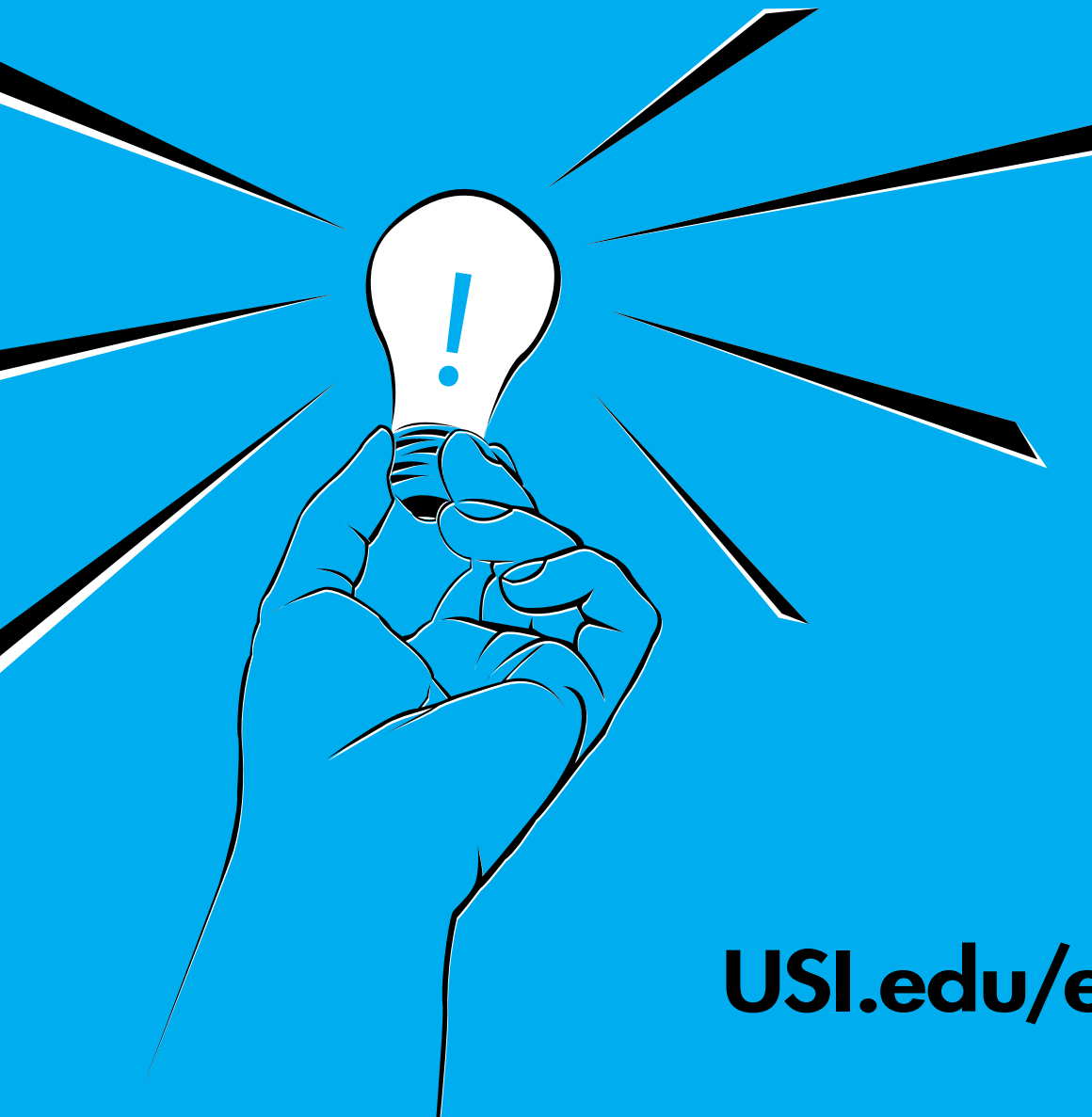
12th Annual Symposium

2013

USI ENDEAVOR! AWARDS *for* RESEARCH & CREATIVITY



Carter Hall
and
University
Center East

University of
Southern Indiana

USI.edu/endeavor

April 2013

Dear Endeavor! Participant:

Welcome to the 12th Annual Endeavor! Undergraduate Research and Creative Works Symposium at the University of Southern Indiana! As a participant in the Symposium, you are deepening your undergraduate learning experience and exhibiting initiative that is valued by graduate degree programs and employers.

During the Symposium, take the opportunity to get to know students and faculty from other departments and universities. Building networks outside your discipline is an important part of preparing for the next step after you complete your undergraduate education.

Congratulations on being a participant in USI's Endeavor! Symposium and best wishes to you.

Sincerely,

Linda L. M. Bennett, Ph.D.
President

April 4, 2013

Dear Endeavor! Symposium 2013 Presenters and Sponsors:

Welcome to the 2013 Endeavor! Symposium. Your work has increased the number of researchers and artists making presentations at this Symposium to more than 100. Your work has advanced discoveries in all your fields of research and creativity, and I am certain you are energizing the University of Southern Indiana's academic culture.

The Endeavor! Research and Creativity Awards program assumes that when you follow a passion, you emerge with an enhanced education and strong ties to your learning. The synergy between research and learning is the foundation for the best education possible. Likewise, when faculty sponsors follow their curiosity, they become more insightful and grounded professors.

I sincerely hope that all of you found one of your research or creativity passions and that the Endeavor! Symposium gave you the incentive to be curious and inventive.

Sincerely,

Jane Johansen, Ph.D.
Director
Endeavor! Research and Creativity Awards

Endeavor! Symposium Agenda

Thursday, April 4, 2013

7:30 - 8 a.m.	**Check-in** for all presenters and sponsors: Receive programs and ID badges at front hall table
8 a.m. - Noon	**Oral Presentations** *UC 204, 2205, 2206, 2207*
8 a.m. - Noon	**Poster and Artwork Sessions** *University Center, Carter Hall A-C* *Presenters of posters and art pieces will be available for two assigned hours.*
12:10 - 1:10 p.m.	Endeavor! Research and Creativity Awards Program Luncheon *Badges are lunch tickets!*
1:10 - 1:30 p.m.	Breakdown of all poster materials and objects

Endeavor! Research and Creativity Awards Committee

Jane Johansen	Director of Endeavor! Awards for Research and Creativity Professor of Business Communication, College of Business
Antonina Bambina	Director of the Honors Program Assistant Professor of Sociology, College of Liberal Arts
Vaughn DeCoster	Director of MSW Program Associate Professor of Social Work, College of Liberal Arts
Khaled Elkhal	Assistant Professor of Finance, College of Business
Sangwoo Heo	Professor of Mathematics Pott College of Science, Engineering, and Education
Emily Lynn	Grant Administrator Sponsored Projects and Research Administration
Rob Millard-Mendez	Art Department Assistant Chair Associate Professor of Art, College of Liberal Arts
Gabriela Mustata Wilson	Assistant Professor of Health Informatics College of Nursing and Health Professions

Acknowledgements

The Endeavor! Committee thanks the following for their support of the Endeavor! Research and Creativity Award Program and Endeavor! Symposium

Dr. Linda Bennett, President, University of Southern Indiana

Dr. Ronald Rochon, Provost

Dr. Shelly Blunt, Assistant Provost

College of Business

College of Liberal Arts

College of Nursing and Health Professions

Pott College of Science, Engineering, and Education

USI Honors Program

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Endeavor! Faculty Mentors

Dr. Daniel Bauer

Dr. Jeri Burger

Ms. Stephanie Bush

Dr. Julian Davis

Dr. Cindy Deloney-Marino

Dr. Paul Doss

Dr. Jim Durbin

Dr. William Elliott

Dr. Brandon Field

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Dr. Michael Kearns

Dr. Glen Kissel

Dr. Jason Langley

Ms. Jeanette Maier-Lytle

Dr. Anthony Maria

Dr. Eric McCloud

Mr. Rob Millard-Mendez

Ms. Jamie Seitz

Dr. Jeff Seyler

Dr. Natasha Smith

Dr. Susan Spencer

Dr. Rex Strange

Dr. Edmir Wade

Dr. Ken Walsh

8 a.m. POSTER SESSIONS

Carter Hall

Alex Arwood	The Taxonomic Status of Subspecies of the Fantail Darter
Scot Patrick Finney & Casey Mackenzie Coffey	Understanding Population Variation Through Discrete Traits and Cluster Analysis: A Class Project
Levi C. Holscher	Assessment of the University of Southern Indiana's Microbiology Laboratory Regarding Aseptic Technique And Biosafety Guidelines of Salmonella Species and Serovars
Maxwell King	Petrography and Geochemistry of an Ultramafic Dike in Southern Illinois
Lauren Martin	Oxidative Addition of Alkanes to Iridium Pincer Complexes
Joseph Richard Schaefer	Characterization of Methyl-Accepting Chemotaxis in *V. fischeri* Using the Quantitative Capillary Assay
Evan Michael Taylor	Flexural Stiffness of the Hindwings of *Lycaenidae* Butterfly
Reuben Warshawski	Synthesis of Green, Red and Far Red Emitting 3-ethynylthiophene Substituted BODIPY Dyes
Aaron Williams	The Invariant Measure for Anderson Localized Negative Index Metamaterials Continuously Disordered
Brett Williams	The Isolation and Amplification of the Actin Gene Sequence for the Slime Mold *Stemonitis flavogenita*
Nathaniel Williams	Development of a Carcerand for C60

9 a.m. POSTER SESSIONS

Carter Hall

Maxwell Dahlquist	Provenance of Cobbles in the Rocky Gulch Sandstone Member of the Hornbrook Formation (Upper Cretaceous) in Siskiyou County, California
Scot Patrick Finney & Casey Mackenzie Coffey Chelsea Heibel	Understanding Population Variation Through Discrete Traits and Cluster Analysis: A Class Project Synthesis of β-C-Glycosides of 2-Amino Sugars from Glycal Aziridines
Levi C. Holscher	Assessment of the University of Southern Indiana's Microbiology Laboratory Regarding Aseptic Technique And Biosafety Guidelines of Salmonella Species and Serovars
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Jarod Allen Richards & Alex Arwood	Comparative Study of Locomotory Systems Across Three Phyla
Sarah Schwartz	Hydrogen Production Through Beta-Elimination
Evan Michael Taylor	Flexural Stiffness of the Hindwings of *Lycaenidae* Butterfly
Matthew Vincent	Modeling Transition States of Fluoride Substitution in F-BODIPY with Organometallic Alkynyl Reagents
Matthew Vincent	Synthesis of Novel Amphiphilic BODIPY Derivatives with Hydroxyl Groups for Live Cell Imaging
Brett Williams	The Isolation and Amplification of the Actin Gene Sequence for the Slime Mold *Stemonitis flavogenita*
Nathaniel Williams	Development of a Carcerand for C60

10 a.m. POSTER SESSIONS

Carter Hall

Nathan Bartholomew	Use of Stratigraphy, Sediment and Soils to Assess the Potential for Converting an Abandoned Agricultural Field into a Man-Made Wetland, Evansville, Indiana
Chelsy Calhoun & Josh Long	Measuring Elementary Teachers' Perceptions as an Initial and Partial Assessment of the Impact of the Indiana Science Initiative
Travis I. Hatfield	Preferential Preservation of Sedimentary Fabrics and Textures in Mudrock Concretions from the Hornbrook Formation (Upper Cretaceous) in Siskiyou County, California
Chelsea Heibel	Synthesis of β-C-Glycosides of 2-Amino Sugars from Glycal Aziridines
Alexandra Jordan & Kaetlyn Schmelzer	Comparative Look at the Reproductive Systems of *Pongo pygmaeus, Pisaster ochraceus, Apis Mellifera*
Carynn Koch & Jennifer Koch	Effect of Meal Composition of Postprandial Blood Glucose Levels in College Students with Varying BMIs and Exercise Patterns
Jarod Allen Richards & Alex Arwood	Comparative Study of Locomotory Systems Across Three Phyla
Sarah Schwartz	Hydrogen Production Through Beta-Elimination
John Talley	Late Quarternary History and Geomorphology of an Underfit Stream Valley in Southern Vanderburgh County, Indiana
Brittany Verble	Mitotic Localization of the CIN-4 Protein in *Caenorhabditis elegans*

(continued)

10 a.m. POSTER SESSIONS
(continued)

Matthew Vincent	Modeling Transition States of Fluoride Substitution in F-BODIPY with Organometallic Alkynyl Reagents
Matthew Vincent	Synthesis of Novel Amphiphilic BODIPY Derivatives with Hydroxyl Groups for Live Cell Imaging
Reuben Warshawski	Synthesis of Green, Red and Far Red Emitting 3-ethynylthiophene Substituted BODIPY Dyes
Aaron Williams	The Invariant Measure for Anderson Localized Negative Index Metamaterials Continuously Disordered
Bi Yu You	Development of a Calixarene-Based Carcerand

11 a.m. POSTER SESSIONS

Carter Hall

Alex Arwood	The Taxonomic Status of Subspecies of the Fantail Darter
Nathan Bartholomew	Use of Stratigraphy, Sediment and Soils to Assess the Potential for Converting an Abandoned Agricultural Field into a Man-Made Wetland, Evansville, Indiana
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ORAL PRESENTATIONS

University Center Rooms 206-2205

	Room 206	Paper Title	Room 2205	Paper Title
8:00-8:20 a.m.	Registration			
8:30-8:50 a.m.	Bielefeld & Adams	Human Powered Vehicle	Long & Calhoun	Comparison of the Perceived Key Concepts in Biology, Chemistry, and Geology Across Education Levels
9:00-9:20 a.m.	Chambers	Variable Water Level Response to Stress in a Sandstone Aquifer of the Ilinois Basin	Dowling	Conduct According to Moll Flanders
9:30-9:50 a.m.	Hamon & Phillips	Coordination, Collaboration, and Application: Increasing the Relevance of Evidence-Based Practice for Novice Nursing Students	Sureck	The 2nd Cholera Pandemic, Its Effect on Society and Disease in the Harmonist Utopia, or How I Learned to Create & Manage a Finding Aid
10:00-10:20 a.m.	**COFFEE BREAK**			
10:30-10:50 a.m.	Rynkiewich & Elpers	SAE Baja Drivetrain	Wink	Distribution of Income, Health, & Education Life Chances in Brazil, Chad, and The Philippines
11:00-11:20 a.m.	Haslam	The Slanger's Slang	Mathis	Biodiversity of *mycetozoa* : Addressing Questions of Species Identification Using DNA Sequence Analysis
11:30-11:50 a.m.	Jay	The Plyboo Bicycle Project	Konieczki, Schwartz, & Martin	PM3 and PM6 Calculations on Organometallic Dehydrogenation Catalysts
12:10-1:15 p.m.	**LUNCHEON**			

ORAL PRESENTATIONS

University Center Rooms 2206-2207

	Room 2206	Paper Title	Room 2207	Paper Title
8:00-8:20 a.m.	Registration			
8:30-8:50 a.m.	Opolski	Ars Poetica: Storytelling	Rose	Analysis of Hindwing Oscillation Frequency of Local *lycaenids*
9:00-9:20 a.m.	Shaw & Shaw	2013 ASCE Concrete Canoe - "Rhoboat"	Crecelius	Relational Uncertainty
9:30-9:50 a.m.	Durchholz	The Acculturation of Medicine in the Peruvian Amazon	Hosterman	Parkour Training for Youth
10:00-10:20 a.m.	**COFFEE BREAK**			
10:30-10:50 a.m.	Calhoun & Long	Measuring Elementary Teachers' Perceptions as an Initial & Partial Assessment of the Impact of the ISI	Utter & Christianson	Don't Forget Me When I'm Gone: Examining Relationships Between the Living and the Dead Through Decorated Headstones
11:00 - 11:20 a.m.	Atkins & Cassin	2013 IMA Case Competition		
12:10-1:15 p.m.	**LUNCHEON**			

Oral and Poster Presentation Abstracts

UC 206-2208, Traditions, Carter Hall

The Taxonomic Status of Subspecies of the Fantail Darter

Alex Arwood

Faculty Mentor: **Dr. Rex Strange**

The fantail darter (*Etheostoma flabellare*) is a polytypic species represented by two subspecies in the Midwest and Southeastern United States, both of which occur in Indiana. The barred fantail darter (*E.f. flaballare)* generally occurs to the east while the striped fantail darter (*E.f. lineolatum*) is distributed to the west; Indiana is located along the contact zone between the two subspecies. Although *E.f. flabellare* and *E.f. lineolatum* were originally described by morphological characteristics, it is arguable whether or not they are genetically distinct. The subspecies appear to show a continuum of intraspecific variation within Indiana, and some authors hold that *E. f. lineolatum* should not be recognized as a separate taxon. However, both subspecies were recognized in the recently published *Fishes of Indiana*. To date, all hypotheses regarding the relationships among these fantail darter populations have been based on morphology; but it is possible that a genetic data set might better elucidate the taxonomic validity of *E.f. flabellare* and *E.f. lineolatum.* The main objective our research is to determine whether there is a genetic distinction between the sub-species.

Specimens were collected from major river systems within Indiana and adjacent states. We then extracted DNA from the specimens and used sequence variation of the mitochondrial cytochrome b gene to infer the phylogenetic relationships among the represented populations. Preliminary analysis of the sequence data revealed evidence for two clades within *E. flabellare*, generally corresponding to 1) populations to the west and prairie regions of Indiana, and 2) populations in the unglaciated regions of Southern Indiana and Kentucky. Although it is tempting to equate these two clades to *E. f. lineolatum* and *E.f. flabellare*, more samples will be needed to assess the taxonomic status of these subspecies.

2013 IMA Case Competition

Taylor Atkins & Katie Cassin

Faculty Mentors: **Ms. Jeanette Maier-Lytle & Ms. Jamie Seitz**

Four USI students will again participate in the 2013 IMA Student Case Competition. The case competition allows students to learn and apply accounting concepts beyond the classroom atmosphere. This year's case was titled *Product Costing at Fine Foods*. The case presented the managerial accounting concept of product costing at a food and condiment manufacturing company that provides branded, high-quality food products.

We ultimately decided that the company is inaccurately assigning costs to their product lines and has incentives that are not promoting goal congruence within Fine Foods. The company needs to identify appropriate cost drivers to be able to control costs as well as accurately measure product line performance and profitability. Our proposed solutions to resolve these issues are the use of a variable product costing system to accurately assign costs, the use of unused storage capacity to optimize profits from special orders, and the implementation of a balanced scorecard to promote goal congruence and effectively evaluate performance.

Use of Stratigraphy, Sediment and Soils to Assess the Potential for Converting an Abandoned Agricultural Field into a Man-Made Wetland, Evansville, Indiana

Nathan Bartholomew

Faculty Mentor: **Dr. James Durbin**

A need to utilize property recently granted to the University of Southern Indiana yielded a plan to develop a human-made wetland. In addition to the wetland providing a location for biological and geological training, it also has potential to capture environmentally hazardous chemicals from campus housing and parking lots.

The study area sits within an underfit stream valley underlain by late Quaternary alluvium and glaciolacustrine sediments associated with the Ohio River. The stratigraphy observed in sediment cores consists of a sand to sandy silt at a depth of 3.26 to 3.35 m overlain by 0.82 to 2.25 m of sandy silt interpreted as fluvial sediments. Overlying these fluvial sediments is a 0.82 to 2 m thick silt to clayey silt interpreted as loess-derived floodplain or colluvial sediment. Wakeland series soils developed in the upper silt are poorly drained, with Ap/Bt/C profiles extending through the silt into the uppermost part of the silty alluvium. Mottling, gleying, and iron nodules are common in all cores, evidence of a fluctuating water table. Cores and GPR data confirm the location of the water table at an average of 1.5 m depth. The water table slopes gently downward from east to west before intersecting the stream channel at 1.9 m.

The main stream channel and “tributary” drainage ditches flood the field semiannually. Water currently ponds in shallow depressions during heavy rains except where the farmer dug a 0.4 m deep drainage slough. Hydraulic conductivity in the soils are poor due to the clay-rich horizons in the soil, but increases with increasing sand at depth.

Based upon the available soil, sedimentologic, and hydrologic data, the area appears to be a strong candidate for developing a human-made or human-augmented natural wetland.

Human Powered Vehicle

Brett Bielfeld

Faculty Mentor: **Dr. Natasha Smith & Dr. Brandon Field**

The objective of this project is to design and assemble a human powered vehicle (HPV) to compete in the Human Powered Vehicle Challenge (HPVC) hosted by the American Society of Mechanical Engineers (ASME) each year. This project will allow students to apply engineering design principles obtained in the classroom to a real-world problem: the development of sustainable transportation. The competition, which will be held April 26-28 at Ferris State University in Big Rapids Michigan, consists of four different events (design, speed, innovation, and endurance) that will put the designed vehicle to the test against several other schools across the nation.

This competition will also allow students to get hands-on experience with the design sequence, time-management, cost-management, metalworking, and fiberglassing. For this year's competition, USI's HPV team will be constructing a recumbent-type bicycle using standard bicycle frame materials, custom fabricated parts, off-the-shelf components, and an aerodynamic fairing (device used to reduce air drag). Team members will be utilizing Solid Works 3-D modeling software to design the various subsystems of the vehicle (frame, steering, etc.) and to test the safety and effectiveness of the design before construction. Team members will create and carry out testing procedures to verify all structures meet ASME regulations. The team will also be required to subject both the design of the vehicle and the validity of the testing procedures to judges at the competition.

Measuring Elementary Teachers' Perceptions as an Initial and Partial Assessment of the Impact of the Indiana Science Initiative

Chelsy Calhoun & Josh Long

Faculty Mentor: **Dr. Jeff Thomas**

This study provides insights into elementary teachers' perceptions of classroom environment through the launch of a major state science initiative. Elementary teachers were surveyed using the Survey of Elementary Science Teaching (SEST) from April 2011 through April 2012. This year bridged implementation of the Indiana Science Initiative (ISI). The initiative promotes science literacy through inquiry-based science kits and student notebooking. Results indicate an absence of school science safety plans; inquiry-based kits are now predominantly used in regional classrooms; and nearly 60 percent of teachers now participate in science fairs. Responses to the challenges and rewards of teaching elementary science were gathered, categorized, and analyzed. After ISI implementation, teachers report a diminishing challenge for needed equipment and technology and a significantly rising challenge for balancing kit dynamics. Increased teaching rewards for student interest and the use of hands-on learning when teaching science were reported.

Variable Water Level Response to Stress in a Sandstone Aquifer of the Illinois Basin

T. Bryce Chambers

Faculty Mentor: **Dr. Paul Doss**

Hydrological systems respond to a variety of stressors. Several years of hourly groundwater levels from a deep-shallow piezometer nest in the Pennsylvanian Inglefield Sandstone of Southern Indiana display water-level responses to barometric pressure and earth tides but do not have the resolution necessary to detect potential changes from seismicity. Existing data show water-level fluctuations of up to 5.5 cm/day (2.2 in/day) with a pronounced inverse relationship to barometric pressure. Water level fluctuations of 2.7 cm (1.1 in) with periodicities of 12 and 12.4 hours correspond to solar and lunar tidal stressors. To observe potential strain responses due to seismic stress, a pressure transducer with data logger was deployed in the Groundwater Monitoring Laboratory at the University of Southern Indiana (USI) to measure ground water levels every minute. The USI campus is also instrumented with a seismometer as part of the Cooperative New Madrid Seismic Network and the Advanced National Seismic System (ANSS).

Since deploying the high-resolution system, several notable far-field earthquakes generated measurable ground accelerations on the USI campus including a magnitude 6.5 earthquake in Costa Rica on October 24th, 2012; a magnitude 7.7 earthquake in the Queen Charlotte Islands Region on October 28, 2012; and a magnitude 7.4 earthquake offshore of Guatemala on November 7, 2012. A magnitude 3.6 near-field earthquake associated with the New Madrid fault system occurred on November 20th, 2012, at a depth of 17 km (10.6 miles) approximately 55 km (34 miles) from USI. Water level data during these events showed no apparent response to seismic stress. The lack of response to earthquakes suggests that we have not yet observed a seismic event of sufficient magnitude or proximity to generate measurable responses or that the Inglefield sandstone does not respond to high-frequency seismic stress as it does to low-frequency tidal stress. Apparently the long period tidal stress allows adequate time for the sandstone to deform while a short period seismic stress occurs too rapidly for a deformation response by the rock body.

Relational Uncertainty

Kylie Crecelius

Faculty Mentor: **Dr. Zachary Henning**

This study examined the difference between cohabitating dating, non-cohabitating dating, and married couples after a conflict episode regarding their uncertainty on the desire, evaluation, and goals within their relationship. Participants (N = 75) surveyed how certain they were on the desire for their partner, the certainty when evaluating their relationship, and the certainty of the goals they had when thinking about their future.

Provenance of Cobbles in the Rocky Gulch Sandstone Member of the Hornbrook Formation (Upper Cretaceous) in Siskiyou County, California

Maxwell Dahlquist

Faculty Mentor: **Dr. William S. Elliott**

The Hornbrook Formation (Upper Cretaceous) consists of 1,200 m of marine mudrock, sandstone, and conglomerate deposited in a forearc basin. The Hornbrook is exposed along the northeastern flank of the Klamath Mountains as a homoclinal structure that extends for 80 km from the southwest to the northeast in Southwest Oregon and Northern California. The Hornbrook Formation is subdivided into five members in ascending order: Klamath River Conglomerate, Osburger Gulch Sandstone, Ditch Creek Siltstone, Rocky Gulch Sandstone, and Blue Gulch Mudstone. The purpose of this study is to determine the provenance of pebbles and cobbles within conglomerates of the Rocky Gulch Sandstone Member of the Hornbrook Formation.

Conglomerates in the Rocky Gulch are matrix-to-grain-supported with thicknesses varying from 0.1 to 20 m and laterally present for 100s of meters. These conglomerates exhibit normal grading, and their basal contact is gradational to erosional. Sole marks (e.g. flute casts) on sandstones above and below these conglomerates provide northeastern paleocurrents. Pebbles and cobbles in these conglomerates are rounded to well-rounded and typically range in size from 0.5 to 25 cm. Approximately 100 pebbles and cobbles collected from an exposure of the Rocky Gulch Sandstone were used in this study. Thin-sections were prepared for selected pebbles and cobbles to better constrain their lithology.

Pebbles and cobbles from the Rocky Gulch are composed primarily of quartzite, felsic to intermediate metavolcanic rocks, and chert with subordinate amounts of metasedimentary rocks and granodiorite. The chert, metavolcanic, and metasedimentary clasts may have been derived from parent materials in the Hayfork and Eastern Klamath terranes in the Klamath Mountains. The granodiorite clasts have a similar composition to the granodiorite of the Jurassic Mt. Ashland pluton in the Klamaths. The source of the quartzite cobbles has not been determined in this study. Overall, the provenance of cobbles in the Rocky Gulch Sandstone is consistent with derivation from the Klamath Mountains. The size of the cobbles also attests to locally derived sediments to the Hornbrook Basin indicating that the area to the west (a.k.a. Klamath Mountains) was uplifted and a source of sediment in the mid-Cretaceous of Southern Oregon.

Conduct According to Moll Flanders

Jerrica Dowling

Faculty Mentor: **Dr. Michael Kearns**

Daniel Defoe's Moll Flanders is both a likeable character and a criminal. Her behavior, however unlawful, is easily justified by the circumstances of her social condition.

This paper discusses the relationship between growing female criminal conduct and the rise of the novel. Defoe's Moll Flanders explores the realms of gender and class disadvantages established by conduct standards of the 18th century. It is in the connections of criminal activity, social conduct standards, and changing print culture that female agency was established. Defoe's choice of a novel style of writing exposes his reader to the hardships and difficulties of living as either a woman or member of the lower class. The novel gives those that were disadvantaged a voice. This, along with the hardships faced by Moll, encourages a sympathetic understanding and connection with the plights and difficulties faced by those held down by law. Though Moll depends on relationships, marriages, and connections to advance her condition, the novel as a genre encourages an individualistic and independent interpretation and connection. Upon stealing a tankard from a local pub, for example, Moll's "criminal trainer" is quick to justify Moll's stealing, "As you have played the cunning part and stole it, you must e'n keep it, there's no going back now; besides child, says she, don't you want it more than they do."

The Acculturation of Medicine in the Peruvian Amazon

Aaron Durchholz

Faculty Mentor: **Dr. Daniel Bauer**

For as long as cultures have been in existence, they have been constantly blended and modified into newer hybrid cultures as a result of contact with outsiders. This process, generally referred to as *acculturation*, often results in the loss of important traditional elements essential to further understanding the society they once constituted. In the Amazon, many people have had difficulty gaining access to health care, an issue which can be attributed to acculturation. Throughout the region, many are impoverished and incapable of receiving the medical care they require due to their financial status. Indigenous traditional healers can provide medicinal plant remedies; however, they can be improved. To make matters worse, the acculturated medical professionals capable of improving such techniques refuse to do so because they ignore such practices in favor of their medical training. Introducing improved plant remedies would not only make them more effective, but also make them more accessible to those of lower class and income. To further investigate this problem, I intend to travel to the Peruvian Amazon to collect information and study the ways people have been affected.

The research will consist primarily of examining the contrasting viewpoints between modern medical practices versus traditional indigenous remedies.

Understanding Population Variation Through Discrete Traits and Cluster Analysis: A Class Project

Scot Patrick Finney & Casey Mackenzie Coffey

Faculty Mentor: **Dr. Susan Spencer**

Nine students in Human Osteology (ANTH 354) examined six crania from around the world for ten epigenetic traits. Disagreements regarding the scoring of traits ensued with the button osteoma and frontal grooves being the most difficult to score (33% agreement). Only the presence of the metopic suture was agreed upon. The biological relationships between the crania were drawn by counting the number of shared similarities. A cluster analysis was performed using a statistical program (PAST) and the results were compared.

We found the discrete trait results to be in conflict with our expectations based on the general understanding of population histories from genetic data. This exercise demonstrated the pitfalls in using individuals with unknown histories in order to understand modern human clinal variation. These discrete traits appear to have limited usefulness in forensic applications. The mode of inheritance and the population distribution of these traits will be presented. However, more research is needed in order to understand the heritability of these traits.

Coordination, Collaboration, and Application: Increasing the Relevance of Evidence-Based Practice for Novice Nursing Students

Christy Hamon & Katrina Phillips

Faculty Mentor: **Dr. Jeri Burger**

Beginning nursing students are concerned about technical skills and provision of basic care. They must also have an understanding of evidence-based practice (EBP) as they continue through their education, but students lack interest in EBP and nursing research. To increase relevance, the nurse research class was modified to emphasize EBP. Coordination with the students' first medical-surgical course and collaboration with the students' clinical units provided an opportunity for participation in a meaningful, real-life EBP project. Each clinical group identified a PICOT question, identified relevant evidence, and completed an appraisal of research related to their clinical question. They developed a hypothetical plan for implementation and evaluation for their EBP project. The students completed a brief literature review related to a clinical topic of interest and identified an evidence-based guideline and compared it to practice on the unit. The coordination between the research class and the medical-surgical class improved the relevance of EBP and research content. Clinical faculty reported the students were better prepared to identify a PICOT question and find evidence. The appraisals the students completed indicated a beginning understanding of research appraisal. Students expressed interest in dissemination of this teaching method, and a small group of students are working with faculty to prepare a manuscript about this approach to EBP.

The Slanger's Slang

Jon Haslam

Faculty Mentor: **Dr. Michael Kearns**

Slang is a very broad term and can range anywhere from *Cool* to the word *Bitchin*. (My dad thinks that one is hilarious). However, I focus my studies on two ideas.

1. How are slang words developed? Commonly, particularly in youth, individuals will use off- the-wall adjectives to describe a particular subject. Take for example the word *sick.* To a young male, a large insect on the ground could be deemed as *sick*, which means very visually appealing or cool; but in an altered context or for a different person, *That is sick* might mean something is absurdly gross or even unhealthy. Words hold different meanings for different people; sometimes a word can hold multiple meanings with a single person! Did somebody one day decide that *sick* is the new *cool* simply because the intended definition of the word meant nearly the opposite?
2. How do words become adapted and changed over the years? Take the word *legitimate* for example. Recently, many individuals slice the word in half and simply say the beginning part: *legit.* While this obviously isn't a word, individuals use it as a word sometimes even adding additional alterations to the already altered word. *Legitimately* has now turned into *legitly.* Even though the word was shortened to *legit,* some continue trying to apply standard basic grammatical rules to the fabricated words/phrases. If in individual tacks an -ly onto the end of a word, it is an attempt to create a usable adverb, even though a non-word follows no rules at all.

Preferential Preservation of Sedimentary Fabrics and Textures in Mudrock Concretions from the Hornbrook Formation (Upper Cretaceous) in Siskiyou County, California

Travis I. Hatfield

Faculty Mentor: **Dr. William S. Elliott**

The Hornbrook Formation (Upper Cretaceous) is made-up of approximately 1,200 m of mudrock, sandstone, and conglomerate exposed along the northeastern flank of the Klamath Mountains in Southwestern Oregon and Northern California. Concretions provide important depositional and sedimentological information that may not have been preserved and/or was obliterated by compaction in surrounding mudrocks. Calcareous concretions were collected from mudrocks in the Blue Gulch Mudstone Member of the Hornbrook Formation near the town of Hilt in Siskiyou County, California.

Calcareous concretions in the Blue Gulch are 10 to 50 cm in diameter with an elliptical shape elongated parallel to bedding and are typically encased within dark gray, siliceous silty mudrock. The concretions occur as either isolated bodies within silty mudrock or as bands along bedding within silty mudrock. These bands have been observed to extend up to 30 meters in the field. Ten samples of calcareous concretions were collected for further study. The concretions were cut using a water-lubricated rock saw and surfaces polished for examination.

At least six of the concretions contain preserved trace fossils including Chondrites, Helminthopsis, Phycosiphon, Planolites, and Thalassinoides. These burrows are only slightly compacted suggesting early cementation of these concretions in a shallow diagenetic environment. In three of the concretions, mollusk fragments with only minor fragmentation are present, also suggesting an early diagenetic origin for these calcareous concretions. At least three of the concretions contain disseminated pyrite with faint zoning within the concretion attesting to localized reduced conditions during their formation. Two concretions contain several fractures formed by dewatering of the mud prior to cementation. These cracks have subsequently been filled with siderite and/or calcite. Although these concretions have varied features, it is apparent from sedimentological observations that they formed early during diagenesis.

Synthesis of β-C-Glycosides of 2-Amino Sugars from Glycal Aziridines

Chelsea Heibel

Faculty Mentor: **Dr. Ken Walsh**

The majority of proteins found in nature are glycosylated, and the interaction of these glycoproteins is vital for many biological processes. C-glycosides are analogs of N- and O-linked glycopeptides which represent potentially useful probes for understanding cellular carbohydrate function and regulation. The intent of the current study is to generate the β-anomer of these sugars through specific ring opening mechanisms of the intermediate glycoside containing an aziridine ring. Tri-O-acetyl-D-glucal was individually treated with (1) Ph-N3, (2) PhI=NTs, and (3) PhI(OAc)2 after successful trial runs using styrene, but synthesis of the desired product has proven to be difficult to accomplish. Treatments (1) and (3) were also attempted using tri-O-benzyl-D-glucal to evaluate the effect of steric influence from the protecting groups on the aziridine ring formation. This presentation outlines the reactions attempted in pursuit of D-glucal aziridine ring formation and opening. Further attempts at synthesizing these compounds are needed to determine whether the formation of the β-anomer can be achieved.

Assessment of the University of Southern Indiana's Microbiology Laboratory Regarding Aseptic Technique and Biosafety Guidelines of Salmonella Species and Serovars

Levi C. Holscher

Faculty Mentor: **Ms. Stephanie Bush**

The goal of this experiment was to assess laboratory safety guidelines within the University of Southern Indiana's microbiology teaching lab. It was hypothesized that laboratory stock *Salmonella* could be found in various locations around campus and on individuals within the teaching lab. According to the Center for Disease Control, over 42,000 laboratory-confirmed cases of Salmonella occur in the United States annually. Of those 42,000 cases, 73 were linked directly to microbiology teaching labs in 2011/2012 All of the laboratory acquired cases could have been avoided through proper biosafety guidelines and aseptic laboratory techniques.

There was no positive confirmation of *Salmonella* species linked to the 120 swabbing locations around the University of Southern Indiana. The swabbing started on 9/27/12 and was completed on 11/8/12. No significant evidence was found to link the microbiology lab's stock *Salmonella* strain to any location tested. Future research could be conducted to test students as well as locations.

Parkour Training for Youth

Hannah Hosterman

Faculty Mentors: **Dr. Renee Frimming & Dr. Jason Langley**

Communities and schools strive to find ways to increase physical activity and health among youth to help reduce obesity. Obstacle courses used in Parkour training are designed for strength training, speed, and agility. This study is aimed at enhancing physical activity levels of elementary students through Parkour training.

The goal of the project is to reduce childhood obesity in elementary school students through increased physical fitness. The objective is to improve elementary students' understanding of fitness through Parkour training, which will be assessed by measuring physical fitness (FitnessGram) administered to the elementary students. Pre- and post-vertical jump and reach measurements will be conducted also. Twice a week for 45 minutes, elementary school students participate in Parkour training. The training activities focus on developing multiple dimensions of fitness and wellness. Thirty-two (n=32) 3rd, 4th, and 5th graders (experimental) complete obstacles using agility ladders, balance beams, hurdles, plyo boxes, Bosu balls, stability balls, medicine balls, and kettle bells. Twelve (n=12) 3rd, 4th, and 5th graders (control) complete more traditional physical activities and nutritional education twice a week for 12 weeks. Both the experimental and control groups were pre-tested using the FitnessGram and vertical jump and reach. At the end of April, post-test data will be collected during the 12th week of the training program. Data will be analyzed from the results of the pre- and post-tests.

The Plyboo Bicycle Project

Nicholas Jay

Faculty Mentor: **Mr. Rob Millard-Mendez**

The Plyboo Bicycle is a project that allows the world of environmentally friendly products to be viewed in a functional yet artistic way. The idea of building a bicycle first came to mind when trying to find a way to cut down on my environmental impact. The name of the project came from the product used to create the frame of the bicycle, Plyboo, a revolutionary, environmentally friendly product that has recently been introduced into the retail market. Plyboo is made of bamboo, a grass-like plant which grows at incredible rates with great strength. What makes Plyboo environmentally friendly is the way it grows because once bamboo is planted, it grows stubbornly. After the plant grows, it is then harvested in a way that allows it to grow after it is cut. Through this project, my goal was to create an eco-friendly, function piece of artwork that can be ridden on a daily basis. Along with this project, I created a blog not only to track progress but also to show how one could create an eco-friendly bicycle, with simple tools from any local hardware store. The link the blog is plyboobikeproject.blogspot.com

Comparative Look at the Reproductive Systems of *Pongo pygmaeus, Pisaster ochraceus, Apis Mellifera*

Alexandra Jordan & Kaetlyn Schmelzer

Faculty Mentor: **Dr. Mari Hopper**

One of the basic characteristics of a living organism is the ability to reproduce. By analyzing the reproductive systems of species from three different phyla, evolutionary divergence and ancestry can be better understood. For this presentation, a literature review of the systems of *Pongo pygmaeus, Pisaster ochraceus,* and *Apis mellifera* was completed in order to compare and contrast physiology and behavior related to reproduction. All three species were distinctly different from one another with a few characteristic similarities. Furthermore, all three organisms depend greatly on the stability of their environment in order to reproduce successfully.

Petrography and Geochemistry of an Ultramafic Dike in Southern Illinois

Maxwell King

Faculty Mentor: **Dr. Anthony Maria**

Since at least the early 1950s, workers have noted ultramafic igneous dikes and breccias within the New Madrid Rift Complex scattered through parts of Illinois, Missouri, Kentucky, and Tennessee. Nevertheless, the nature and origin of these rocks has not been fully resolved largely due to their susceptibility to weathering. We recently sampled a dike freshly exposed in the Cottage Grove Coal Mine (Peabody Coal) near Eldorado, Illinois, approximately 27 km northwest of Hicks Dome. This near vertical dike, approximately 10 m wide and trending N20W, is clearly silicate at its interior but transitions to a carbonate-rich composition towards the dike margins, which are mildly brecciated. The goal of this study is to characterize the mineralogy and geochemistry of the intrusion, to investigate the nature of the melting event that produced it, and investigate the relationship between the silicate magma and the associated carbonate material. We present modal data for samples, which are dominated by phlogopite and serpentinized phenocrysts that appear to have been olivine. In addition, the samples contain large partially altered clinopyroxene phenocrysts, abundant apatite, occasional small garnets, Fe-Ti oxides, carbonate, and a phase that is probably perovskite. We await microprobe data that will allow us to definitively identify some of the phases. In addition, the probe data (compositions of the phlogopite and clinopyroxenes) will be helpful for naming the rock which seems to fit the description of an aillikite. Major element composition, with approximately 33-34 wt. % SiO_2, 7-8% Al_2O_3, 11-13% FeO(total), 14-17% MgO, 9-14% CaO, 0.5-1.5% Na_2O, 2% K_2O, and 1% P_2O_5 is consistent with an ultramafic lamprophyre. We await trace element data that will further help characterize the magma, the melting event, and the source rocks. In addition, as samples were collected at 1-foot increments across the width of the dike, we plan to use trends in incompatible trace element concentrations to evaluate a possible origin for the carbonate by devolatilization from the silicate magma.

Effect of Meal Composition of Postprandial Blood Glucose Levels in College Students with varying BMIs and Exercise Patterns

Carynn Koch & Jennifer Koch

Faculty Mentor: **Dr. Mari Hopper**

We investigated the effects of meal composition and levels of physical fitness and body composition on postprandial blood glucose. For 20 college students, BMI was determined and classified (High BMI ≥25; Low BMI <25). Participants self assessed their physical fitness using a Likert type scale (High Fit >5; Low Fit ≤5). Subjects completed an oral glucose tolerance test (OGTT) and in following weeks consumed one of three breakfast meals (all 520 kcals) following an overnight fast in random order: 1) energy drink and toaster pastry; 2) ham and cheese; 3) bagel, peanut butter, and banana. An Accucheck® glucometer was used to determine fasted, 30, 60, and 120 minute postprandial blood glucose levels. All fasted glucose values were normal. Two-hour OGTT glucose remained above 130 mg/dL in both the High BMI and Low Fit groups. Low Fit glucose levels were significantly higher than High Fit at all time periods for both toaster pastry and bagel meal treatments. Similarly, High BMI glucose levels were higher than Low BMI by10.5% at 30 min, 15.8% at 60 min, and 20.8% at 120 min.

The greatest differences in blood glucose level occurred at two hours following the energy drink and toaster pastry (Low BMI 90±3.3 vs High BMI 120±15.3 mg/dL). These results indicate that postprandial blood glucose response depends on both meal composition and the individual's BMI and level of physical fitness.

PM3 and PM6 Calculations on Organometallic Dehydrogenation Catalysts

Allison M. Konieczki, Sarah B. Schwartz, & Lauren A. Martin

Faculty Mentor: **Dr. Jeff Seyler**

The catalytic mechanism for Iridium pincer dehydrogenation catalysts have been studied with semi-empirical methods. The intent of the current study is to compare the results of past PM3 calculations (Spartan '10, Wavefunction, Inc.) with results using the newer PM6 level of theory. For this report, we have examined the dissociation of cyclooctene from the iridium complex containing the isopropyl substituted PCP pincer ligand. This is a critical step in the catalytic cycle where catalyst regeneration occurs following the dissociation.

The energy diagram of this portion of the cycle was investigated to yield the energy of the Iridium-cyclooctene complex, along with the energies preceding the regenerated catalyst and dissociated cyclooctene. Geometry optimizations with PM6 have proven to be problematic with these organometallic systems. In cases where PM6 optimization failed to generate appropriate geometries, single point calculations were performed using the PM3 optimized geometries.

Comparison of the Perceived Key Concepts in Biology, Chemistry, and Geology Across Educational Levels

Josh Long & Chelsy Calhoun

Faculty Mentor: **Dr. Jeff Thomas**

Over a one-year period, data were collected from high school teachers, college students, and college professors about what they perceived were the most important concepts in their areas of study. Data were collected from populations in biology, chemistry, and geology. The purpose was to determine how much overlap existed.

Undergraduate science students and their faculty Mentor collected the data as part of a college supported early undergraduate research program. Inter-rater agreement was conducted so that data could be collapsed into common fields (concepts). Data were placed into a database and then extracted to yield final results for analysis. Results indicate that biology had the strongest alignment across populations; geology had the second strongest alignment; and chemistry had the third strongest alignment. The results are now being shared among education stakeholders to communicate the perception of the key concepts and how curriculum can be aligned across high school and college classrooms.

Biodiversity of *mycetozoa*: Addressing Questions of Species Identification Using DNA Sequence Analysis

Zebulon Isaac Mathis

Faculty Mentor: **Dr. Katherine Winsett**

Dictyostelids are one of the two groups of true slime molds or Mycetozoa. These organisms have a unique life cycle with an amoeboid vegetative phase and multicellular, spore-producing fruiting bodies. In nature, dictyostelids are soil-inhabiting organisms that prey upon single-celled bacteria and fungi. There are approximately 100 known species with new species found regularly as the techniques of molecular biology are used in the analysis of soil. It is know that Mycetozoa can be extremely abundant in soil, but their actual function and diversity is largely unknown. The purpose of this research was to produce DNA sequences to further describe samples from Thailand including a few samples that did not fit the description of currently recognized species. The internal transcribed spacers (ITS 1 and 2) along with the 5.8S region of the nuclear ribosomal gene were amplified through PCR and sequenced. Using the sequences, we developed a phylogenetic tree using known gene sequences for other dictyostelid species from GenBank to determine the most closely related species for each sample examined.

Oxidative Addition of Alkanes to Iridium Pincer Complexes

Lauren Martin

Faculty Mentor: **Dr. Jeff Seyler**

Iridium pincer complexes have proved to function as dehydrogenation catalysts. An early step within the catalytic cycle involves the activation of a C-H bond through oxidative addition. We have studied this process with semi-empirical methods. The intent of the current study is to compare the PM3 calculations with the newer PM6 level of theory (Spartan '10, Wavefunction, Inc.). For this report, we have examined the reaction of cyclooctane as the C-H source with an iridium complex containing an isopropyl substituted PCP pincer ligand. In previous reports, the oxidative addition step has been claimed to control the activation energy of the overall process. We have attempted to obtain transition states for this process in our model complex. Comparison of geometries and energies obtained with the two semi-empirical methods will be presented.

Ars Poetica: Storytelling

Morgan Opolski

Faculty Mentor: **Dr. Michael Kearns**

This poetry collection titled "Ars Poetica: Storytelling" was written for the 2013 Sigma Tau Delta International Convention. This collection focuses on the act of storytelling as a way of learning about our histories, cultures, and ultimately about us. It builds on the Native American culture and their reliance on storytelling to learn about their history, ancestry, and themselves both as a culture and as individuals. Furthermore, this piece includes parts of the narrator's story as she learns her history and culture through the stories she's heard. The second poem, "Old Bones and Pride," focuses on the parts of a culture's stories that we consider to be undesirable but are inescapable. This poem was written as a type of Spoken Word, a poetry type that is used to call the audience's attention to sort of some human aspect or injustice. The poem fights with the parts of our stories that we do not wish to accept and explores how we descendants could not control those parts but must now accept as them as the foundation of our culture: Horrific acts of injustice are our own. The last poem shows how our stories define us by showing the reader a diasporic community—people who are from two places at once with a new culture and community with new stories and a new language, but they sit around in a circle and tell their own stories in their own tongue as the Native American cultures once did. It shows how they accept being from two cultures simultaneously the way we must accept the undesirable parts of our own histories as part of ourselves.

Comparative Study of Locomotory Systems Across Three Phyla

Jarod Allen Richards & Alex Arwood

Faculty Mentor: **Dr. Mari Hopper**

Locomotion is accomplished in many different ways across all the phyla. It provides a means of food acquisition, predation, and safety. This presentation focuses on organisms from three distinct phyla, Echinodermata, Mollusca, and Chordata. While the use of locomotion varies between organisms, individual form meets function in regard to niche. *Asterias rubens* is the model species of the phyla Echinodermata and has evolved specific locomotory behaviors as a benthic, marine dwelling organism. Its five arms are branches of the body itself. Tube feet are the primary locomotive organ of *A. rubens* and are unique to the phyla. *Enteroctopus dofleini* represents a typical octopod with two major forms of locomotion. Walking requires less energy expenditure, is used within reefs, and is performed by highly muscularized arms and suckers. Jetting is utilized in short bursts or migration and is accomplished via the expansion and contraction of mantle cavity volume. The locomotory capability of *Falco peregrinus* is interesting due to its ability to travel at and withstand high speeds. After diving from a perch, *F. peregrinus* uses an extremely derived body plan and large keel musculature to reach speeds of over 200 miles per hour. A highly effective respiratory system allows the predator to withstand 25 times the force of gravity.

Each of these organisms evolutionarily developed specific locomotory physiologies in order to accomplish a certain niche. For the sea star, the niche was a slow moving, bottom dwelling predator. The octopus filled the role of a reef based predator that utilizes multiple means of underwater locomotion. A peregrine falcon maximized its flight power and aerodynamics over time to generate and withstand incredible velocities. Overall, each phyla established its respective locomotory behaviors to suit an environmental role.

Analysis of Hindwing Oscillation Frequency of local *lycaenids*

Douglas Alexander Rose

Faculty Mentor: **Dr. Eric McCloud**

We studied the hind wing oscillation frequency of two Lycaenid butterflies (*Lepidoptera: Lycaenidae*) in Southern Indiana to determine if there were a difference in hind-wing oscillation frequency between species or locations. The two locations were an indoor cage and the butterflies' natural habitat. Observations were recorded by video and later analyzed using position tracking software. The software was used in order to map the movements of the recorded subjects. Fast Fourier transformation was applied to the oscillation to find the most important frequencies contributing to the overall wing movements. Finally, statistical analysis was utilized to compare oscillation frequencies between species and locations. There were significant differences between species and locations.

SAE Baja Drivetrain

Frank Rynkiewich & Patrick Elpers

Faculty Mentor: **Dr. Julian Davis**

Each year the USI Society of Automotive Engineers (SAE) Baja team competes in the SAE Baja Design Series Competition, which is a series of events and races that test different aspects of the Baja cars. A Baja car is a small off-road vehicle similar to an all-terrain vehicle (ATV) or utility terrain vehicle (UTV).

The goal of this year's team was to reduce the overall weight for the 2012-2013 car, and in fact much weight can be eliminated from the drivetrain subsystem alone. One such component of the drivetrain that lent itself to weight reduction was the transmission. The previous car's transmission took advantage of a standard, linear parallel-shaft gear train; however, a different type of gear train was analyzed and eventually selected for use in this year's car. This type of gear train was a planetary layout, which would be custom-designed and built by the USI Baja team and would allow for both forward and reverse operations. The Endeavor Grant money was used to fund the material costs of the transmission components and other drivetrain elements such as the continuously variable transmission (CVT) and differential.

Characterization of Methyl-Accepting Chemotaxis Proteins in *V. fischeri* Using the Quantitative Capillary Assay

Joseph Richard Schaefer

Faculty Mentor: **Dr. Cindy Deloney-Marino**

Research has shown that intimate associations between organisms, known as symbioses, are prevalent throughout the animal and plant kingdoms. One such relationship is the long-term association between the bioluminescent marine bacterium, *Vibrio fischeri*, and the Hawaiian bobtail squid, *Euprymna scolopes*. Questions that remain regarding the establishment of this relationship are how microbial symbionts are attracted to their animal host and what specific chemical signals and receptors may serve to attract the bacterial cells to colonize the squid light organ. This research explores bacterial chemotaxis in *V. fischeri* by investigating the role played by specific methyl-accepting chemotaxis proteins (MCPs) in the bacterium to probe the chemical signals that are relevant to bacterial colonization of the squid light organ.

Previously, we identified a number of attractants for *V. fischeri* using the qualitative chemotaxis soft agar assay. Among these is chitobiose, the disaccharide subunit of chitin, the presence of which we have recently shown is required for the bacterium to enter into the ducts that lead to the light organ. Initial tests of 21 confirmed MCP mutants using the soft agar assay identified only a single chemoreceptor gene specific for serine demonstrating that the swim plate assay has major limitations. We aim to study the process of chemotaxis further in *V. fischeri* by screening these same mutants for altered chemotaxis phenotypes using the quantitative chemotaxis capillary assay. This assay has allowed us to confirm the identity of the *V. fischeri* serine chemoreceptor VfcA and to identify tentatively two other MCP mutants that are deficient in attraction for chitin subunits. Ultimately each mutant will be tested for the ability to colonize juvenile squid to determine if the altered phenotype affects the bacterium's colonization competency.

Hydrogen Production Through Beta-Elimination

Sarah Schwartz

Faculty Mentor: **Dr. Jeff Seyler**

Semi-empirical methods are used to investigate the catalytic mechanisms of iridium pincer complexes in dehydrogenation reactions. PM3 and the newer PM6 semi-empirical methods can be used to calculate geometries and energies of chemicals within these mechanisms. The mechanism includes a β-elimination step within the catalytic cycle and was the focus of this study. PM3 and PM6 transition state calculations were performed, and the results where compared. The catalyst was an iridium-based pincer with isopropyl groups. The substrate used in this study was cyclooctane. The PM6 geometry optimizations had little success, so many of the PM6 calculations are single point calculations of results derived from PM3 calculations. This presentation will delve into the results of the calculations found for the β-elimination and the implications it has on the potential production of hydrogen.

2013 ASCE Concrete Canoe - "Rhoboat"

Katie Shaw and Donald Shaw

Faculty Mentor: **Dr. Kerry Hall**

The University of Southern Indiana (USI) student chapter of the American Society of Civil Engineers (ASCE) is traveling to the regional concrete canoe competition, hosted by Trine University in Angola, Indiana. The canoe shape and concrete mix were developed through research and materials testing as well as structural calculations. At the competition, the team will present their findings from hull design, structural analysis, and concrete mix design. The culmination of the canoe competition will be the canoe races where teams of two men, two women, and a co-ed team of four (two men and two women) will participate in canoe races against the other schools. This will be the final demonstration of how the research and analysis developed throughout the year were combined in canoe design.

The 2nd Cholera Pandemic, Its Effect on Society and Disease in the Harmonist Utopia, or How I Learned to Create and Manage a Finding Aid

John Sureck

Faculty Mentors: **Dr. Casey Harison & Ms. Jennifer Greene**

As part of a joint effort between USI's Center for Communal Studies and the University Archives and Special Collections funded by Endeavor! Awards for Research and Creativity, I have begun a twofold project: create a finding aid for the Harmonist papers in the USI Archives and research how the cholera pandemic that plagued Europe and America, 1830-1850, affected societies, primarily the Harmonists. I will discuss how I created a finding aid from the largely untouched group of documents formerly used by Dr. Karl Arndt during his research into the Harmony Society. These unorganized papers contain primary documentation about the Harmony Society and the general state of trade, government, and affairs affecting areas that surrounded Harmonist towns. In addition, through use of these documents and secondary sources focusing on both cholera and the Harmonist Society, I will construct a picture of the time period's understanding of health, treatment, and the social responses to the second cholera pandemic. By looking at these reactions, I hope to construct a more complete picture of how cholera and disease were dealt with in the 1830-1850 time period.

Late Quarternary History and Geomorphology of an Underfit Stream Valley in Southern Vanderburgh County, Indiana

John D. Talley

Faculty Mentor: Dr. Jim Durbin

This research explores the Quaternary history of an underfit stream valley near the campus of the University of Southern Indiana. The study area is a plot of abandoned agricultural land situated in a north-south oriented valley flanked by loess-capped highlands to the east and west underlain by glaciolacustrine sediments and Quaternary alluvium. A stream flows north to south through the valley, meandering, but generally hugging the western margin of the valley. The stream width averages 6.0 m ± 1.6, has steep ~2 m high incised banks, and drains a basin of 3.7 km^2. The valley, by contrast is 230 m wide on average, producing a stream width/ valley width ratio of 0.03, and categorizing it as underfit. The area lies 30 km south of the Illinoisan glacial maximum and 170 km south of the Wisconsinan glacial limit.

Sediment cores and soil pits reveal sand to sandy silt at a depth of 3.26 to 3.35 m overlain by 0.82 to 2.25 m of sandy silt determined to be of locally derived fluvial origin. Overlying these sediments is a 30 cm to 1 m thick layer of silt to clayey silt probably derived from locally common loess-covered uplands and deposited as floodplain sediments. Wakeland series soils developed in the upper silt are poorly drained, with Ap/Bt/C profiles extending through the silt into the uppermost part of the silty alluvium. The subsoil sediments include cross-stratified sands, poorly sorted, non-imbricated siltstone and sandstone pebbles and granules interpreted as levee deposits, and silt and clay interpreted as floodplain deposits. The lack of laminar bedding in the fine sediments as well as the presence of an acorn, a gastropod shell, and charcoal found in this layer support the floodplain interpretation rather than a lacustrine environment found elsewhere in tributaries to the Ohio River.

The sequences of sediment interpreted as fluvial and the small stream/valley width ratio support the hypothesis that the sediments in this valley are the products of a stream that may have been larger in the past than it is now. It is unlikely however, that glaciation played a critical role, and geomorphic evidence suggests that structural elements are likely responsible for the valley configuration and late Pleistocene Holocene stream behavior.

Flexural Stiffness of the Hindwings of *Lycaenidae* Butterfly

Evan Michael Taylor

Faculty Mentors: **Dr. Eric McCloud & Dr. Julian Davis**

Insect wing mechanics have been studied with the motivation of characterizing the relationship between flight and mechanical properties including flexural stiffness. Lyceanid butterflies offer a different mechanism for which flexural stiffness may contribute to behavior. Lycaenidae have characteristics of their hind wings that are described as a false head including posteriorly oriented wing projections called tails. While maneuvering on a substrate, many Lycaenidae fold and oscillate their hind wings along the cephalic-caudal axis. At this time, the tails oscillate in a peculiar bouncing motion. This is called false head behavior. One of the predictions from the False Head hypothesis posits that false head behavior deflects predator attacks away from the vulnerable body and head toward a weaker decoy region of the insect that can break away upon attack similar to the autotomizing tails of lizards. We predict that this weaker region in the hind wing may be a result of decreased modulus.

We measured flexural stiffness profiles of butterfly wings along the length of the wing. We used these measurements along with finite element models to predict average modulus of the wing. Uniform moduli of wing membrane and wing vein structures can predict the flexural stiffness to within approximately 18% of mechanically tested wings. However, preliminary results indicate regional variation of wing moduli allows us to better capture the flexural stiffness profile observed in experimental data. In addition, dynamic analysis of the wing models indicates that there may be a mechanical relationship between hind wing movement and tail bouncing.

Don't Forget Me When I'm Gone: Examining Relationships between the Living and the Dead through Decorated Headstones

Jillian Utter & Ashley Christianson

Faculty Mentor: **Dr. Susan Spencer**

Decorated headstones from two Evansville, Indiana, cemeteries were examined in order to understand the relationships between the living and the dead. This study specifically aimed to examine how the identity of the decedent affects whether their loved ones will continue to decorate their headstone after their death. Decorations left on headstones commonly included flowers, ceramic figurines, flags, letters, and decorative seasonal items. It is expected that the type and number of decorations left on headstones will be dependent on the sex and life stage of the decedent. We expected that most loved ones would not continue to decorate headstones after five years since death. Online memorial web pages were used to understand the life and death of people with elaborately decorated headstones. This data elucidates the very active relationship that the living continues to share with the dead.

Mitotic Localization of the CIN-4 Protein in *Caenorhabditis elegans*

Brittany Verble

Faculty Mentor: **Dr. Landon Moore**

Gene duplication can lead to the creation of new genes which may retain former gene functions or may acquire new gene functions. The gene cin-4 found in Caenorhabditis elegans is a partial duplication of the C. elegans topoisomerase II (top-2) gene. Topoisomerase II genes are found in many organisms and are essential for removing DNA topological linkages created during DNA replication. Orthologs of cin-4 are not found in other species of Caenorhabditis suggesting that the duplication creating the cin-4 gene occurred in the C. elegans lineage. Previous results indicated that cin-4 and top-2 are both expressed and have distinct functions in maintaining genome stability. The cin-4 gene is 89% similar to the catalytic domain of top-2. To further characterize this emerging gene family, we undertook to determine the localization patterns of the CIN-4 and TOP-2 proteins in C. elegans embryos. Antibodies directed against each protein were generated and used for immunofluorescence microscopy. Both the CIN-4 and TOP-2 proteins were observed to localize to mitotic chromosomes; however, the localization patterns were spatially and temperally different. To extend these studies, we plan to create fluorescently tagged versions of the cin-4 gene. We will fluorescently tag the cin-4 gene by fusing it with the Green Fluorescent Protein (GFP), a gene which produces a small protein that can be made to fluoresce. The fusion product will be used to construct transgenic strains of C. elegans via biolistic transformation that will express the cin-4-GFP fusion. Establishment of these strains will allow for the creation of site-directed mutations to investigate the sites important for localization and gene function. By determining the roles that cin-4 plays in genome stability, the role of topoisomerase II may be further expanded aiding in the designing of cancer therapies that target topoisomerase II.

Modeling Transition States of Fluoride Substitution in F-BODIPY with Organometallic Alkynyl Reagents

Matthew Vincent

Faculty Mentor: **Dr. Priya Hewavitharanage**

Substitution of the fluorine atoms bonded to the boron center in 4,4-difluoro-4-bora-3a,4a-diaza-s-indacene (F-BODIPY) compounds with alkynyl and aryl anions is used to attach other chromophores to the BODIPY dye. This can be achieved through either Grignard or organolithium reagents. Mono- and disubstituted alkynyl products can be isolated using Grignard reagents whereas only the disubstituted alkynyl product is isolated using lithium reagents. Using SPARTAN '08 modeling software to perform quantum chemical calculations, transition states for mono- and disubstitution processes were modeled for both Grignard and lithium trimethyl silyl protected ethynyl reagents. Differences in theoretical activation energies between the first and second substitution steps were -11.3 kJ/mol for the lithium reagent and +35.9 kJ/mol for the Grignard reagent. These differences support the unavailability of monosubstituted alkynyl -BODIPY when the lithium alkynyl reagent is used.

Synthesis of Novel Amphiphilic BODIPY Derivatives with Hydroxyl Groups for Live Cell Imaging

Matthew Vincent

Faculty Mentor: **Dr. Priya Hewavitharanage**

New BODIPY derivatives with one 4-hydroxy-1-butynyl group at the 2 position and two 4-hydroxy-1-butynyl groups at the 2, 6, or 4, 4' positions were conveniently synthesized using tert-butyldimethylsilyl (TBDMS) protected alcohols. Deprotection of TBDMS of 4, 4' substituted BODIPY was achieved using tetrabutylammonium fluoride (TBAF) while deprotection of 2 and 2, 6 substituted BODIPY was achieved with acetyl chloride to obtain corresponding alcohols in excellent yields. All BODIPY derivatives with TBDMS protected alcohols fluoresce in higher quantum yields when compared to those with free hydroxyl groups. Cell uptake experiments showed that these compounds are accumulated in human osteosarcoma (Saos-2) cells. The main site of localization for 4, 4' substituted compound was found to be the endoplasmic reticulum (ER). This makes our compounds useful as potential ER markers for fluorescence microscopy. Some of these compounds form excimers inside cells as well as in CH_2Cl_2 solution.

Synthesis of Green, Red and Far Red Emitting 3-ethynylthiophene Substituted BODIPY Dyes

Reuben Warshawski

Faculty Mentor: **Dr. Priya Hewavitharanage**

Novel BODIPY derivatives with one 3-ethynylthiophene unit at the 2 position and an iodine at the 6 position or two 3-ethynyl units at the 2, 6 positions or the 4,4' positions were synthesized. The derivative with 4, 4' substitution emits in the green (λmax 524 nm) while the 2,6 substituted derivative emits in the red (λmax 595 nm). Placing a styryl group at the 3 position of the 2,6 substituted derivative through Knovengeal condensation resulted in a far red emissive BODIPY derivative (λmax 635 nm). All the 3-ethynylthiophene containing compounds were taken up and accumulated in human osteosarcoma cells. In addition, they showed phototoxicity indicating possible singlet oxygen generation. Photooxidation of 1,5-dihydroxynapthelene to juglone in the presence of 3-ethynylthiophene substituted BODIPY derivatives confirmed the singlet oxygen generation.

The Invariant Measure for Anderson Localized Negative Index Metamaterials Continuously Disordered

Aaron M. Williams

Faculty Mentor: **Dr. Glen Kissel**

We consider one-dimensional photonic bandgap structures with negative index of refraction materials modeled in every layer or in every other layer. When the index of refraction is randomized, and the number of layers becomes large, the light waves undergo Anderson localization resulting in confinement of the transmitted energy. Such a photonic bandgap structure can be modeled by a long product of random transfer matrices from which the (upper) Lyapunov exponent can be calculated to characterize the localization effect and thereby further understanding of the phenomenon. Furstenberg's integral formula can be used to calculate the Lyapunov exponent via integration with respect to the probability measure of the random matrices and with respect to the so-called invariant probability measure of the direction of the vector propagated by the long chain of random matrices. This latter invariant probability measure, so fundamental to Furstenberg's theorem, is generally impossible to determine analytically. Here we use a bin counting technique with Monte Carlo chosen random parameters from a continuous distribution to numerically estimate the invariant measure and then calculate Lyapunov exponents from Furstenberg's integral formula. This result, one of the first times an invariant measure has been calculated for a continuously disordered structure made of alternating layers of positive and negative index materials, is compared to comparable results for positive index structures.

The Isolation and Amplification of the Actin Gene Sequence for the Slime Mold *Stemonitis flavogenita*

Brett Williams

Faculty Mentor: **Dr. Jeanne Collins**

Stemonitis flavogenita is a slime mold which is not often studied, and its genome is not currently known. This research focuses on the isolation of the actin gene sequence. Actin is a cytoskeletal protein and is highly conserved among the eukaryotes. DNA and RNA were extracted from both the aphanoplasmodial and coralloid stages of *S. flavogenita.* Using a sequence alignment program, other actin sequences were aligned and used to help design primers for PCR. The isolated RNA was used to produce cDNA using specific primers, and then the cDNA and DNA samples were amplified using PCR. The PCR was performed using a temperature gradient. The samples were analyzed to determine the size of the DNA fragments produced.

Development of a Carcerand for C60

Nathaniel J. Williams

Faculty Mentor: **Dr. Edmir Wade**

The field of organic chemistry, though very diverse in nature, has in the last decade, become particularly interested in the area of host molecules. The reason behind this interest is the unique properties associated with these molecules' ability to detect, encapsulate, and transport a host-specific molecule to a targeted site. This ability opens the door to a wide variety of applications for these molecules. The primary focus of this study was to produce such a carcerand that was capable of hosting C60 guest molecules based on the allotted intermolecular interaction properties of the molecule's structure. Upon assembly of the molecule, the aromatic nature of the host and guest will allow for the interaction to be monitored via ultraviolet/visible spectroscopy or fluorescence. This detectable nature of the host and guest complex allows for potential advances in medicine in applications stemming from molecule detection.

Distribution of Income, Health, and Education Life Chances in Brazil, Chad, and The Philippines

Tyler Wink

Faculty Mentor: **Dr. Stephen Zehr**

Nation-specific data on resource distribution and life chances may be used for international policies that address economic and social deficiencies. These data are often aggregated at the regional level, which may lead to inadequate compensation for individual nations' needs. There is a need for more focused study of resource distribution and life chances at the level of individual nations. This research focuses on economic, health, and educational inequality in three countries: Brazil, Chad, and The Philippines. Most recent data were collected from The World Data Bank. The analysis focuses on patterns in the linkage between economic conditions and health and educational quality. While past research has often collapsed data at the regional or global level, this project identifies more subtle and surprising differences among these nations.

Development of a Calixarene-Based Carcerand

Bi Yu You

Faculty Mentor: **Dr. Edmir Wade**

In recent years, host molecules have been a special focus in organic chemistry. This interest was due to the molecule's ability to encapsulate, detect and transport host specific molecules to target sites, which incorporates multitudes of applications. The prime focus of this project was to develop the revolving door carcerand which has the capability of hosting C60 guest molecules via intermolecular interactions. This host molecule is named so due to the rotating subunits that make up the structure. In light of the project, the revolving door carcerand is made of three subunits: calix[4]arene, dihydroxydithiane, and anthracene dicarboxyaldehyde based subunits.

The project is aimed at developing the different subunit followed by their successful coupling. The calixarene-based subunit is the crown that enables the host molecule to complex with its C60 host. The aromatic nature of the host and guest will allow for the complexation to be monitored through Ultraviolet/Visible spectroscopy or fluorescence. This host molecule has the potentiality of advancing applications in medicine, molecule detection, and forensics.

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