of a National Science Foundation Faculty Early Career award.

Daniela Bortoletto

Professor of Physics, Purdue University

Dr. Bortoletto's research specialization is Experimental Particle Physics. Her research interests include the studies of heavy quarks, first at CLEO, and then at CDF where she was a co-discoverer of the top quark. She is well known for the development and fabrication of silicon detectors including the CDF SVX detector and the recently installed forward pixel detector for the CMS experiment at the LHC. She is very involved in post graduate education and, in addition, leads the Quarknet outreach effort at Purdue. She was recently appointed to the Mathematical & Physical Sciences Advisory Committee (MPSAC) to the NSF.



Ian Shipsey

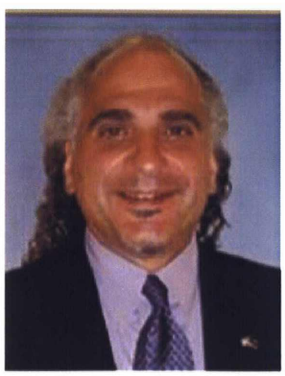
The Julian Schwinger Distinguished Professor of Physics
Purdue University

Professor Ian Shipsey is involved in searches for CP violation and studies of parity violation in the weak interactions of elementary particles. As a graduate student, he was a member of the NA31, the only experiment to have observed direct CP violation. He has been a member of the CLEO collaboration since 1986. He built the muon detector for the CLEO II, and since 1994 he has been leader of the mechanical design and fabrication group for the silicon microstrip detector for CLEO III. He is one of the leaders of CLEO IV, a proposed new experiment that would succeed CLEO III in about 2004. He is also involved in the development of microstructure gas detectors for future high energy physics experiments.

Pamella P. Dale Shaw

Assistant Provost, Purdue University
Statewide Director, LSAMP Indiana
Director, Midwest Crossroads AGEP

Dr. Shaw is the Statewide Director of the Louis Stokes Alliance for Minority Participation for Indiana (LSAMP-Indiana) and the Director for the Midwest Crossroads Alliance for Graduate Education and the Professoriate (AGEP). LSAMP Indiana and the Midwest Crossroads AGEP are National Science Foundation programs of support that work to increase the numbers of undergraduate and graduate students receiving degrees in science, technology, engineering and mathematics. Both programs have multiple campuses and programs across the state of Indiana with the Midwest Crossroads AGEP including a program in Illinois at Northwestern University.



Pablo Malavenda

Associate Dean of Students, Purdue University

In his role, Dean Malavenda oversees the Student Activities and Organizations area, including the 815+ student organizations, independent housing units, leadership programs, and community service initiatives. Dean Malavenda came to Purdue in 1998. He serves as the primary advisor to the Barbara Cook Chapter of Mortar Board, as well as Presidents Roundtable. He also serves as a co-advisor to Purdue Student Government. He is a faculty fellow at Hillenbrand Hall and an instructor for EDPS 300A Student Leadership Development.

Fourth Annual Joint Research Conference
Indiana *LSAMP* and Midwest Crossroads *AGEP*

Student Presentation Listing

ORAL PRESENTATIONS

Andrea Abdullah
Purdue University/Indiana University
Biology

Jannah Bacchus
Purdue University/Indiana University
Life Science

Aurelio Bedollà
Purdue University/Calumet
Management

Laty Cahoon
Northwestern University
Microbiology and Immunology

Sean Campbell
Purdue University/Indiana University
Chemistry

Michael Cui
Purdue University/Indiana University
Life Science

Oscar Curet
Purdue University/Northwestern
Life Science

Zachary Fisher
Purdue University/Indiana University
Chemistry

Shanti Frausto
Northwestern University
Neuroscience

Bryon Gaynor
Purdue University/Northwestern
Life Science

Francisco Iacobelli
Northwestern University
Computer Science

RoJenia Judkins
Ball State University
Chemistry

Heather Leavesley
Purdue University
Medicinal Chemistry & Molecular

Zamir Libohova
Purdue University
Hydropedology

Eric Mauser
Purdue University/Indiana University
Chemistry

Rhoda Owolabi
Purdue University/Indiana University
Biology

Sarah Parrish
Purdue University/Calumet
Life Science

Ashley Perkins
Purdue University/Indiana University
Life Science

Juan Reyes
Purdue University/Northwester
Life Science

Mayte Ruiz
Purdue University/Indiana University
Biology

Fourth Annual Joint Research Conference
Indiana *LSAMP* and Midwest Crossroads *AGEP*

Student Presentation Listing

ORAL PRESENTATIONS

Yolanda Ruiz
Purdue University/Calumet
Political Science

Lori Stalter
Purdue University/Calumet
Life Science

Beatrice Thungu
Purdue University/Indiana University
Biology

Mariah Veit Judd
Purdue University
Biological Sciences

Andrea J. Abdullah

Indiana University, Purdue University Indianapolis: Junior, Pre-med Biology
Mentor: Dr. Teri Belecky-Adams, Department of Biology

Characterization of Epithelial Sodium Transporters (ENaC) in Human Lens Epithelial Cells

The lens is a vital organ made up of an intricate grouping of polarized epithelial cells. These cells act as a single unit allowing rapid ion flow through gap junctions. Epithelial sodium channel (ENaC) is a transporter responsible for maintaining hydration through osmosis. The osmotic balance within the lens has been found to be directly related to its level of transparency. The hypothesis is that vision loss in individuals with cystic fibrosis can be attributed to Cystic Fibrosis conductance trans-membrane regulator (CFTR), a chloride channel, not being expressed in the lens in addition to ENaC. Cystic Fibrosis is an inherited disease caused by the loss of the CFTR gene. Experiments were carried out in using chambers to measure ion transport through control epithelial kidney cells. Cells were placed into the chamber with serum free media to reach equilibrium. Insulin was injected into the serosal side of the apparatus to activate ENaC. To test for the presence of ENaC, amiloride, a channel-specific inhibitor was introduced to the apical side of the set-up. We will be applying this technique to human lens epithelial cells to study ENaC more in-depth, attaining a greater understanding of this channel's full capabilities within the eye.

Jannah Bacchus

Indiana University, Purdue University of Indianapolis: Junior, Biology
Mentor: Dr. Martin Bard, Department of Biology, Genetics

Selection for Ergosterol Biosynthetic Mutants in Sterol Esterification Mutant Background in Yeast

The functionality of cholesterol in humans is very similar to that of ergosterol to Saccharomyces cerevisiae. This study deals with the biosynthetic pathway that leads to ergo sterol formation. Genes ARE1 and ARE2 are wild type for encoding proteins that esterify sterols in the biosynthetic pathway to ergo sterol. In this study strain SCY308 containing genes are1are2/ARE2-Ura3 was used to determine whether sterol esterification would take place in certain conditions. The first condition, mutagenesis, manipulated the strain via ultraviolet radiation. Mutagenesis added mutant erg6, erg2, erg3, erg4, or erg5 to the strain. These mutant gene additions did not allow for the formation of ergo sterol, but did allow for other sterol formations in the biosynthetic pathway. Another condition was media. Nystatin is an anti-fungal drug, which was added to the growth media in set concentrations. If the are1are2/ARE2-Ura3 grew, the mutant was resistant to Nystatin. Three mutant colonies grew: Dj1, Dj2, and Dj3. The colonies that grew were transferred to 5-Fluorootic Acid (FOA) media. I hypothesized that are1are2/ARE2-Ura3 combined with erg6, erg2, erg3, erg4, or erg5 added via mutagenesis would be viable. In order to verify results, all plated colonies underwent gas chromatography, mass spectrometry, and polymerase chain reaction.

Laty A. Cahoon, H. Steven Seifert
Northwestern University Feinberg School of Medicine: Graduate Student, Integrated Graduate Program
Mentor: Prof. Steven Siefert, Integrated Graduate Program

An alternative DNA structure is necessary for gene conversion leading to pilin antigenic variation in *Neisseria gonorrhoeae*

The strict human pathogen, *Neisseria Gonorrhoeae,* can utilize homologous recombination to generate antigenic variability in targets of immune surveillance. To avoid the host immune response, *N. gonorrhea* promotes high frequency gene conversion events between many silent pilin loci and the single expressed pilin locus, *pilE,* resulting in the production of variant pilin proteins. We have genetically defined a *cis*-acting DNA element localized near *pilE* that is required for the homologous recombination reactions leading to pilus antigenic and phase variation without affecting palliation. This sequence forms a guanine quartet (G4) structure *in vitro,* and mutations within this sequence that block antigenic variation (Av) alter the structure. Growth of *N. gonorrhea* in the presence of a compound that specifically interacts with and stabilizes G4 structures inhibits pilus phase and Av, showing that the structure and not just the sequence is required to allow recombination. The location, composition, and orientation of the G4 upstream of *pilE* is specific and essential for its activity in pilin Av. We predict that the *pilE*-linked G4 structure acts to initiate recombination and direct the processes that mediate gene conversion exclusively at *pilE*.

Sean Campbell, A. Cissell and Sapna K. Deo
Indiana University, Purdue University Indianapolis: Junior, Chemistry
Mentor: Sapna K. Deo, Department of Chemistry and Chemical Biology

Nucleic Acid Detection based on Bioluminescence Resonance Energy Transfer Between Renilla Luciferase and Quantum Dots

The detection of nucleic acids is of paramount importance in medical diagnostics, microbial identification, drug discovery, disease path physiology, genetic analysis, and forensic chemistry. A hybridization-based method for the detection of nucleic acid through bioluminescence resonance energy transfer (BRET) involving *Renilla* Luciferase (Rluc) as the internal energy source and quantum dot (QD) as the BRET acceptor has been developed. The Rluc and QD must be in close proximity in order for BRET to occur. This was accomplished through the conjugation of complementary oligonucleotide probes to the Rluc and QD through cross-linkers. The Rluc and QD hybridized once they were mixed together. When coelenterazine, the substrate for Rluc, was added it was oxidized by luciferase, which resulted in the formation of coelenteramide and irradiation of light, which in turn excited the QD. The QD emission was then measured. With coincident addition of target nucleic acid, Rluc-labeled probe and QD-labeled probe, the target and the Rluc-labeled probe competed to hybridize with the QD-labeled probe and resulted in a quenching of the QD emission. The quenching of QD luminescence emission was used in the detection of target nucleic acid as low as 4 pmoles in solution.

Michael X. Cui
Indiana University, Bloomington: Sophomore, Biology
Mentor: Dr. Viola Ellison, Department of Molecular Biology & Genetics

Elucidating the Role of RFC in Maneuvering of DNA Onto the Center of PCNA

Efficient DNA replication is achieved through the use of a sliding clamp that stabilizes the interaction between the DNA polymerase and the DNA. The sliding clamp in eukaryotes is identified as a ring shaped protein called PCNA (Proliferating Cell Nuclear Antigen) that is loaded onto the DNA via a protein called replication factor C (RFC). My project focuses on elucidating the mechanism by which RFC assembles onto chromosomes PCNA, which is an essential component of many DNA-metabolizing machineries. Prior to obtaining data a dye coupling technique was being developed that would not only increase the efficiency of subsequent experiments, but would enable researchers to quantify the amount of PCNA loaded. This new technique would involve covalently linking a small fluorescent dye to the PCNA. The dye was successfully linked to PCNA, and the dye linked PCNA could be quantized. However, a clamp-loading assay suggested that the dye-linked protein no longer has normal PCNA function. This problem could be the result of excess dye in solution interacting with PCNA. Upon resolution of this problem, future clamp loading assay experiments will be done with different RFC mutant proteins and the dye linked PCNA.

Oscar M. Curet, Ibrahim K. AlAlil, Malcolm A. MacIver, Neelesh A. Patankar
Northwestern University: Senior, Graduate Student, Mechanical Engineering
Mentors: Malcolm A. MacIver and Neelesh A. Patankar, Department of Mechanical Engineering

Fully resolved simulation of self-propulsion of aquatic organisms

We present a computational approach for fully resolved simulation of self-propulsion of organisms through a fluid. Our implicit algorithm solves for the translational and rotational motion of the organism for prescribed deformation kinematics. In addition, the solution for the surrounding flow field is also obtained. The approach is easy to apply to the body forms of a variety of organisms. Our final goal is to use this computational tool to help in understanding the mechanisms of movement and its control in aquatic animals. In this abstract we present validation of this method for different organisms. To validate the method with respect to analytical solutions, we consider two cases: 1) a flagellum which propagates plane waves, and 2) a flagellum that propagates helical waves. To validate the method with respect to empirical measurements we consider data from two organisms: 1) jellyfish (data from John Dabiri at Caltech), and 2) zebrafish (data from Melina Hale at The University of Chicago). We also present the primary flow features of in the swimming of the highly maneuverable weakly electric black ghost knifefish.

Zaq Fisher
Indiana University, Purdue University Indianapolis: Sophomore, Chemistry B.A.
Mentor: Dr. Keith Dunker, Director of Computational Biology & Bioinformatics

Protein Devolution: Site-Directed Mutagenesis of Dephosphocoenzyme A kinase

The particular sequence and combination of a chain of amino acids determine a protein's function, structure, and chemical properties. Most proteins naturally fold into unique tertiary structures but those that do not and are known as intrinsically-disordered proteins. These proteins tend to share similar attributes with one another such as less aromatic amino acids in their sequences and heightened structural flexibility. The protein Dephosphocoenzyme A kinase is an enzyme responsible for the biosynthesis of Coenzyme A. It contains several aromatic amino acids and shares other properties of an intrinsically-ordered specimen. The plasmid for this protein was extracted from the bacterium Thermatoga Maritima to address the question whether or not Dephosphocoenzyme A kinase could be regressed to a disordered state upon the removal of a combination of aromatic amino acids within 7 Angstroms of its active site. The hypothesis proposed that if Dephosphocoenzyme A kinase were to undergo site-directed mutagenesis to replace the genetic expression of its aromatic amino acids with Alanine, then the mutated protein would exhibit the behaviors of an intrinsically-disordered specimen. Enzyme assays would then be used to determine decreased levels of enzymatic activity and the technique of circular dichroism would characterize the anticipated lack of tertiary structure.

Shanti F. Frausto, Koichi Ito, William Marszalec and Geoffrey T. Swanson
Northwestern University: PhD Candidate (4th year), Interdepartmental Neuroscience Program (NUIN)
Mentor: Geoffrey T. Swanson, PhD, Department of Molecular Pharmacology & Biological Chemistry

Low-frequency, mGluR1 dependent induction of mossy fiber long-term potentiation

Synaptic plasticity is thought to contribute to the processes of learning and memory. Long-term potentiation (LTP), a type of synaptic plasticity is a widely used cellular model for learning and memory. Mossy fiber-CA3 LTP is classically evoked by high frequency tetanic stimulations of 25-100 Hz, which are predominantly above known natural firing frequencies of granule cells in the hippocampus. In contrast, we demonstrate in this study that patterned low-frequency (1-2 Hz) stimulation potentiates mossy fiber EPSCs for up to 30 minutes following induction. Here we set out to characterize the induction parameters that produce LTP at this synapse following low-frequency stimulation and also began to explore the mechanisms that underlie this form of plasticity. We found that low-frequency (1 Hz) paired pulse stimuli produced a ~150% mean increase in mossy fiber EPSC amplitudes in whole cell recordings from CA3 pyramidal cells in acute mouse brain slices. We tested potential roles for R-type voltage-dependent calcium channels (VDCCs), kainate receptors (KARs), and metabotropic glutamate receptors (mGluRs) in this form of LTP. Our results indicate that R-Type VDCCs and KARs do not mediate the induction of low-frequency mossy fiber LTP. This form of LTP was reduced by the mGluR1 antagonist JNJ16259685, but not the mGluR5 antagonist MPEP.

Bryan Gaynor, Charles C. Tseng
University of Purdue Calumet: Senior, Biology
Mentor: Charles C. Tseng, Ph.D.

Using Multiplex PCR to Distinguish Between Pathogenic and Non-Pathogenic *E. coli*

The purpose of this research is to distinguish between different strains of pathogenic and nonpathogenic *E. coli*. This common intestinal bacterium is widely used as an indicator of fecal contamination in water and food. Most *E. coli* strains are nonpathogenic, but the pathogenic strains such as *E. coli O157* are deadly. The DNA typing method to be developed in this study will be important for public health and environmental agencies in distinguishing between pathogenic and nonpathogenic *E. coli*. Furthermore, it may be possible to identify biomarkers for determining the source of bacterial contamination. In this study, restriction enzymes and electrophoresis will be used to cleave *E. coli* DNA into fragments to create genomic libraries of different strains. The fragments will be sequenced and primer sets will be designed to amplify the DNA fragments using a technique called polymerase chain reaction (PCR). Numerous primer sets will be used for determining the biomarkers for different pathogenic and non-pathogenic bacteria from different host species including human, goose, and cow. If the primer sets are proven to be useful in distinguishing pathogenic from nonpathogenic *E. coli*, they will be combined to form a group of primers for multiplex PCR so that multiple *E. coli* strain markers can be generated for source tracking.

Francisco Iacobelli, Kris Hammond, Larry Birnbaum
Northwestern University: 4th Year Graduate Student, Computer Science
Mentor: Larry Birnbaum, Department of Computer Science

MakeMyPage, Social Media and Automatic Aggregation

Learning about a topic online is time consuming. It involves visiting multiple news sites, encyclopedia entries, videos and other resources while discarding irrelevant information. MakeMyPage (MMP) speeds this process by combining automatic aggregation of information and social media to build web pages with images, videos and links to important information about a topic. Automatic aggregation provides the initial content of the web pages. This content is organized by type: blogs, news, web links, images, video and a main article. MMP creates a front page about the topic by selecting a few items from each category. Each category, in turn, provides links to more resources within it. Users can vote on the links and media they like best for a given topic and, based on these votes, the system decides what information to display on the front page. By combining automatic aggregation and voting, the front page becomes an accurate source of information in a short time. This system is a work in progress, and future work consists of a user study to determine usability and accuracy of the content, accuracy of the aggregation and search optimization algorithms, and the effects that voting has over the relevance of the content.

Mariah Veit Judd, Maria Mercedes Levy and Morris Levy
Purdue University/West Lafayette: 5th year PhD Student, Biological Sciences
Mentor: Morris Levy, Biological Sciences

Molecular evolution of the fungal avirulence gene *Avr-pita* in the rice blast fungus

Rice blast fungus, *Pyricularia Oryzae*, is the most important pathogen of cultivated rice worldwide. Infection depends on the fungus having avirulent (non-infecting) genotypes that don't elicit defensive responses from matching resistance genes in rice. Understanding how avirulence genes evolve is one key for developing durable resistance breeding strategies. Fungal isolates are sorted into clonal lineages with DNA fingerprinting and then *Avr-Pita* variation is characterized by RFLP and sequence analysis. The objective is to determine the relative frequency of mutational mechanisms displayed at *Avr-Pita*. Sequence data from Colombian isolates reveals that the coding region is strongly conserved among both avirulent and virulent (infecting) alleles, the latter frequently associated with specific changes at positions 174 and/or 207 in the 223-224 amino acid sequence of the inferred protein. Remarkably, among isolates of the widespread Colombian lineage, SRL-6, we find: 1) an allele identical to the Chinese isolate from which *Avr-Pita* was originally cloned, 2) a pseudo allele caused by a frame shift mutation and, 3) loss of the locus entirely. Collectively, we find all mechanisms of mutation in Colombia. But, contrary to lab mutation studies, the evolutionary balance in nature favors virulence shifts due to gene modification and duplication rather than gene loss or disruption.

RoJenia N. Judkins, Phil A.Kovac, Dr. Patricia L. Lang, Dr. Gary Dodson
Ball State University: 2nd year Graduate Student, Chemistry
Mentor: Dr. Patricia L. Lang, Dept. of Chemistry

Extraction of Potential Chemical Attractants from the Black-eyed Susan

We aim to identify the volatile compounds in inflorescences of *Rudbeckia Hirta* that may be responsible for the olfactory attraction of the crab spider *Misumenoides Formosipes* to this plant. For copulation *M. Formosipes* adult males search their vegetatively complex habitat for the foraging locations of sub-adult females. Females commonly forage from the inflorescences of *R. Hirta,* and previous research demonstrated that males in the field will move towards these flowers, but only when olfactory cues are available. Therefore, our research aims to reveal the possible chemical attractant(s). In y-tube bioassays 84% of 19 male spiders moved towards the olfactory-only cues from *R. Hirta* inflorescences over a water control. Our overall approach is to use ultrasonic extraction method, separate the extract into like components using flash chromatography, and test the attraction of the male spiders to the pooled like fractions using the y-tube olfactometer bioassay. Ultrasonic extraction is carried out using a solvent mixture of 1:2 hexane/diethyl ether with 10g of inflorescences for 30 minutes. Preliminary bioassay results indicate that male spiders choose the bulk ultrasonic extract over a control of the hexane/diethyl ether solvent mixture. We will report on the results of the bioassay behavior using pooled fractions as possible attractants.

Heather B. Leavesley, Soma Mukhopadhyay, Lu Zhang, Li, Li, Xun Zhang, Joseph L. Borowitz, Gary E. Isom
Purdue University, West Lafayette: Doctoral Graduate Student
Mentor: Dr. Gary E. Isom, Department of Medicinal Chemistry and Molecular Pharmacology

The Mechanism for Cyanide-Mediated Elevation of Mitochondrial NO

Cyanide is a fast-acting neurotoxicant that targets brain mitochondria. Cyanide causes rapid toxicity by inhibiting cytochrome c oxidase (CcOX), the terminal oxidase of the mitochondrial respiratory chain. Intracellular nitric oxide (NO), which also binds to CcOX, aids in cyanide inhibition. In the present study, we examined the mechanism by which cyanide increases mitochondrial NO (NO_{mt}) in N27 rat brain neurons. NO is produced by cytosolic and mitochondrial nitric oxide syntheses (cytNOS, mtNOS), which rely on intracellular Ca^{2+}. Cyanide is known to increase cytosolic Ca^{2+} (Ca^{2+}_{cyt}). Thus, we hypothesized that cyanide increases NO_{mt} by increasing Ca^{2+}_{cyt}. To examine the hypothesis, we compared cyanide-mediated changes in intracellular Ca^{2+} and NO using cell-permeable fluorescent probes. We found that the cyanide-mediated increase in NO_{mt} was directly correlated to changes in $Ca^{2+}_{cyt,}$ not mitochondrial Ca^{2+}. Therefore, the source of elevated NO_{mt} appears to be cytNOS, not mtNOS. Future studies involve decreasing the expression of cytNOS to confirm the source of NO. The results of this study will have important implications for the treatment of acute cyanide toxicity.

Zamir Libohova Student, Phillip Owens, Philip Schoeneberger, B.D. Lee and Laura C. Bowling
Purdue University, West Lafayette: Graduate Student 2008, Hydropedology
Mentor: Dr. Phillip Owens, Assistant Professor, Department of Agronomy

Measured Versus Estimated Saturated Hydraulic Conductivity for Some Indiana Soils Using Pedotransfer Functions Derived from Micro morphology

The development of Hydropedology depends on the success of translating the qualitative soil information to quantitative values. Some of the physical soil properties like pore-size distribution, soil structure and texture, are categorical and difficult to relate to K_{sat}. The objectives of this research were to (i) estimate K_{sat} based on pore-size distribution derived from thin-sections and pedotransfer functions, and (ii) establish relationships between field-measured and estimated K_{sat} values. Thirty nine thin-sections were selected. Pores and solids were classified using image analysis software. Pores were classified based on their size and shape. K_{sat} for the soils represented by thin sections were measured in the field using Amoozemeter and also estimated using pedotransfer functions. Regression analyses were used to relate pore categories with measured and estimated K_{sat} values. The measured K_{sat} values varied from 0.3-0.6 cm hr^{-1}, while the estimated K_{sat} based on pedotransfer functions varied by an order of magnitude between 0.036 and 0.36 cm hr^{-1}. Measured and estimated K_{sat} were related (R^2=0.3; $p<0.01$). Estimated K_{sat} using thin-sections is important in understanding the controls at a micro scale, and its applications can be useful if combined with other soil information at coarser pedon and watershed scales.

Eric Mauser, Brian Hamilton
Indiana University, Bloomington: Junior, Biotechnology
Mentor: Dr. Tom Tolbert, Department of Chemistry

Cloning and expression of an N-terminal cysteine containing glycosylated interleukin-1 receptor antagonist (IL-1ra)

Interleukin-1 receptor antagonist (IL-1ra) is a protein that counteracts the acute pro-inflammatory action of Interleukin-1 by binding to the IL-1 receptor, thereby blocking IL-1 binding and transduction of the signal. Previous reports of expression of IL-1ra in mammalian and yeast systems reveal that 70% of the total IL-1ra production is glycosylated. Recent research has shown that glycosylation of other therapeutic proteins has led to altered functional activity and increased half-life. The majority of previous research has focused only on the non-glycosylated form of the protein to optimize the therapeutic. Glycosylation of IL-1ra may offer enhanced biological effects or increased stability and therefore must be examined to potentially enhance this therapeutic. The gene encoding for a N-terminal cysteine containing IL-1ra was cloned into the *Pichia pastoris* yeast vector pPICzαA and transformed into the *och1::URA5* mutant of *P. Pastoris* strain SMD1168. A His tag and TEV protease cleavage site was added to the N-terminus to allow for a simplified purification of IL-1ra. In addition a N-terminal cysteine was added to IL-1ra to allow chemical modifications such as fluorescent groups to be added site-selectively to facilitate biochemical studies. Once obtained, the N-terminal cysteine containing IL-1ra will be utilized in biochemical and biophysical studies of the function and stability of IL-1ra.

Sarah Parrish
Purdue University, Calumet: Senior, Biotechnology
Mentor: Dr. Radmilla Sarac, Professor of Biological Sciences

Mutational Analysis of Kir2.1 N-and C-Termini Residue Interactions and Their Role in Channel Function

Using mutational analysis we study how the C and N termini of the ion channel Kir2.1 (Gβγ-independent inward rectifier) interact with one another. We used potassium Kir2.1 and GIRK (G-protein coupled inwardly rectifying K+) channels, and it is thought that the GIRK channels have a prerequisite for activation. The assembling of the Gβγ protein complex in the GIRK channels has been found to associate with the cell membrane and activate the channels. It is thought the reduced channel activation when a wild GIRK channel is mutated is caused by interference from the Gβγ binding interaction. The Kir2.1NT-myc-pcDNA3.1Zeo+ vector, Kir2.1, was subcloned into the pcDNA3.1Zeo+ vector prior to the start of this study to be used for mammalian expression for N terminus analysis of mutants F47L and F47R. For the C terminal mutation, a separate primer was used to make a construct in which the point mutation L330F was inserted into the YFP-CTKir2.1-pEFYP vector. The transfection process into COS-7 mammalian cells was performed as well as the screening for the constructs via Western Blot and Co-Immunoprecipitation. These tests will determine whether the mutants' function has been affected and how this change affects the channel and interactions of the N and C termini.

Ashley Perkins
Indiana University, Bloomington: Junior, Biology
Mentor: Professor Diane Henshel, Department of SPEA

Histology Project

Diabetes can gradually deteriorate the kidneys by damaging the small blood vessels in the kidneys, causing high blood pressure and other glomerular diseases. My research involved determining the microscopic differences between kidney tissues from diabetic and normal rats, as well as diabetic rats treated with red light. Diabetic induced rats were used and treated with light therapy. Near –infrared (NIR) light treatment was used because it helps accelerate cells and tissue repair *in vivo* (Desmet *et al.* 2006). I took pictures of the kidney tissue samples to produce larger images of the glomeruli to see if any glomerular diseases such as glomerulonephritis and glomerulosclerosis were present. It was determined that there were a few differences in some of the pictures taken of the glomeruli of diabetic and diabetic tissues treated with red light. The next step is to measure the length and width of some of the glomeruli for comparison to see if there are significant differences between diabetic and normal kidney tissues as well as diabetic tissues treated with red light.

Juan F. Reyes[1], Yifan Fu[1], Changiz Geula[2] and Lester I Binder[1,2]
Feinberg School of Medicine, Northwestern University: 3rd Year Graduate Student
Thesis Advisor: Dr. Lester I. Binder.

Tau Susceptibility to Nitration and Phosphorylation at Tyrosine 197: Implications for Alzheimer's Disease and Other Tauopathies

Alzheimer's disease (AD) and other non-AD tauopathies are a clinically diverse group of neurological disorders characterized pathologically by the formation of unique morphological structures composed of aggregated tau in affected areas. Different post-translational modifications have been identified that accelerate tau aggregation. Nitrative modifications however, are less well studied. Of the five tyrosine residues present within the tau molecule, nitration selectively occurs at tyrosine residues within the most N-terminal end of the molecule, occurring first at tyrosine 18 and 29 and to a lesser extent at tyrosine 197. Previously, we characterized two monoclonal antibodies specific for nitrated tau at tyrosine 18 and tyrosine 29. These probes identified different cell types susceptible to nitrative modifications at specific tyrosine residues in AD and other non-AD tauopathies. To determine whether nitration occurs at tyrosine 197 in AD pathogenesis, we generated two monoclonal antibodies specific for nitrated tau and unphosphorylated tau at tyrosine 197. Similar to tyrosine 18, Tau-nY197 selectively labels tau within activated astrocytes. Unlike tyrosine 18, however, Tau-nY197 robustly labels reactive astrocytes not associated with amyloidal plaques. In contrast, Tau-Y197 selectively labels the hallmark pathological lesions of AD and other non-AD tauopathies. These data suggest that tyrosine 197 is a potential site for phosphorylation and/or nitration in different cell types, a modification likely induced as a result of inflammation and/or astrocyte activation.

Mayté Ruiz
Indiana University, Bloomington: Graduate Student, Biology
Advisors: Dr. Emilia P. Martins, Biology; Dr. Greg E. Demas, Biology

Experimentally elevated testosterone suppresses immunity in food-limited sagebrush lizards

Testosterone has been shown to increase reproduction and decrease immunity in many cases. Yet, although reproductive investment decreases immune function, supplemental feedings can eliminate this effect. In this study, we considered the effect of food availability and testosterone on immune function and reproductive behavior in sagebrush lizards to assess how testosterone and energy availability affect this trade-off. We experimentally manipulated diet and testosterone of males in a natural population. We determined immune response by calculating the bacterial killing capability of collected plasma exposed to E. coli ex vivo. We measured reproductive behavior by counting the number of courtship displays produced in a 20-minute sampling period. Immune function increased with supplemental feedings, a finding that was most pronounced in lizards with increased testosterone. Furthermore, testosterone increased immunity in lizards with additional food resources but not in food-control lizards. Testosterone also exhibited a trend towards increasing courtship displays, an effect that was noted only in lizards on a restricted diet. Thus, we observe an interactive effect of food availability and testosterone. Collectively, this study shows that the energetic state of the animal plays a critical role in modulating the interactions among testosterone, behavior and immunity in sagebrush lizards and likely other species.

Lori Simmons-Stalter, Deborah Johnson, and Michael C. Henson
Purdue University, Calumet: Biology
Mentor: Dr. Michael C. Henson, Department of Biology

Assessment of Leptin Messenger RNA (mRNA) Expression in Human Placenta Using Quantitative Real-Time Polymerase Chain Reaction (PCR)

Leptin, a hormone produced by adipose tissue and the placenta, is commonly associated with the regulation of human satiety and metabolism. However, recent discoveries have determined that leptin also plays a role in reproduction, with results from our laboratory suggesting regulatory roles in fetal growth and lung maturation in primate pregnancy. The objective of the current study was to validate the use of quantitative real-time polymerase chain reaction (qPCR) for the measurement of leptin messenger RNA (mRNA) expression in human placental villous tissue. PCR involves the amplification of nucleic acids via thermal cycling and fluorescent chemistry to quantify amplified products. Real-time PCR measured the detected products and produced a standardized curve for evaluation. This eliminated the need for gel electrophoresis, a step necessary in conventional PCR. Elimination of this step allowed for a reduction in experiment time and a decrease in potential contamination. Gene expression was compared to our endogenous control, TATA box (cis-regulatory element found in most genes) binding protein (TBP), and was reported as fold-changes between samples. We anticipate that this methodology will result in quantitative repeatability over that of older techniques and will lend itself to our studies of leptin transcriptional regulation in human and primate pregnancy.

Jerrah E. Jackson
Indiana University, Bloomington: Senior, Biology
Mentor: Dr. Demas Professor, Biology Department, and Melissa-Ann L. Scotti Graduate Student

Pheromones and Seasonal Aggression in Male Siberian Hamsters

Some seasonally breeding animals exhibit *higher* levels of aggression during the non-breeding season when testosterone levels are relatively low. An example of such a species is the Siberian hamster (*Phodopus sungorus*). The overall goal of my studies has been to examine alternate hormonal regulation seasonal aggression in Siberian hamsters. Previously I investigated the role of the adrenal steroids as potential mediators of aggression. Short-day hamsters were more aggressive than long-day animals; however, cortisol treatment reduced aggression in short- but not long-day hamsters. More recently, I have investigated the role of pheromones in seasonal aggression. Hamsters were individually housed in either long or short days for 8 weeks. Trials were composed of: sampling both urine and ventral gland secretions and collecting blood samples from hamsters both before and after aggression trials were run. Samples were processed for pheromones using gas chromatography mass spectrometry. As with the previous experiment, short-day animals were more aggressive than long-day animals. In addition, there were significant changes in specific chemical compounds in response to both photoperiod and aggression. Analyses are currently underway to further quantify and characterize the specific nature of these compounds. Collectively, these findings provide support for alternate forms of endocrine regulation of aggression.

Fourth Annual Joint Research Conference
Indiana *LSAMP* and Midwest Crossroads *AGEP*

Student Presentation Listing

POSTER PRESENTATIONS

Adetayo Adesanya
Purdue University
Electrical and Computer Engineering

Laurent Ahiablame
Purdue University
Agriculture & Biological Engineering

Shalamar Armstrong
Purdue University
Agronomy

Jannah Bacchus
Indiana University/Purdue University
Biology (Genetics)

Aurelio Bedolla
Purdue University/Calumet

Gozel Berkeliyeva
Ball State University
Chemistry

Eric Bird
Purdue University/Calumet
Ecology

Joseph Blockland
Indiana University/Northwest
Geology

Tafor Bonu
Indiana University/Bloomington

Sean Campbell
Indiana University/Purdue University
Chemistry

Heather Carter
Ball State University
Chemistry

Natasha Crosby
Indiana University
Biology

Artemio Del Real
Indiana University/Northwest
Chemistry

Raymond Detweiler
Ball State University
Chemistry

Dominique Edwards
Purdue University/North Central
Chemistry

Laurie Elmore
Ball State University
Dietetics, Chemistry

Branly Eugene
Purdue University
Environmental Soil Chemistry

Rachel Ford
Ball State University
Chemistry

Carlos Garza
Purdue University/North Central
Biology

Crystal Hansel
Ball State University
Chemistry

Fourth Annual Joint Research Conference
Indiana *LSAMP* and Midwest Crossroads *AGEP*

Student Presentation Listing

POSTER PRESENTATIONS

Genesse Jenkins
Purdue University
Chemical Engineering

Jose Juncosa
Purdue University
Medicinal Chemistry and Molecular

Camille Kite
Ball State University
Chemistry

Philip Kovac
Ball State University
Chemistry

Megan McGlothin
Purdue University/North Central
Biology

Blucher Menelas
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Agronomy

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Chemistry

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Svetiana Pekovic
Ball State University
Biochemistry

Breanna Ricketts
Ball State University
Chemistry

Darren Robinson
Purdue University
OLS, IT

Monica Rodriguez
Purdue University
Mechanical Engineering

Yolanda Ruiz
Purdue University/Calumet

Irma Ruvalcaba
Ball State University
Biology

Robert Sharon
Ball State University
Chemistry

Kelley Wilson
Indiana University/Purdue University
Biology

Chun Zhao
Purdue University
Soil Chemistry and Fertility

Kelli Zimmerman
Ball State University
Biology/Premedical

L. M. Ahiablame, I. Chaubey
Purdue University: Graduate Student, Agricultural and Biological Engineering
Mentor: Dr. I. Chaubey, Department of Agricultural and Biological Engineering

Comparison of Phosphorus Retention Capacity between Flood Plain Sediments and Streambed Sediments in an Agricultural Drainage Ditch

Even though a substantial number of studies have discussed the role of various biotic and a biotic processes in mediating the movement and dynamics of nutrients in stream environments, little consideration has been given to stream geometry and its role in nutrient removal. The objectives of this study were to determine if a statistically significant difference exists in: (1) equilibrium phosphorus concentration (EPC) between flood plain sediments and streambed sediments; (2) P sorption index (PSI) between flood plain sediments and streambed sediments. Ditch bed sediments and flood plain sediments were collected simultaneously at three specific locations and extracted from May to July 2008. Extracted aliquots were analyzed for EPC and PSI. Results showed that sediments were not in equilibrium with water column P but act as source or sink at all locations in both types of sediments. The next step is to assess differences in P sorption ability between the two groups of sediments.

Shalamar Armstrong, D. Smith, B. Joern, P. Owens, and C. Huang
Purdue University: Ph.D. Candidate, Agronomy
Mentors: Phillip Owens and Douglas Smith, Agronomy Department

Chemical Treatment to Reduce P Desorption From Manure Exposed Fluvial Sediments

After the occurrence of a manure spill, phosphorus (P) enriched bed sediments act as a major source of P to the water column, which leads to further impairment of the fluvial system. Therefore, the objectives of this study were to determine the impact of a manure spill on the P accumulation of fluvial sediments and to evaluate the effectiveness of chemically treating manure exposed sediments. Swine manure spills were simulated in three flumes packed with ditch sediments for 23 hours. Following the manure spills, four flumes were used with the following treatments: (1) no manure and no treatment; (2) manure spill without treating sediment; (3) manure spill followed by 1:1 molar ratio (Al:P) application of aluminum sulfate (alum); and (4) manure spill followed by 2:1 molar ratio (Al:P) application of alum. Maximum P desorption concentrations of untreated clayey and sandy sediments were 0.09 and 0.23 mg P L^{-1} within the 24 hour desorption period, respectively. However, treating sediments with a 2:1 application rate of alum and $CaCO_3$ reduced P desorption to soluble P concentrations near background concentrations recorded before the spill occurred. This study suggests that sediment treatment following a manure spill could reduce P desorption from highly enriched sediments.

Aurelio Bedolla
Purdue University, Calumet: Senior, Management
Edward Furticella, Management

The Truth about Corporate Financial Statements: What "Lies" Behind the Numbers?

This research will focus on companies that have misrepresented their performance by issuing fraudulent financial reports. These reports are to provide the various users with information that will improve decision-making. Many companies have issued financial statements that accurately reflect value and performance; unfortunately, the reality is that some companies have also misrepresented their performance through the issuance of financial statements based on unethical behaviors and the use of fraudulent accounting techniques. The question raised is: "Can financial statements be relied on to tell the story of business value and opportunity?" The claim to be made is that "lies" exist because behaviors and techniques have been developed to manipulate the data. Because these "lies" exist, procedures must be developed that improve financial disclosure and reduce the risk of financial misrepresentation. The research will demonstrate that in cases where "lies" have been told, the moral and economic fallout has been significant. Data is gathered from previously released reports and sources.

Gozel Berkeliyeva, James S. Poole
Ball State University: Junior, Chemistry/Pre-Medicine
Mentor Dr. James Poole, Department of Chemistry

Encapsulation of an Aryl Azide in a Hemicarcerand

Low temperature photolysis of aryl azides in inert matrices generally result in the formation of triplet nitrene, as well as ketenimine products formed by sequential nitrene cyclization and ring expansion steps. Previous studies have demonstrated that in the case of 3-azidopyridine 1-oxide, a benzazirine product generated from cyclization may also be observed. The room temperature photochemistry of this azide cannot be readily characterized by standard techniques such as laser flash photolysis or product analysis. Encapsulation of the starting azide in a relatively non-reactive hemicarcerand isolates the formed intermediates, which may be characterized by low temperature IR and NMR experiments. This in turn should provide insight into the photochemistry of the azide in solution at room temperature. This contribution describes the synthesis and characterization of the encapsulated azide.

Joseph D. Blockland
Indiana University, Northwest: Senior, Geology
Mentor: Dr. Kilibarda Professor, Department of Geosciences

Environmental Interpretation of Modern and Ancient Carbonate Rocks using the Grain Verticality Method

To date, identifying the absence or presence of large scale structures is the primary means of interpreting the origins of carbonate rocks. These structures, however, are often difficult to identify, and other more consistent means of interpretation are still being sought to prevent ambiguity. Throughout this project we have been testing the method of LeGuern and Davaud (2005) on using grain orientations to predict environments of deposition for carbonate rocks by petrographic analysis. They predict that eolianites should have a higher abundance of grains positioned near 90 degrees, while rocks deposited in a marine environment should have more grains positioned at lower angles. Our current statistics, however, suggest that their method is not so direct, and we were unable to make an accurate interpretation of environment by using this method. Thus far we have tested Bahamian carbonates from the Holocene and Pleistocene, Mississippian rocks from the Ste Genevieve Formation, and Jurassic rocks from the Sundance Formation. Our results show at best less than a 50% accuracy of prediction. There is, however, grain imbrications present throughout the samples, and we believe this to be of significance. Our next step is to test the viability of this method towards predicting marine transgressions and regressions.

Heather M. Carter
Ball State University: Senior, Chemistry
Mentor: Dr. Tykhon Zubkov, Department of Chemistry

Photocatalytic Degradation of Acetone – A Model Organic Contaminant

Photocatalysts facilitate chemical reactions when irradiated with light. If H_2O is present during the reaction, a $^{\bullet}OH$ radical can be produced. This radical can attack organic compounds. Practical applications of this photooxidative degradation of various organic compounds are in water treatment, waste treatment, and self-cleaning surfaces. Acetone is a convenient model organic compound whose photocatalytic oxidation can be used for testing novel photocatalysts. The goal of this research was to discover possible products of the photodegradation of acetone. A 24.4% aqueous solution of acetone in the presence of anatase TiO_2, a known photocatalyst, was irradiated with light of λ (wavelength) > 320 nm for various periods of time up to 92 hours. The reaction mixture was analyzed using infrared spectroscopy, ultraviolet-visible spectroscopy, and high-performance liquid chromatography. No photooxidation products were detected, contrary to our expectations. This is attributed to the insufficient power of the ultraviolet lamp used in the study. An alternative approach will involve producing $^{\bullet}OH$ radicals by (Photo-)Fenton reactions to initiate acetone degradation.

Candice Colome

Purdue University, Calumet: Senior-Chemistry Major
Mentor: Dr. Liberty Pelter

Ionic Solvents

The purpose of this project was to develop an efficient and reproducible method for using ionic solvents in organic reactions. The significance of this project is that it has the potential to aid in the world's new goal of reducing our "carbon footprints," or the impact of humans on the amount of carbon emitted into the atmosphere. With the threat of global warming looming, it has become increasingly more essential for the world to find some answers to our problem. The long-term effects of this project, if successful are to reduce pollution and possibly slow the effects of global warming. All reactions are run under the fume hoods and proper safety equipment is worn at all times, including but not limited to, proper attire and shoes, safety goggles, and gloves. Reactions were run several times in order to show reproducibility. As this is a continuing project, it is still in preliminary stages. Several reactions have been run, but unfortunately there has been some difficulty in separating the ionic solvents from the product. New methods are being developed in order to attempt to correct this problem. In particular, I am currently looking into a concept called carbon polymerization.

Natasha M. Crosby

Indiana University: Graduate Student, Biology
Mentor: Dr. David L. Daleke, Department of Medical Sciences

The Mechanism of Hyperglycemia-Induced Erythrocyte Phospholipid Rearrangement

Hyperglycemia has been implicated as the cause of diabetic vascular complications. In the erythrocyte membrane, hyperglycemia induces externalization of phosphatidlyserine (PS), which promotes cell adhesion and triggers blood clotting factors. Hyperglycemia also accelerates the rate of transbilayer phospholipid movement (flip-flop) across the erythrocyte membrane. The mechanism by which hyperglycemia causes the loss of phospholipid asymmetry and increased rate of lipid flip-flop is unknown, but may be due to oxidative stress. The goal of this research is to determine how hyperglycemia causes these effects and if the effects are permanent or transient. Treatment of isolated non-diabetic human erythrocytes with hyperglycemic concentrations of glucose resulted in externalization of PS as measured by annexin V binding. An increase in flip-flop was also demonstrated and could be suppressed by the use of the antioxidants ascorbic acid and alpha-tocopherol. Erythrocytes isolated from diabetic rats (induced by streptozotocin injection) also exhibited an increase in annexin V binding and an increase in flip-flop, which could be prevented by antioxidant administration. Taken together, these data suggest that the effects of hyperglycemia on membrane structure are transient, provide support that hyperglycemia affects erythrocyte membranes through oxidative stress and suggests a possible therapeutic approach for the treatment of diabetic patients.

Raymond Detweiler
Ball State University: Junior, Chemistry
Mentor: Dr. Tykhon Zubkov, Department of Chemistry

Synthesis Of Composite TiO_2/CeO_2 Photocatalysts

Semiconductors can act as photocatalysts when irradiated with light of sufficiently high energy. Electrons and holes produced in the process may transfer onto molecules adsorbed on the surface of the material and initiate reactions. Environmental applications of this phenomenon include degradation of toxic chemicals, air and water purification, and bactericidal coatings. The goal is to synthesize materials composed of two different semiconductors, TiO_2 and CeO_2. In the composite, photoproduced electrons and holes are expected to be spatially separated, thus preventing recombination and making the photochemistry more efficient. CeO_2 was deposited onto the rutile and anatase modifications ofTiO_2 by precipitation from a Ce(IV) compound. The products were then centrifuged, washed and calcined. Transmission electron microscopy was used to image the oxide particles, and ultraviolet-visible spectroscopy was used to probe their optical properties. Photocatalytic activity of these composite materials will be tested by photooxidation of acetone under UV or visible light.

Helsel, N., Dudley A., Higgins, B.
Purdue University, North Central: Sophomore, Chemistry
Mentor: Dr. Sharron K. Jenkins, Department of Biology/Chemistry

The Quality of Oil Extracted from Fast Food French Fries

Although many fast food restaurants claim to deep fry in vegetable oil to increase food quality, studies have shown that improper monitoring of oil-discard times, repeated oil use, and other manageable factors compromise not only the quality of the oil, but also the quality of the food consumed by the public(3, 4). In order to better understand the stability and quality of oil absorbed by food during deep frying, we have studied oil extracted from French fries from several fast food restaurants: Arby's, Wendy's, Burger King, McDonald's, Culver's, Steak and Shake, Buffalo Wild Wings, Kentucky Fried Chicken (KFC), Rally's, White Castle, Dairy Queen, Long John Silver's, and Purdue University North Central (PNC). French fries were obtained from each restaurant at approximately the same time of day. Oil was extracted from the fries using ligroin (petroleum ether). The extracted oil quality was determined using chemical and physical tests such as acid value, iodine number, spectroscopic t*rans-f*at analysis, melting point, density, color, and odor. According to the preliminary data, the oil extracted from Arby's, Wendy's, and PNC fries showed much less deterioration than the oil samples from the other restaurants. This may suggest a higher standard of oil quality or frying procedures maintained by these franchises.

Artemio Del Real, Aditya Shah, Julie Peller
Indiana University, Northwest: Senior, Department of Chemistry
Mentor: Julie Peller, faculty mentor, Department of Chemistry

Sand as a substrate for TiO_2 photocatalytic transformations of organic contaminants and problematic algae

Cladophora is a naturally occurring alga that grows along the shoreline of the Great Lakes, but has become a nuisance due to recent overgrowth. High phosphorus levels in the water and/or the increase in zebra mussels in Lake Michigan have likely contributed to the overgrowth of *Cladophora*. A remediation method was investigated, where initial experimentation showed that the use of titanium dioxide (TiO_2) inhibits algal growth. TiO_2 is a photocatalyst, which when exposed to ultraviolet light from a lamp or sunlight, initiates oxidation of organic compounds. The oxidation takes place near the surface of the TiO_2 photocatalyst and, therefore, requires sufficient surface area. Since the TiO_2 slowly washed off the glass surface utilized in the initial experiments, sand is being investigated as a catalyst substrate. Titanium isopropoxide, isopropanol and diethanolamine were combined and heated. The prepared TiO_2 solution was further heated with pure silica, and then annealed at 500°C. The TiO_2 on sand has been used to oxidize three different organic compounds: methylene blue dye, caffeine and bisphenol A. In both UV light environments, the photocatalyst on sand has been effective in remediating the organic compounds. The next step is to investigate the effectiveness of the preparation with *Cladophora* and determine the practicality of its use in algal growth inhibition.

Laurie Elmore, Rachel A. Ford, Shawn Leary, Lee Moores, John Seyler, Philip R. Durham, and Jason W. Ribblett
Ball State University: Department of Chemistry

ADAPTING AND PERFECTING A CASPiE MODULE FOR BALL STATE UNIVERSITY: PHYTOCHEMICAL ANTIOIXDANTS WITH POTENTIAL HEALTH BENEFITS IN FOODS

The Center for Authentic Science Practice in Education (CASPiE) is a multi-institutional collaborative effort designed to address major barriers to providing research experiences to younger undergraduate science students. As part of CASPiE, the Department of Chemistry at Ball State University has implemented the use of the antioxidant module in the second semester general chemistry course. Although the module was successfully completed by the students last spring, many improvements were required. The focus of this project was to design and integrate these improvements to the module to make the lab experience for beginning chemistry students more productive. The primary goal was to make the testing processes more efficient and to produce more accurate results.

Branly Eugene and Brad C. Joern
Purdue University: PhD Student, Environmental Soil Chemistry
Mentor: Dr. Brad C. Joern: Professor, Department of Agronomy

Impact of Dietary Modification on Manure Total P, HCl-extractable P, and Water Soluble P from Growing Beef Cattle and Poultry Layers.

Manure-amended soils have been raising environmental concerns with excess phosphorus (P) lost to rivers causing eutrophication. Management practices aimed at reducing P loss from animal manure applications should integrate the potential impact of dietary modification on P loss to water resources. Dietary modifications can reduce manure total P concentrations, but changes in P forms present in manure have not been well-documented. The objectives of this study were to determine how dietary modifications impact manure total P (TP), water soluble P (WSP) and HCl-extractable P (HCl-P) from growing beef cattle and poultry layers as well as quantify inorganic P (Pi) and phytate P (IHP) present in the water soluble and HCl-extractable manure P fractions. Total P and total soluble P (TSP) were determined by inductively-coupled plasma atomic-emission spectroscopy (ICP-MS). Phytate P and inorganic P (Pi) in the WSP and HCl-P extracts were determined by ion chromatography (Dionex DX-600 Ion Chromatography Workstation, Dionex, Sunnyval, CA.). The results and implications of this study will be presented in this poster.

Ashley A. Everett, Shea R. Idlewine, Laura E. Janiga, Kelli L. Zimmerman
Ball State University: Senior, Biology/PreMedical
Mentor: Dr. Jason W. Ribblett, Department of Chemistry

Amending the General, Organic, and Biochemistry for the Health Sciences Laboratory Manual

Motivation for this research was to improve student comprehension and understanding during the laboratory. In previous semesters, students did not apply concepts learned from course materials to tasks completed in the laboratory when using a more traditional laboratory manual. By interspersing procedure with application questions to create an inquiry approach, students are more able to make connections between laboratory work and concepts learned in the course. Success of this approach will be determined in a series of pre- and post-laboratory course surveys of students using the laboratory manual.

Cris Hansel

Ball State University: Senior, Chemistry
Mentor: Dr. Scott Pattison, Department of Chemistry

Catalyzing the Reaction between Diphenyl-1-pyrenylphosphine and tert-butylhydroperoxide

Diphenyl-1-pyrenylphosphine (DPPP) is useful in monitoring hydro peroxides in biological systems. In past studies, the Cu^{+2} cation has been useful in catalyzing the reaction between DPPP and tert-butylhydroperoxide (t-BuOOH). The goal of our research was to examine the effects of using other metal cations to catalyze this same reaction to determine if any were better at catalysis than the Cu^{+2} cation. Some of the cations used in this study include Fe^{+2}, Fe^{+3}, Co^{+2}, Ni^{+2}, Mn^{+2}, Zn^{+2}, and Cr^{+3}. To obtain results, each cation was tested under a variety of conditions, including changing the concentrations of the cation and/or t-BuOOH, as well as examining the rate of the reaction when pyridine, an inhibitor, was added. The reactions took place inside a spectrofluorometer. We discovered when comparing the reaction rates of different cations that the rate was not dependent on Lewis acid strength as we had originally speculated. Instead, metal cations that had redox capabilities, and were in their higher oxidation states, made the best catalysts.

Martin Jaspers, Nicole Jaspers, Dominique Edwards, and Patty Campbell

Purdue University, North Central: Junior, Biology and Freshman, Biology
Mentor: Dr. Rosa E. Rivera-Hainaj, Department of Biology and Chemistry

The effect of chaya in ergosterol metabolism

Cnidiscolous chayamansa (chaya) is leafy shrub natives of Mexico, used as a dietary supplement over the centuries and identified as a potential remedy for metabolic disorders. However, there is no scientific data supporting these claims. Cholesterol is a sterol essential to cellular activity. Biosynthesis of cholesterol in higher eukaryotes uses HMG-CoA reductase, target of many anti-cholesterol medications. Other animals, such as insects, are not capable of utilizing the HMG-CoA pathway and require transformation of dietary ergosterol to cholesterol. In this study, we investigated the effects of chaya tisane on ergosterol synthesis in *S. cerevisiae* (yeast) and on cholesterol production in *T. molitor* (mealworm). *S. cerevisiae* was chosen because the pathway it uses for ergosterol synthesis is homologous to the cholesterol synthesis pathway in humans. T. molitor was chosen because it transforms other sterol molecules into cholesterol. The concentration of total cholesterol in worms and the concentration of total ergosterol in yeast were determined, using a fluorometric assay, after treatment of the samples with chaya tisane. Preliminary data suggest that chaya can lower the cholesterol concentration in worms and the ergosterol concentration in yeast. Future experiments will investigate the observed effects in more detail

Genesse R. Jenkins
Purdue University: Senior, Chemical Engineering
Mentor: Dr. Michael T. Harris, Associate Dean of Engineering

Comparing Electrophoretic Mobility Measurements of Colloids Using DELSA and PALS

The charge on nanometric and colloidal particles play an important role in biological systems, the targeted release of drugs, and food processing. The Doppler Electrophoretic Light Scattering Analyzer (DELSA) and Phase Analysis Light Scattering (PALS) were used to obtain zeta potential and electrophoretic mobility measurements of polystyrene latex particles. The results were acquired through Doppler shifting and Smoluchowski's relation, which allowed for the calculation of the zeta potential and electrophoretic mobility measurements. The results were both precise and accurate concluding that both the DELSA and PALS are reliable apparatuses to use for testing the charge on particles. Next, the charge on aniline silica particles and various other solutions will be acquired and compared to literature values with the use of the DELSA and PALS.

Jose I. Juncosa, Jr., Markus A. Lill and David E. Nichols.
Purdue University: PhD Candidate, Medicinal Chemistry and Molecular Pharmacology
Mentor: Dr. David E. Nichols, Department of Medicinal Chemistry and Molecular Pharmacology

Development of activated models of monoamine neurotransmitter receptors by *in silico* activation of the $_2$ adrenergic receptor

Virtual docking is an extremely valuable tool to study receptor-ligand interactions. It has applications that can range from novel ligand design to elucidating mechanisms of action of drugs. Although highly relevant to the design of novel treatments for several neurological disorders, performing such studies directly on monoamine neurotransmitter receptors such as those for dopamine and serotonin remains an impossible task due to the lack of three-dimensional structures for these targets. Our approach has been to use homology models of these receptors created from related proteins. *In silico* activation of bovine rhodopsin, the first related structure to be published, did not lead to completely satisfactory homology models. Recently, the crystal structure of the more closely related β_2-adrenergic receptor (β_2AR) was published, although in an inactive form. We have made significant progress toward activating the β_2AR *in silico*, by performing Molecular Dynamics simulations of the membrane-bound and solvated receptor, associated with the agonist ligand isoproterenol. Using this activated model, we are creating homology models of various monoamine neurotransmitter receptors and will perform virtual docking studies with existing and proposed agonist ligands. Obtaining new insights into the molecular basis for receptor function will facilitate the structure-based design of more efficacious and selective drugs.
This work was supported by NIH grant MH42705 (DEN), and a Purdue Midwest Crossroads AGEP supplies and expenses funding grant (JIJ).

A.R.P.Kingsly, Klien E. Ileleji
Purdue University: Graduate Student, Agricultural and Biological Engineering
Mentor: Dr. Klien E. Ileleji, Assistant Professor, Department of Agricultural and Biological Engineering

Sorption Characteristics of Corn Dried Distillers Grain with Solubles (DDGS) and its Prediction from Chemical Composition

Corn distillers grains dried with solubles (DDGS) have high feed value due to their nutritive contents. DDGS is produced by drying the mixture of wet distillers grains (WDG) and condensed distillers soluble (CDS) in rotary drum dryers. The ratio of WDG and CDS added during the production process determines the chemical composition of DDGS. The effect of changing this ratio on the equilibrium moisture content (EMC)–equilibrium relative humidity (ERH) relationship of DDGS, at different temperatures (10-40°C), was studied. The experimental data was fitted with five mathematical models to predict the storage stability. The potential of predicting the sorption isotherm from chemical composition using a four-component model was also investigated. The EMC of DDGS increased with increases in relative humidity. The effect of temperature reduced as ERH increased. The EMC and binding energy of water molecules of DDGS depended on the quantity of CDS added during the production process. A Modified Halsey equation was found suitable for mathematically explaining the sorption behavior of DDGS, which can be predicted from the chemical composition of protein, sugar, minerals, starch and fiber. The deviation in predicted and experimental values indicated the influence of glycerol, the plasticizer present in DDGS, and its interaction with other compounds. Inclusion of water chemical potential of glycerol may improve the performance of prediction model.

Camille M. Kite, C. Bryan Huehls
Ball State University: Junior, Chemistry
Mentor: Dr. Robert E. Sammelson, Department of Chemistry

Synthesis of 3-Cyano-2-Pyridones from Malononitrile

Substituted pyridones have many known uses in medicinal chemistry. These substances are used as topoisomerase inhibitors in anticancer medicines. Cerpegin, a naturally occurring 2-pyridone, functions as an analgesic, anti-ulcer, tranquilizer, and anti-inflammatory. 2-Pyridones have also been associated with antitumor, antifungal, antibacterial, antiviral, and antithrombotic properties. 2-Pyridone derivatives are currently being researched as inhibitors of HIV-1 replication. Recently, our lab has examined the condensation reaction of malononitrile with aldehydes and ketones. We are now extending this uncatalyzed reaction to β-diketones. This reaction requires two equivalents of malononitrile and produces 3-cyano-2-pyridones. We have also isolated an intermediate that we characterized by proton-NMR, carbon-NMR and IR. The structure obtained provides information about new possible mechanistic routes. The scope and limitations of this reaction will also be discussed. The possible mechanistic routes will be explored in the future.

Megan McGlothin and Rebecca Hughes
Purdue North Central: Sophomore, Biology
Mentor: Dr. Vanessa S. Quinn, Department of Biology and Chemistry

Cover Object Preference in Forest Dwelling Salamanders

We were interested in examining the factors that determine choice of cover objects in forest dwelling salamanders. We provided salamanders with four different types of cover objects dispersed randomly in a wooded area. There were three treatment groups (painted, altered edges, and cover objects inserted in 9-10 cm depressions) and one control group used for this test. There were 10 cover objects for each group. Each board was checked for salamanders at least once a week and in many cases two times a week. At the end of the 2 month experiment, more salamanders were counted beneath the painted cover object group and the control group in comparison to the altered edge group and the bare soil group. It was interesting that the salamanders did not distinguish between the control group and the painted group suggesting that they could not detect possible toxic chemicals in the paint.

Blucher Menelas, Brad C. Joern, and James J. Camberato
Purdue University: Graduate, Agronomy
Mentors: Dr. Brad C. Joern, Dr. James J. Camberato, Department of Agronomy

Fate of Applied Fertilizer N through Nitrogen Transformation.

Understanding the retention and transformation of ammonium-N following application of anhydrous ammonia fertilizer to soil is critical to predicting nitrate-N formation and thus potential for leaching and denitrification losses. The distribution patterns of fixed and exchangeable ammonium-N after injection of anhydrous ammonia into several important soil types in the Eastern Corn Belt were examined in this study. Anhydrous ammonia was applied at a rate equivalent to 170 kg N/ha on a 76 cm spacing. After N application, soils were incubated at a moisture tension of 0.05 MPa and 20 °C. Soils were sampled in concentric rings from the injection point at 1, 7, 14, 21, 28, 35, and 42 days after application. Fixed and exchangeable ammonium and potassium were determined for each sample date. The results and implications of these experiments will be presented at the meeting.

Mamie N. Miles
Ball State University: Department of Medical Education, Senior, Pre-Medical Preparation and Exercise Science
Mentor: Dr. Michael Litt, Genetics

Does the loss of glycogen synthase result in epigenetic modifications which correlate with persistent changes in the gene expression profile?

Little is known about the changes in gene expression and epigenetic modifications during glucose deprivation. These studies will examine mice deficient in Glycogen Synthase 1 in order to determine regulatory genes and chromatin modifications involved in the extreme condition of complete glucose deprivation in the brain. The brain's primary source of energy is glucose. Glycogen Synthase 1 is responsible for storing glycogen in the brain. Consequently, the knockout mice have no detectable glycogen in the brain. When extremely fasted or exercised the mice can be severely depleted of circulating glucose. Therefore, this results in deprivation of glucose in the brain because there is no glycogen reserve. Currently we validated quality RNA. We also have found that Glycogen Synthase 2, which is normally only in the liver and muscle, is found in the brain. Our studies will used Affymetrix© microarrays to identify differences in the gene expression and changes in epigenetic modifications between the wild-type mice and mice deficient in Glycogen Synthase 1 in the brain.

Cameron Miller, Kelli Martin, Nancy Marthakis, Noel Pavlovic
Purdue University, North Central: Senior, Biology
Faculty Mentor: Dr. Nancy Marthakis, Dept. of Biology

Isolation of Arbuscular Mycorrhizal Fungi from Successional Dune Soil

Arbuscular Mycorrhizae is a soil fungus that is believed to play an intimate role in enhancing nutrient uptake between plant root and soil. In infertile soils, nutrients taken up by the mycorrhizal fungi can lead to improved plant growth and reproduction. The ability of several sand dune inhabiting plant species to successfully colonize dune sites appears to depend upon the presence in the soil of Arbuscular Mycorrhizal Fungi (AMF) that form mutualistic associations with roots. It is also known that dune sites along the eastern coast barren of vegetation lack these fungi. This interaction between dune plants and the Arbuscular soil fungi have been shown to promote better ecosystem restoration outcomes. The focus of this study is to collect soil samples along the plant-root-soil interface, also known as the rhizosphere. Soil was collected from an experimental block in each of the three habitats along the Indiana Dunes National Lakeshore to include fore dune, secondary dune and oak dominated communities. The root pieces in the soil samples were processed, stained and evaluated by microscopic analysis for the presence of AMF. Preliminary results of our slide analysis show an overall low rate of infectivity by AMF.

Keith. Murphy, Rebecca. Turpin, Tommy Peller, K. Vinodgopal, Julie Peller, Department of Chemistry; Murulee Byappanahalli, and Richard Whitman, Lake Michigan Ecological Research Station
Indiana University, Northwest: Senior, Chemistry Major
Faculty Advisor: K. Vinodgopal, Department of Chemistry

Fluorescent Whitening Agents (FWAs) as Chemical Markers of Human Contamination

Bacteria from both animal and human sources contaminate bodies of water, but the health risk is substantially higher from human waste. Since biological assays require at least 18 hours for cultures to develop, a faster method to detect human contamination involves the utilization of chemical markers associated with sewage discharge. A significant portion of wastewater is generated from household laundry/detergents, which typically contain whitening agents. Three common whitening agents (FWAs) have been selected for this study: Tinopal UNPA-GX, Tinopal CBS-X and 4, 4'-Diamino-2, 2'-stilbenedisulfonic acid (DAS). The detection and quantification of these compounds are being investigated in lake water and secondary treated wastewater samples using optimized fluorescence excitation-emission matrix characterizations and HPLC (High Performance Liquid Chromatography) equipped with fluorescence detection. The water samples were tested directly and were concentrated using C18 solid phase extraction disks, followed by methanol elutions. HPLC chromatograms of the samples reveal the presence of FWA peaks, the highest quantity being the DAS-type FWAs. Excitation-emission matrix characterization techniques are being used to distinguish between naturally emitting species in lake water and treated wastewater and the FWA compounds. Both instrumental techniques are able to quantitatively detect the FWAs as low as parts per trillion (ppt). The quantity and distribution of FWAs are under further analysis to determine their relationship to water bacterial counts.

M. Navarro, S. Dusanter, P. S. Stevens and R. A. Hites
Center for Research in Environmental Science, School of Public and Environmental Affairs, and Department of Chemistry, Indiana University. Ph.D Candidate, Environmental Science
Mentor: Philip Stevens, School of Public and Environmental Affairs, and Department of Chemistry

Measurements of the yields of methacrolein and methyl vinyl ketone from the OH-initiated oxidation of isoprene under NO_x free conditions.

Isoprene, the dominant natural hydrocarbon emitted into the atmosphere by deciduous trees, can contribute significantly to the production of ozone in the troposphere because of its high reactivity with the hydroxyl radical (OH). The accuracy of urban and regional air quality models depends on a complete understanding of the mechanism of isoprene oxidation and its products. Recent measurements of OH and HO_2 radicals in forest environments show serious discrepancies with modeled concentrations of these radicals, bringing into question our understanding of the atmospheric chemistry of isoprene. Using a small UV-irradiated reaction chamber coupled to an on-line mass spectrometer, we investigated the formation of isoprene oxidation products under NO_x free conditions. UV-photolysis of hydrogen peroxide (H_2O_2) was employed as the OH precursor. During experiments carried out at 50° C and various concentrations of H_2O_2, yields of methacrolein (MAC) and methyl vinyl ketone (MVK) were derived from their time-resolved concentration profiles. The measured yields exhibit a decrease with increasing H_2O_2, suggesting a dependence on the concentration of radicals. Experimental concentration profiles were compared to model predictions to test current mechanisms of isoprene chemistry. Future work will investigate the temperature dependence of the MAC and MVK yields.

Rhoda Owolabi

IUPUI: Junior, Biology
Mentor: Dr Pierre Andre Jacinthe, Department of Soil Geobiochemistry

Factors controlling the relative concentration of dissolved hydrophilic and hydrophobic carbon fractions in surface waters.

Municipalities throughout the US Midwest obtain drinking water from streams and rivers, and these surface water sources contain varying amount of dissolved organic carbon (DOC). Chlorination is a routine procedure implemented at water treatment plants to kill or inactivate pathogens that may be present in the finished waters. However during chlorination, chloride reacts with DOC, particularly with the dissolved hydrophobic fractions, to produce various disinfection by-products including trihalomethanes, which are suspected carcinogens. A study will be conducted to determine the factors controlling the abundance of hydrophobic and hydrophilic fractions in surface waters of Central Indiana. Factors to be investigated include: relative position within the stream network (upstream vs. downstream), and vegetation (algae, corn and soybean biomass). Water samples will be obtained from Eagle Creek Reservoir and its tributaries and filtered (0.45 micrometer) to obtain whole DOC. This whole DOC will be fractionated into hydrophobic and hydrophilic fractions by passage through DAX-8 resin. Whole DOC and DOC fractions will be analyzed for total carbon content using a DOC analyzer. Biodegradation, IR spectroscopic and fluorescence analyses will also be carried out for further characterization of DOC biochemical properties. This study will contribute to understanding the linkage between climate, vegetation and water quality.

Svetlana Pekovic

Ball State University: Junior, Biochemistry
Mentor: Dr. Timea Gerczei, Department of Chemistry

Exploring the Binding Specificity of the ykkCD Riboswitch Aptamer Domain Using Fluorescent Spectroscopy

Riboswitches are a type of natural genetic control element that uses an untranslated sequence of mRNA to form a binding pocket for a metabolite that regulates expression of that gene. Thus, an mRNA that contains a riboswitch is directly involved in regulating its own activity, depending on the presence or absence of its target molecule. The ykkCD riboswitch, discovered in *Bacillus subtilis,* is an ideal target to tackle the growing problem of antibiotic resistance by pathogenic bacteria. We propose that it regulates the expression of a multidrug-resistant efflux pump. Our goal is to decipher the molecular mechanism by which the ykkCD riboswitch triggers the expression of the multidrug-resistant efflux pump. Fluorescent binding assays will be used to show that the ykkCD riboswitch aptamer domain specifically recognizes what we hypothesize to be aromatic cations as ligands.

Breanna Ricketts, Ryan L. Miller
Ball State University: Junior, Chemistry
Mentor: Dr. Robert E. Sammelson, Department of Chemistry

Synthesis of Mono- and Disubstituted Malononitrile Derivatives: Carbon Alkylation Selectivity

Recently, our lab has developed a one-pot synthesis for the reductive alkylation of malononitrile to efficiently prepare monosubstituted malononitriles. Once a monosubstituted derivative has been formed, simple alkylation techniques can be used to create new derivatives. When the monosubstituted derivative contains a phenol or pyridyl substituent (from 3-hydroxybenzaldehyde, 4-hydroxybenzaldehyde, 3-ethoxy-4-hydroxybenzaldehyde, vanillin, 3-pyridinecarboxaldehyde, 4-pyridinecarboxaldehyde) C-alkylation is selective, and disubstituted malononitriles are obtained. Further reaction of the disubstituted malononitriles finally allows for phenol or pyridyl alkylation. Analogous disubstituted malononitrile derivatives have been found to be useful intermediates and/or targets for creation of numerous agricultural pesticides and pharmaceutical chemicals. The next step will be to implement the chemistry into a one-pot procedure and synthesize other derivatives.

Monica Rodriguez
Purdue University: PhD Student, Mechanical Engineering Technology
Mentor: Dr. Michael Whitt, Department of Mechanical Engineering

A Comparison between Traditional Heat Stress Characterization and a Novel Approach

Excessive exposure to heat has been the root cause of numerous deaths in the United States between the years 1979-2002. The resultant elevation in body temperature resulting in hyperthermia has no standard safety measure to indicate an individual's degree of heat stress. Wet Bulb Globe Temperature (WBGT) is currently used to classify heat stress for a given activity performed over a given period of time. However, individualized factors are not taken into account pertaining to individualized risk for heat stroke. The purpose of this research is to gather data and observe the relationship between evaporative losses, the body's tissue fluid content, and cardiovascular metrics which could become part of an algorithm allowing heat stroke susceptibility to be categorized based on individualized physiological data. It is believed that a relationship exists between cardiovascular metrics and evaporative losses from the skin leading to heat stress under certain environmental conditions. The ultimate goal is to provide an individualized probability of heat stroke by focusing on physiological heat strain measurements which by definition are the physiological responses to heat stress and not environmental metrics.

Irma Jazmin Ruvalcaba
Ball State University: Senior, Biology
Mentor: Dr. Susan A. McDowell

Potential Inhibition of *S. aureus* infection in HEK 293A cells by deletion of the PI3K RhoGAP domain

Staphylococcus aureus is responsible for a wide range of illnesses that can be as harmless as small boils or pimples but as grave as a full-blown bodily infection or sever sepsis. Severe sepsis is becoming increasingly problematic because it accounts for many hospitalizations worldwide, with death rates at 30% to 60%. Because these bacterial organisms have the ability to develop antibiotic resistance, it is crucial to further understand the mechanism underlying the infection so that alternate treatments may soon become available. *S. aureus* uses the cell's eating ability, endocytosis, to enter the host cell. A series of cascading events allow this, including the binding of PI3K to CDC42 via the RhoGAP domain of the PI3K. Interrupting the mechanism, further explained in the poster, may allow us to inhibit infection of cells by *S. aureus*. This research involved the transfection of cells with mutant DNA, which would encode the PI3K protein lacking the RhoGAP domain, and comparing the number of infections with that of normal cells. Further research is still necessary in order to produce significant results with this project.

Anthea C. Saez, Senior, Biology: Pre-veterinary medicine; Sarah E. Dwyer, Senior, Ecology; Eric J.E. Bird, Sophomore, Ecology
Purdue University, Calumet
Mentor: Dr. Young D. Choi: Department of Biological Sciences

Biomass Allocations and Seedling Emergence of Four Prairie Plant Species In Response to Soil Nitrogen Enrichment

It has been reported that atmospheric deposition adds approximately 6 kg of nitrogen in each hectare of Indiana dunes. Such enrichment of soil by nitrogen from atmospheric deposition causes changes in plant communities of the Lake Michigan sand dunes. While a majority of studies on this subject have addressed decline of biological diversity and invasion of exotic species, little has been studied on the responses of native plant species and the dynamics of their assemblage. Understanding how native plant communities are responding to their changing environment helps us to predict the future state of those communities, and eventually conduct conservation and restoration practices in response to these changes. In this study, we hypothesized that soil nitrogen enrichment may cause native species to alter their biomass allocations in nitrogen-limited soils of Lake Michigan's sand dunes. Our goal is to investigate the effects of soil nitrogen enrichment on the production and allocation of biomass for native plant species of the Lake Michigan sand dunes.

Robert Sharon
Ball State University: Senior, Chemistry
Mentor: Dr. Priya Hewavitharanage, Department of Chemistry

Synthesis of a novel photochromic conjugated polymer containing dithienylethene

Diarylethene derivatives undergo reversible photocyclization between their ring open and ring closed forms when irradiated with the appropriate wavelength of light. They show good photo-fatigue resistance and thermal stability. Photochromic conjugated polymers with diarylethenes have potential applications as reversible photoconductors and fluorescence switches for optical data recording. We have designed a novel class of pi-conjugated photochromic polymers with dithienylethene and three-coordinate boron in the main chain. The synthesis and photochromic behavior of one of these novel polymers will be discussed.

Beatrice M. Thungu, Christopher J. Oldfield, and Vladimir N. Uversky
Indiana University/Purdue University, Indianapolis: Biology Major and Medical Humanities Minor
Mentor: A. Keith Dunker

Intrinsic Disorder in Signaling Domains and Their Interaction Partners

For many years proteins are believed to fold into unique 3D structures that are responsible for many biological functions. However, experimentalists have provided evidence that some proteins are disordered or lack fixed structure under physiological conditions. These intrinsically disordered proteins have regions that lack the 3D structure yet carry out important functions like cell-cell signaling, regulation, and molecular recognition. Recognition between proteins is often carried out by specialized signaling domains, and our focus is on the role of intrinsic disorder in protein recognition by signaling domains. To this end, we hypothesized that disordered regions of proteins bind to specific protein partners, called signaling domains, via recognizable sequence patterns known as Eukaryotic Linear Motifs (ELMs). The approach used was Pawson Lab Signaling domain database, which contains a 'gold standard' set of signaling domains mediating protein-protein interactions. Next, the Eukaryotic Linear Motif (ELM) server was used to find ELMs containing Polyproline and Phospho-Serine/Threonine motifs. Our analysis revealed that 13 of the 75 signaling domains are able to interact with Polyproline and Phospho-Serine /Threonine motifs. Finally, after matching signaling domains to the ELMs using the ELM server, a final set of 35 Polyproline- and Phospho-Serine /Threonine-containing ELMs were assembled and were targets of at least one of 13 signaling domains.

Vanessa Valentin

Purdue University: PhD Student, Second Year, School of Civil Engineering
Professor: Dr. Dulcy Abraham, School of Civil Engineering

Stakeholder Interaction and Influences in Success of Construction Megaprojects

The term *megaproject* is frequently used to define construction projects whose costs exceed one billion dollars. Due to the magnitude and complexity of these types of projects, and due to the presence of multiple organizations with conflicting objectives, megaprojects typically experience significant delays and cost overruns. This study focuses on the following research question: *What are the impacts of the interactions between multiple stakeholders with conflicting objectives on performance measurements of the construction process (i.e., cost, schedule, adherence to quality and safety) of megaprojects*? Modeling approaches under investigation for this research include network analysis, system dynamics and game theory. In order to validate and verify the modeling framework, the construction of nuclear power plants is used as a case study. These projects are excellent examples of megaprojects and have a history of cost overruns up to 300% of the estimated cost. Subject Matter Experts have been interviewed to gather data regarding the construction process and stakeholders involved in such projects. The modeling of the interactions between stakeholders at different levels is currently underway. The results of this study will provide strategies to reduce and mitigate the impact of stakeholder interactions and influences on mega-projects and may result in decreasing time extensions and cost escalations due to conflicting interests.

James H. Wesolowski

Indiana University, Northwest: Senior, Anthropology and Geology
Mentor: Dr. Erin P. Argyilan, Department of Geosciences

Using Information Systems to Represent Geoarchaeological Data from an Alluvial Terrace in Coastal Ecuador

Archaeological excavations of an alluvial terrace in central coastal Ecuador have revealed two occupational surfaces from the Guangala culture (2500 to 1500 BP) interrupted by a gravel and mud deposit. The gravel likely represents a short period of extremely high precipitation and was previously thought to have originated from the adjacent hillside in a mass wasting event. However, field observations suggest that the deposits could also have originated from the adjacent river during flood stage, and this alternative hypothesis is tested. Sediment samples were collected from ten locations on the terrace extending from the surface to approximately 1.5 m, and the characteristics of the samples, including the presence of gravel and thickness of strata, were recorded and subsequently entered into subsurface modeling software. The lateral extent and consistency of gravel-bearing deposits was then determined. The deposits do not form a wedge near the base of the hill, but rather extend nearly evenly over the terrace indicating deposition by water instead of gravity. Thus, the tested hypothesis is supported, and further research will refine existing data by particle size analysis and correlation to known climatic events in prehistoric South America.

Kelley M.M. Wilson, Deborah Sarria, Hai Nguyen, Ellen A.G. Chernoff
Indiana University/Purdue University, Indianapolis: Sophomore, Biology
Mentor: Dr. Ellen A.G. Chernoff, Department of Developmental Biology

The Role of Nerves in *Short-toes* Mutant Axolotl Limb Regeneration

The Axolotl, an aquatic salamander (*Ambystoma mexicanum)*, regenerates spinal cord, brain, tail, and limbs. The *short-toes* mutant Axolotl (s/s) fails to regenerate its limbs past the blastema stage, while other tissues still regenerate. It is known that early limb regeneration is nerve-dependant, and it was hypothesized that the s/s limbs or blastemas are nerve deficient. Sectioning of normal s/s limbs and imaging using immunohistological staining with anti-Neurofilament 200 antibody (NF200) showed large nerve bundles in normal and s/s limbs. In this exploratory experiment, limbs were amputated and normal median bud stage and mutant end stage (3-6 month old) blastemas were compared. NF200 staining showed that nerves are present in the s/s blastemas, though the distribution differs from that of the normal blastemas. Currently, with the results suggesting that s/s end stage blastemas are innervated, early stage (3 weeks old) s/s blastemas are being compared with early stage d/d blastemas to determine whether the rate of nerve growth is slower than normal. If the rate of nerve growth in the s/s blastema is normal, allowing for sufficient innervation, then growth factor release from nerves or Schawnn cells may be abnormal. Alternatively, the defect may lie in the muscle or stem cells.

C. Zhao, D. Emmert, J. Camberato, and B. Joern
Purdue University: Agronomy Dept., Second year for master's with a major of soil chemistry and fertility
Co-advisor: Brad Joern, James Camberato, Agronomy Dept., Purdue University

Estimating Mineralizable Nitrogen in Indiana Soils

Previous field research across 20 site-years in Indiana found soil N supply was the most important factor determining fertilizer N rate needed to optimize corn yield. Current soil testing methods did not predict soil N supplying capacity in these experiments. The inability to estimate mineralizable soil N prior to the growing season limits our ability to develop more accurate N rate recommendations for corn production. We assessed N mineralization in major soil types of Indiana that differed substantially in organic matter, texture, and previous crop with a laboratory incubation procedure. Soils were incubated at 25°C and a water suction of 10 kPa and extracted weekly with 2M KCl solution for 12 weeks. The soil extracts were analyzed colorimetrically for inorganic N to determine the mineralization rates. Laboratory mineralization rates were compared to field measurements of N supplying capacity and related to soil properties. The results showed that Mineralized N was not correlated with soil OM ($p=0.18$, $R^2=0.08$). Additionally, more N was released in the lab incubation than in the field in all soils except the two soils with higher OM content.

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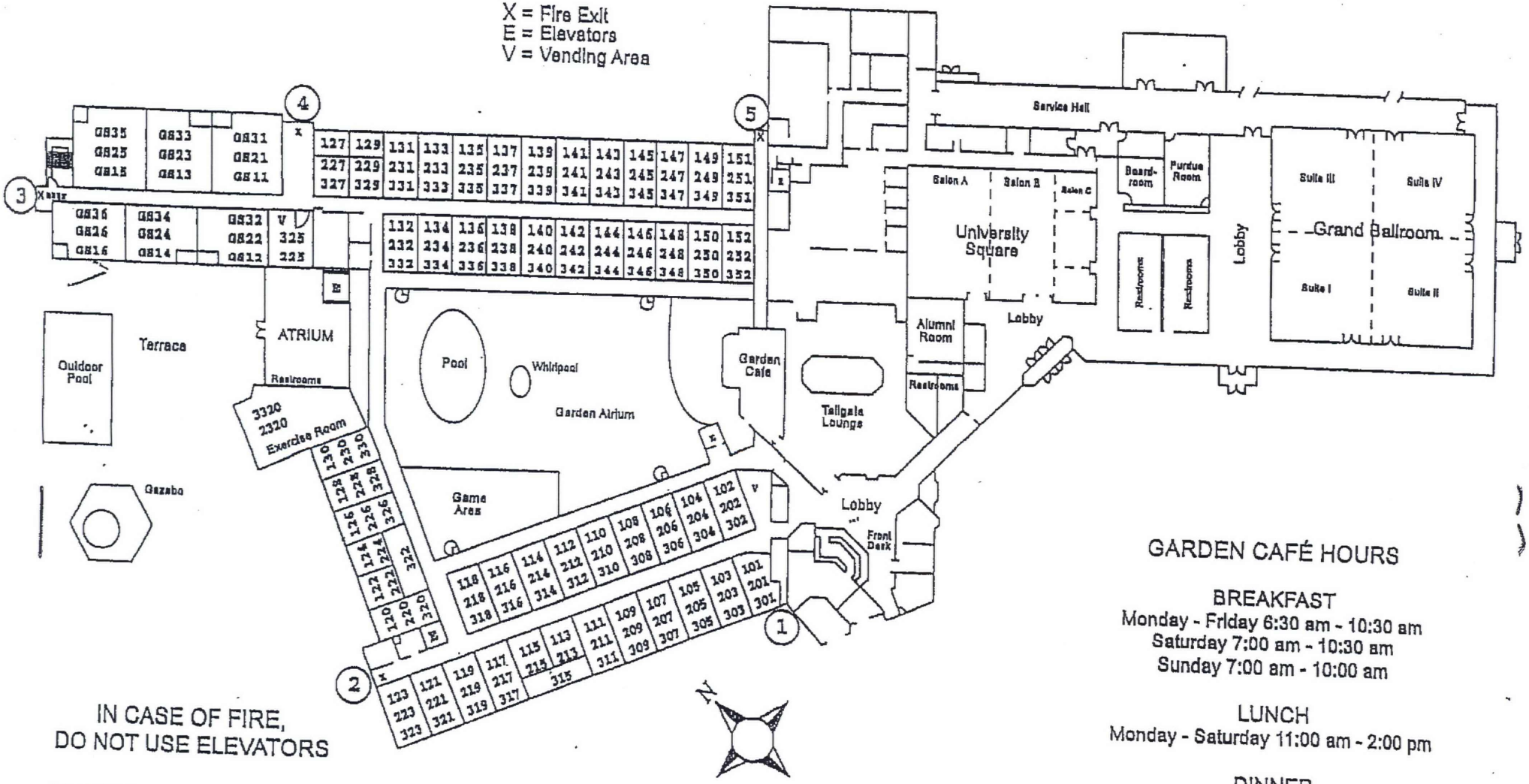

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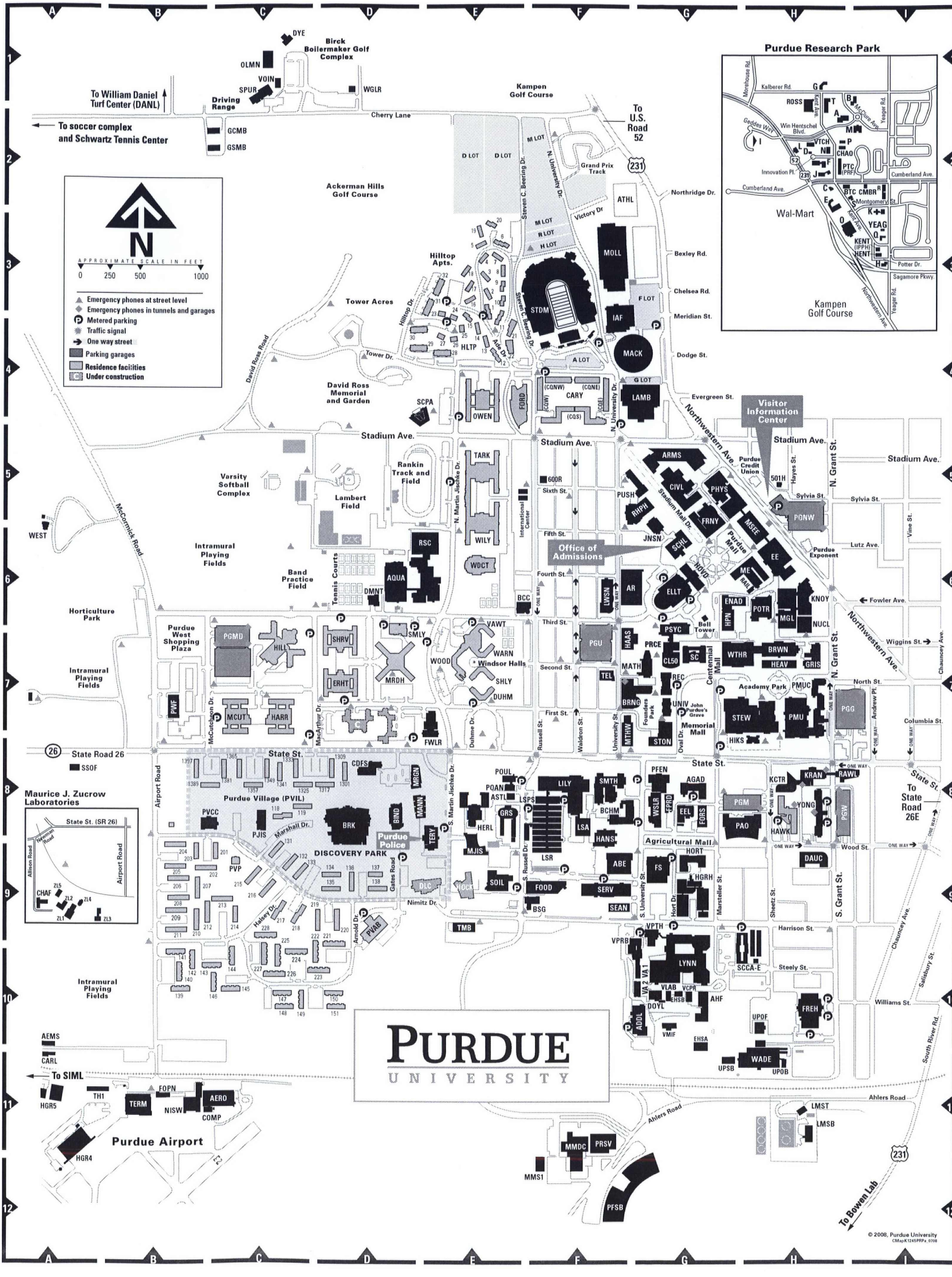
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GSMB
Kampen Golf Course
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Grand Prix Track
Ackerman Hills Golf Course
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N. University Dr.
Northridge Dr.
ATHL
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R LOT
H LOT
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1000
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IAF
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David Ross Memorial and Garden
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OWEN
FORD
CARY
G LOT
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Northwestern Ave.
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Stadium Ave.
Stadium Ave.
Stadium Ave.
Stadium Ave.
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TARK
Varsity Softball Complex
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Vine St.
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EE
Purdue Exponent
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WDCT
Fourth St.
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SHLY
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TEL
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PMUC
North St.
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John Purdue's Grave
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PGG
Andrew Pl.
Columbia St.
PWF
McCutcheon Dr.
MCUT
HARR
MacArthur Dr.
FWLR
Duhme Dr.
Russell Dr.
First St.
Waldron St.
University St.
MTHW
STON
Oval Dr.
HIKS
26
State Road 26
SSOF
State St.
CDFS
State St.
KCTR
KRAN
RAWL
State St.
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Maurice J. Zucrow Laboratories
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Allison Road
Airport Road
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ZL5
ZL2
ZL4
ZL1
ZL3
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PJIS
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SMTH
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PGW
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DLC
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HORT
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Halsey Dr.
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S. University St.
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South River Rd.
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UNIVERSITY
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