

16th Annual Symposium

2017



USI
ENDEAVOR

AWARDS *for*
RESEARCH & CREATIVITY



Carter Hall
and
University
Center East



USI.edu/endeavor



April 6, 2017

Dear Endeavor Participants:

Welcome to the 16th 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,

A handwritten signature in black ink that reads "Linda L. M. Bennett". The signature is fluid and cursive, with the first name "Linda" being the most prominent.

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



April 6, 2017

Dear Endeavor Symposium Presenters and Sponsors:

Welcome to the 2017 Endeavor Symposium. As I'm sure you've come to appreciate, combining research and learning is one of the best ways to get the most out of your time here at USI, and I hope that the experience has helped to develop strong ties to your education – ties that you will take with you after you leave the university.

You have worked hard on your projects and we are proud to give you the chance to present the results of your work to the USI community.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael Strezewski". The signature is fluid and cursive, with a large loop at the end.

Michael Strezewski, Ph.D.
Associate Professor of Anthropology
Director, Endeavor Research and Creativity Awards

Endeavor Symposium Program

Thursday, April 6, 2017

- 7:30 – 8:30 a.m. **Check-in** for all presenters and sponsors: Pick up your programs and ID badges at registration table (located in 2nd floor UC hallway, next to Conference Services Desk).
- 8:30 – 11:00 a.m. **Oral Presentations**, Rooms UC 2205, and 2206.
- 8 a.m. – Noon **Poster Sessions**, *University Center, Carter Hall D* (note: all posters must be removed from Carter Hall D by noon).
- 12:00 – 1:00 p.m. **Endeavor Luncheon** for student participants and mentors, *Carter Hall A-C*. Your badge will serve as your lunch ticket.

Endeavor Research and Creativity Awards Committee

- Dr. Michael Strezewski Director of Endeavor Awards for Research and Creativity,
Associate Professor of Anthropology, College of Liberal Arts
- Dr. Jeannie Collins Associate Professor of Chemistry, Pott College of Science,
Engineering, and Education
- Ms. Rebecca Deeg Grant Administrator, Office of Planning, Research, and
Assessment
- Dr. Ronald Diersing Associate Professor of Engineering, Pott College of Science,
Engineering, and Education
- Dr. Lifang Gao Assistant Professor of Management, Romain College of Business
- Mr. Rob Millard-Mendez Associate Professor of Art, College of Liberal Arts
- Dr. Erin Reynolds Assistant Professor of Health Services/Administration, College of
Nursing and Health Professions
- Dr. Edmir Wade Associate Professor of Chemistry, Pott College of Science,
Engineering, and Education

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, Associate Provost for Academic Affairs
- Michele Duran, Senior Administrative Associate, Office of the Provost
- Kathryn Reneer, Manager of Conference and Meeting Planning
- Romain College of Business
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- College of Nursing and Health Professions
- Pott College of Science, Engineering, and Education
- USI Honors Program

Endeavor Faculty Mentors

- Dr. Alex Champagne
- Mr. Eric Cope
- Dr. Srikanth Dandotkar
- Dr. Kimberly Delaney
- Mrs. Jody Delp
- Dr. Paul Doss
- Dr. William Elliott
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- Ms. Nancy Raen-Mendez
- Dr. Melinda Roberts
- Dr. Natasha Smith
- Dr. Rebecca Sparks-Thissen
- Dr. Melissa Stacer
- Dr. Rex Strange
- Ms. Jane Vickers
- Dr. Edmir Wade
- Ms. Carrie Wright

8-9 a.m. POSTER SESSION

Carter Hall D

Rachel Cash	Interprofessional Teamwork: Improving the Community Healthcare Experience
Aaron Costlow	Antimicrobial Properties in the Stems of <i>Epiphyllum strictum</i> and <i>Epiphyllum oxypetalum</i>
Tabatha Loppnow	Effect of Seasonal Changes on Antimicrobial Defenses in the Avian Stratum Corneum II: Antimicrobial Activity in Lipids
Victoria Pigg	Effects of Ambient Temperature on the Organization of Lipids of the Avian Stratum Corneum
Mananchaya Potchanant	Correlation of the Thickness of Enamel and Diet Between Carnivores, Herbivores, and Omnivores
Shayna Roos and Anna Riebel	Creating Resources for the Community Utilizing Interprofessional Collaboration
Rachel Silliman	Effect of Seasonal Changes on Antimicrobial Defenses in the Avian Stratum Corneum I: Changes in Lipid Composition with Season
Alexis Skelton	Crawling Through History: An Investigation of RNA Bindings in Worms
Grace Stone	Detailed Sedimentological Study of the West Franklin Limestone Member (Desmoinesian to Missourian) of the Shelburn Formation (Upper Pennsylvanian) of Southwestern Indiana
Taylor Swisher, Haley Pierce, and Danny Schurman	Down Syndrome Awareness Today: Healthy Smile for a Lifetime
Destiny Tannahill	Enhancing Scientific Literacy through Writing: Effects of Informal In-Class Writing Assignments in Introductory Geology Courses
Kimberlyn Vennekotter, Rachel Scofield, and Paige Hall	Dental Care in Dogs
Jonathan Will	Comparison of Extraction Methods for Capsaicin

9-10 a.m. POSTER SESSION

Carter Hall D

Sloan Billings, Sara Libbert, and Paige Hawthorne	Periodontal Disease: A Stiff Impact on Rheumatoid Arthritis
Sara Hornby	Processing Colors
Victoria Pigg	Effects of Ambient Temperature on the Organization of Lipids of the Avian Stratum Corneum
Mananchaya Potchanant	Correlation of the Thickness of Enamel and Diet Between Carnivores, Herbivores, and Omnivores
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Alexis Skelton	Crawling Through History: An Investigation of RNA Bindings in Worms
Paige Spieth and Megan Evans	The <i>E. coli</i> inner membrane protein YhiM is necessary for efficient attachment of bacteriophage T4
Grace Stone	Detailed Sedimentological Study of the West Franklin Limestone Member (Desmoinesian to Missourian) of the Shelburn Formation (Upper Pennsylvanian) of Southwestern Indiana
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Destiny Tannahill	Enhancing Scientific Literacy through Writing: Effects of Informal In-Class Writing Assignments in Introductory Geology Courses
Allen Thomas and Katie Gross	Meth Mouth: The Oral Findings and Treatment
Jonathan Will	Comparison of Extraction Methods for Capsaicin

10-11 a.m. POSTER SESSION

Carter Hall D

Scott Beard	Petrified Wood from the Inglefield Sandstone of the Patoka Formation (Upper Pennsylvanian) in Vanderburgh County, Southwest Indiana
Matthew Becker	Antibiotic Potential of <i>Epiphyllum oxypetalum</i> Stem and Roots
Sloan Billings, Sara Libbert, and Paige Hawthorne	Periodontal Disease: A Stiff Impact on Rheumatoid Arthritis
Rachel Cash	Interprofessional Teamwork: Improving the Community Healthcare Experience
Aaron Costlow	Antimicrobial Properties in the Stems of <i>Epiphyllum strictum</i> and <i>Epiphyllum oxypetalum</i>
Brock Harvey	Chemical Make-up of Plants Used in Herbal Remedies and their Applications
Sara Hornby	Processing Colors
Bryson Jenkins	Synthesis Strategies for Developing a Dithiepin Framework for Host Molecules
Philip Kuhns	Illustrated Survey of the Sonoran Desert
Rachel Miller and Lexis Schue	Development of Extraction Methods for Active Compounds in Botanical Species
Jacob Robbins	The Hybrid Account of Knowledge How
Paige Spieth and Megan Evans	The <i>E. coli</i> inner membrane protein YhiM is necessary for efficient attachment of bacteriophage T4
Jason Vaal	Tailoring the Solid-State Emission of BODIPY Dyes
Kimberlyn, Vennekotter Rachel Scofield, and Paige Hall	Dental Care in Dogs

11 a.m. - noon POSTER SESSION

Carter Hall D

Matthew Becker	Antibiotic Potential of <i>Epiphyllum oxypetalum</i> Stem and Roots
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Oral Presentations

Session I, UC 2205

- 8:30 – 8:45 **Lydia Moll** – New Opportunities or Closing Doors? How Correctional Facility Tours Impact Students’ Thoughts about Correctional Careers
- 8:50 – 9:05 **Rachel Bacher** – Hydrogeological Impacts of Savanna Ecosystem Restoration and Regional Climate Change, and the Potential Consequences for Endangered Species Management, in Manistee National Forest, Michigan
- 9:10 – 9:25 **Travis Durham** – Improving Scientific Literacy of Undergraduate Historical Geology Students by Teaching the Nature of Science through Historical Paleontological Debate
- 9:30 – 9:45 **Ryan Loehrlein** – Alberta Energy Challenge Case Competition
- 9:45 – 10:00 **BREAK**
- 10:00 – 10:15 **Cameron Gibson and Anna Steurer** – ASME Human Powered Vehicle
- 10:20 – 10:35 **Erin Bonner and Katie Biggs** – Perceptions of Depression in Men and Women
- 10:40 – 10:55 **Carli Kempf** – Applied Techniques in Three-Dimensional Cloisonné Enameling
- 11:00 – 11:15 **Shianne Bowlin** – Perceptions of Crime and Punishment

Session II, UC 2206

- 8:30 – 8:45 **Jackson Traylor** – Solar Splash 2016
- 8:50 – 9:05 **Chelsea Pfister** – Student Instruction and Understanding
- 9:10 – 9:25 **Jacob Jones and Lauran Ledbetter** – American Society of Civil Engineers
Concrete Canoe 2016 - Calypso
- 9:30 – 9:45 **Taylor Patty, Chelsea Pfister, Desirae Hanna, Katelyn Heaton, Gunnar Lynch**
– Undergraduate Students’ Ability to Evaluate Arguments: Emphasis on
Game Theory and Peer Pressure
- 9:45 – 10:00 **BREAK**
- 10:00 – 10:15 **Nicholas Smith** – Advanced Study in Dynamic Pixelmapping Techniques
- 10:20 – 10:35 **Nicholas Smith** – Advanced Study in Flexible LED Panel Design
- 10:40 – 11:00 **Melanie Belarmino** – Japanese Gender Role Expectations: A Qualitative
Study



Oral and Poster Presentation Abstracts

Hydrogeological Impacts of Savanna Ecosystem Restoration and Regional Climate Change, and the Potential Consequences for Endangered Species Management, in Manistee National Forest, Michigan

Rachel Bacher

Faculty Mentor: **Dr. Paul Doss**

The U.S Forest Service is reducing tree canopy cover in Manistee National Forest, Michigan, to restore the natural oak-savanna ecosystem in support of the endangered Karner Blue Butterfly. Long-term hydrogeological monitoring of groundwater levels and temperature was initiated to evaluate the potential effects of restoration on the local groundwater system. Hourly groundwater level and temperature data were collected by continuously recording instrumentation, periodic soil moisture data were collected on-site, and precipitation data were obtained from the National Oceanic & Atmospheric Administration. Annual groundwater recharge to the thick and permeable glacial outwash sands is dependent on a complex inter-relation among spring precipitation, snowpack melt, leaf emergence, incoming radiation, and other factors. Inter-annual groundwater recharge fluctuations show high variability in terms of amount, duration, and timing. For example, although 2014 had significantly less precipitation than in 2013, groundwater levels displayed a greater recharge response, and this coincides with the onset of canopy reduction efforts. This study focuses on developing a conceptual model of the hydrogeological impacts generated by ecosystem transformation, specifically savanna restoration. Additionally, we are positioned to document any hydrological change that may have potential consequences on the successful reintroduction of the Karner Blue Butterfly. Finally, an impact of climate change on local hydrological variability may manifest as altered groundwater recharge dynamics.

Petrified Wood from the Inglefield Sandstone of the Patoka Formation (Upper Pennsylvanian) in Vanderburgh County, Southwest Indiana

Scott Beard

Faculty Mentor: **Dr. William Elliott**

Upper Pennsylvanian rocks in southwest Indiana dip 1 to 2 degrees to the west on the eastern margin of the Illinois Basin. The Patoka Formation overlies the West Franklin Limestone of the Shelburn Formation and is capped by the Carthage Limestone of the Bond Formation. The lower part of the Patoka is subdivided into the Ditney Coal overlain by the Inglefield Sandstone. The Inglefield Sandstone consists of tan to gray, thin to thick bedded, trough cross-stratified, fine- to medium-grained quartz arenite. The Inglefield Sandstone is typically 5 to 10 m thick, with localized 20 to 25 m thick deposits in Vanderburgh and Posey Counties, Indiana. These localized thick sandstone deposits are interpreted as incised paleovalleys that formed during lowstand systems tracts and subsequently back-filled during early transgression.

Eight samples of petrified wood were collected from the Inglefield Sandstone west of Evansville in Vanderburgh County, Indiana. Tangential and transverse thin sections were prepared from silicified specimens. Transverse sections exhibit uniseriate rays and are one to twelve cells high. Most cells are circular in shape, while others are angular, most likely caused by compaction. Tangential sections show narrow rays in contrast to broad tracheids. There are no growth rings present in any of the specimens. Four specimens are identified as *Dadoxylon*, two specimens are *Cordaites*, and two specimens are coniferous.

Regression of continental seas due to periodic Gondwana glaciation resulted in repeated exposure of the Illinois Basin and the onset of climatic aridity. The association of Cordaitalean and coniferous petrified wood from the Inglefield Sandstone is consistent with the remains of seasonally dry lowland vegetation that accumulated during a lowstand systems tract. Because of the decreased preservation potential of lowstand deposits, this study provides additional insights into the xerophytic floras of the Late Pennsylvanian (Kasimovian) of North America.

Antibiotic Potential of *Epiphyllum oxypetalum* Stem and Roots

Matthew Becker

Faculty Mentor: **Dr. Henri Maurice**

With bacterial resistance to antibiotics increasing, alternatives are needed to replace resisted drugs. One relatively untapped source of potential antimicrobial compounds is plants. Historically, plants have been used to derive a number of useful medicines like Aspirin and prophylactics taken to prevent malaria. However, plants have yet to be utilized as antibiotics in a mainstream way, despite the interesting research currently taking place. *Epiphyllum oxypetalum* is a plant that has shown promise as a source of antimicrobial compounds. While its stems have been screened for useful extracts, its roots have not. I will be comparing the root extract to the stem extract to look for differences in activity and potency. To make a useable extract, I will use a Soxhlet apparatus. Because the available literature on the subject does not specify the exact methodology, it has taken some finagling to come up with an exact procedure. For the extraction using soxhlet, I will use the maximum amount of available dried plant matter (approximately 20 grams) with ethanol as the solvent. After ten cycles the liquidus extract will then be rotovapped dry and then reconstituted with a ratio of 1 ml per gram of initial plant matter. This will be done for both the stems and roots of *E. oxypetalum*. The extracts will be used to inoculate small Whatman paper discs and placed on petri plates with *E. coli*, *B. subtilis*, *S. pyogenes*, *P. spp.*, *S. aureus*, and *S. epidermidis*. As a positive control, I will use Whatman paper with an antibiotic known to inhibit growth in these microbes and a negative control of the paper with only the ethanol solvent. Once the bacteria have been allowed to grow at 37°C for approx. 42 hrs, the zone of inhibition for each strain will be measured.

Japanese Gender Role Expectations: A Qualitative Study

Melanie Belarmino

Faculty Mentor: **Dr. Melinda Roberts**

Due to current technology and the third wave feminist movement, social awareness of gendered violence in other countries has a global platform. However, these issues are commonly viewed through a Western lens and the voices of women experiencing this violence are largely invisible. Violence against women has largely been studied within the United States, but such violence in Asian countries has not received as much attention in the scholarly literature. The purpose of this qualitative study is to investigate the gender role expectations that lead to violence and victimization inflicted on Japanese women. Data was obtained through the researcher travelling to Japan and conducting interviews with ten Japanese women, and findings reveal that there are very specific expectations for Japanese women in the home, at work, and in society.

Periodontal Disease: A Stiff Impact on Rheumatoid Arthritis

Sloan Billings, Sara Libbert, and Paige Hawthorne

Faculty Mentor: **Mrs. Emily Holt**

The investigation of the connection between rheumatoid arthritis (RA) and periodontal disease has been on the rise in recent studies. The effects of hypercitrullination, *Aggregatibacter actinomycetemcomitans* (Aa), and *Porphyromonas gingivalis* (P. gingivalis) on the exacerbation of rheumatoid arthritis have been a recent study. The purpose of this study was to investigate additional links between RA and periodontal disease.

A method of collecting and combining results from past research studies was performed to provide strong support for the problem statement. Information was collected from PubMed, the CDC webpage, and the Arthritis Foundation webpage. Key words searched in PubMed were: rheumatoid arthritis and periodontal disease (272 Results), rheumatoid arthritis and periodontitis (368 results), rheumatoid arthritis and oral health (508 results), rheumatoid arthritis and dental (806). A total of ten sources were used in the creation of this manuscript.

One study collected gingival crevicular fluid (GCF) from the gingival sulcus, the space between the gingival mucosa and tooth. GCF has been widely used to study the microbial and inflammatory components of the periodontal pocket. In periodontitis, analysis of GCF revealed extensive protein citrullination, mirroring patterns of cellular hypercitrullination previously observed in the RA joint. Hypercitrullination was minimal in healthy subjects without periodontitis, where protein citrullination was limited to physiological substrates such as keratins. In effect, the data obtained indicates that the prevalence of periodontal disease is clearly greater in patients with RA than in those without RA, in accordance with most of the published literature.

In conclusion, the collected research emphasizes key points of recent studies on the connection of rheumatoid arthritis and periodontal disease along with microbial and biological factors explaining these connections. The focus on citrullination, *Aggregatibacter actinomycetemcomitans*, and *Porphyromonas*

gingivalis results in considerations of the links between the two diseases. It is evident that rheumatologists, periodontists, and microbiologists collaboration work would result in increased understanding of the study of biologic mechanisms and microbiology of RA and PD associations.

Perceptions of Depression in Men and Women

Erin Bonner and Katie Biggs

Faculty Mentor: **Ms. Margaret Felton**

Research has shown that one in four women will be diagnosed with depression in their lifetimes. While the 3:2 female to male ratio at the University of Southern Indiana has put this statistic into a concerning perspective, this evidence should not limit depression's severity to a single gender. This study focuses on the perceptions of depression among honors students in the University of Southern Indiana community. When presented with a gender-neutral scenario in which a fictional student was dubiously suffering depression, twelve participants freely indicated whether the neutral name was attached to a male or female gender. Additionally, participants ranked the severity of the character's ailments. A short interview followed this to ascertain how participants identified depression in people they knew well versus their identification in those they did not have an intimate relationship with. It was found that subtle depression was more attributed to males, and though depression would be more recognizable when an intimate relationship was maintained, it would be more difficult to immediately address.

Perceptions of Crime and Punishment

Shianne Bowlin

Faculty Mentor: **Dr. Melissa Stacer**

The death penalty has been a source of controversy for many years. This study seeks to determine society's perceptions on the death penalty and its appropriateness for two different crime types, murder and brutal rape. Research indicates that men are more likely to receive the death penalty as women for the same crime (Rappaport, 1991). This study seeks to confirm perceptions on which gender is more likely to receive the death penalty. Although the death penalty for juveniles has been declared unconstitutional, demands for this penalty continue to flourish particularly when juveniles commit heinous crimes (Crosby, Britner, Jodl, & Portwood, 1995). This study seeks to aid in the understanding of death penalty appropriateness for juveniles. The participants will receive one of ten vignettes describing one of two crimes, with the gender and age of the defendant both being variables. Participants will answer a survey regarding various demographic information and their beliefs on different aspects of crime. The data will be analyzed using qualitative and quantitative methods. Data is still being collected on this topic. With this 2x2x2 factorial design, I plan to conduct a 3-way ANOVA with punishment as the dependent variable. It is hypothesized that participants will indicate more

support for male defendants to receive the death penalty than female defendants, that the participants will indicate more support for adults to receive the death penalty than juveniles, and that participants will indicate more support for defendants who commit murder to be sentenced to the death penalty than those who commit rape. The hypothesis indicates that I expect a significant effect on punishment for age of the perpetrator, with a smaller, but still significant effect for gender of the perpetrator and crime type. The findings of this study will contribute to the forensic psychology field by allowing a better understanding of the criteria that one bases their punishment decisions, given that many Americans will serve on a jury. It is important to understand this criteria in order to neutralize any influential factors in order to receive the most fair and just punishment.

Interprofessional Teamwork: Improving the Community Healthcare Experience

Rachel Cash

Faculty Mentor: **Ms. Jody Delp**

The interprofessional student team studied the population of patients treated at a community health clinic. The team identified barriers to healthcare including lack of continuity of care, inaccessibility to a variety of healthcare disciplines, and limited availability of resources within the community. Research has shown that substantive change is occurring in healthcare, with increased emphasis being placed on the ability of providers to engage in teamwork, effective communication, and care coordination across disciplines. Much of the research noted that IPE was important because of the team-based nature of patient care and believed that it could serve to strengthen and improve existing healthcare teams.

In order for this team to implement approaches for improving community healthcare, discipline specific professional skills were applied and demonstrated. Using the TeamSTEPPS approach, collaboration among professions was practiced and achieved. Interprofessionalism improved communication efforts between healthcare providers and assisted in developing patient-centered treatment goals. Team members successfully adopted a holistic perspective in order to develop a plan of care congruent with patient needs and wants.

The team utilized TeamSTEPPS Team Performance Observation Tool (TPOT) and Teamwork Attitudes Questionnaire (T-TAQ) to evaluate team dynamics. Implementation of the Office of Interprofessional Education and Practice Collaboration Practice Assessment Tool (CPAT) was also utilized. The PROMIS Health Organization Global Health Survey and Consumer Assessment of Healthcare Providers and Systems (CAHPS) Health Plan Survey and Healthcare Effectiveness Data and Information Set (HEDIS) were collected to assess patient data.

The team noted their attitudes improved towards other healthcare professions and gained knowledge about the other disciplines' roles and responsibilities. The ability of the students to work together as a team improved throughout the experience. The patient's healthcare goals were addressed holistically through interprofessional collaboration to meet their needs.

The team will carry this experience into professional practice with an understanding of how to approach individuals from a variety of backgrounds and socioeconomic statuses. The team will be able to provide client-centered care by understanding other professions' skills and expertise and having the communication and teamwork skills gained during this experience.

Antimicrobial Properties in the Stems of *Epiphyllum strictum* and *Epiphyllum oxypetalum*

Aaron Costlow

Faculty Mentor: **Dr. Henri Maurice**

Past research using the extracts created from the stem of *Epiphyllum oxypetalum*, a species of cactus that is native to Central and South America, has shown possible antimicrobial effects for the plant. In light of the possible overuse of antibiotics and the resistance shown in some bacteria strains, it may be time to look into alternative options to keep our bodies free from malicious microbes in our environment. Without some kind of intervention from classical antibiotics creation and use, a great deal more bacteria will become resistant to antibiotics. The initial steps to take in order to screen plants for medicinal research is to see if an extract created from the stem of the plant being tested is able to inhibit bacteria from reproducing in a laboratory setting. An initial extract from the leaves of *E. oxypetalum* was created using a soxhlet extractor and 95% ethanol as a solvent. This initial extract was created using dried leaves, and after the extraction, the solvent-extract solution was dried in a rotary evaporator; the extract was brought back into solution with 1ml of solvent per gram of initial sample. This procedure will be duplicated for a sample of the related species, *Epiphyllum strictum*. These extracts will be used to coat sterile discs, and these discs will be tested on several different microbial cultures to test for significant areas of bacterial inhibition. Preliminary results and past research using *Epiphyllum oxypetalum* extracts indicates that the created extracts may be able to prevent bacterial growth on a petri dish.

Improving Scientific Literacy of Undergraduate Historical Geology Students by Teaching the Nature of Science through Historical Paleontological Debate

Travis Durham

Faculty Mentor: **Ms. Carrie Wright**

Scientific literacy is essential for citizens in public debates and to discuss socially important issues, such as climate change or evolution, but many non-scientist citizens are scientifically illiterate. The Nature of Science (NOS) is crucial for scientific literacy, yet it is not often considered a major part of undergraduate geosciences. We conducted a study through a series of activities to explore and record the effectiveness of scientific writing of undergraduates. The experimental research was created to increase scientific literacy of undergraduates and develop skills associated with how argumentation builds upon scientific knowledge. Aspects of the NOS that are important in geology include nonlinear thinking with multiple testable hypotheses through field work and experience, peer collaboration, research to enhance student scientific literacy and writing. The best course to teach the NOS of geology is in Historical Geology. This introductory science course enhances undergraduate understanding of geological knowledge, experience, and introduces the NOS through identifying historical figures, events, and concepts such as Plutonism or dinosaur metabolism. A set of assignments were developed and

implemented in a Historical Geology course and inspired by the NSF-funded “The Story Behind the Science” project. In the assignments, students applied tenets of the NOS in order to draw conclusions concerning dinosaur metabolism based on evidence provided in the research paper. A course of fourteen students responded with written responses that were evaluated for comprehension and understanding. We hypothesized that the writing and lab assignments would increase student understanding of the NOS and argumentation skills for scientific literacy. Methods used in the assignment include a writing assignment and the associated lab. We evaluated NOS literacy by assessing student writing based on assigning values of 0-6 (lowest to highest) based on content, structure, and characteristics of science. The data reveals that most of the students showed improvement in writing style and understanding of the NOS. The study demonstrated that geoscience educators can improve writing skills and scientific literacy of students with writing assignments and understanding of the NOS.

ASME Human Powered Vehicle

Cameron Gibson and Anna Steurer

Faculty Mentor: **Dr. Natasha Smith**

During the 2016-2017 academic year, USI’s American Society of Mechanical Engineers (ASME) chapter designed, built, and tested The Screaming Eagle, a semi-recumbent, tadpole tricycle with a tail box fairing, to compete in the 2017 ASME Human Powered Vehicle Challenge (HPVC). The ASME HPVC is designed to provide engineering students with real world challenges to improve the efficiency of human powered transportation.

After competing in 2016 with the Fortuna, a two-wheeled full fairing vehicle originally constructed in 2013, Cameron Gibson, Chris Huber, and Anna Steurer decided to design and construct the tricycle from start to finish as their senior capstone design project. USI’s ASME Chapter wanted to create a completely new design that improved upon stability, maneuverability, and rider comfort, which were problems experienced during the previous year. Suggestions from the chapter’s previous experiences were primary considerations when generating the design for The Screaming Eagle. The scope of this year’s vehicle focused on designing and constructing the frame, steering, and drivetrain with secondary emphasis on the tail box fairing. The vehicle was designed to have front wheel steering and rear wheel drive, with a rollover protection system incorporated into the frame.

The team ran analyses, conducted simulations on 3D CAD models, and performed physical testing to ensure that The Screaming Eagle complies with all regulations set forth by ASME and USI’s ASME chapter. This year’s innovative component of the vehicle includes an electric generator powered by rotation of the rear drive wheel to power the headlight and taillights of the vehicle.

The 2017 ASME HPVC will be held April 21-23, in Cookeville, TN, at Tennessee Technological University. The Screaming Eagle’s construction was not complete by the submission of this abstract. However, it is projected that The Screaming Eagle will provide a balance of speed, maneuverability, sustainability, and practicality.

Chemical Make-up of Plants Used in Herbal Remedies and their Applications

Brock Harvey

Faculty Mentor: **Dr. Edmir Wade**

With nearly half of all currently used medications based on compounds found in plants, it can be reasoned that many more medicinal compounds can be discovered by studying the different herbal remedies around the world. Examples include the chemical ephedrine, derived from the plant *Ephedra sinica*, which is used as a decongestant in Sudafed, and the chemical paclitaxel, derived from the Pacific yew, and used in the anti-cancer treatment drug, Taxol. Our focus will be on comparing the chemicals used in local plant remedies and tropical plant remedies, and their applications towards the alleviation of ailments they are used to treat. Using a generalized method of addition of solvents, compounds will be separated into organic and aqueous layers, then isolated from each other. Another route of extraction using Pressurized Liquid Extraction (PLE) will be explored. Once the desired chemicals are isolated from the rest of the organic matter, they will be analyzed, identified, and quantified using techniques such as Gas Chromatography-Mass Spectrometry (GC/MS), HPLC, and NMR. A comparison of the findings will be done to determine which method of extraction is optimized to give the highest yield of the chemical with medicinal properties.

Processing Colors

Sara Hornby

Faculty Mentor: **Dr. Srikanth Dandotkar**

The colors we perceive around us every day affect us in ways we do not realize. For instance, the colors in a room affect one's emotions: women felt more depressive working in a white, as opposed to colored, office (Kwallek et al., 1996); participants felt more relaxed and performed more efficiently on a cognitive task while their computers were surrounded by blue, as opposed to yellow or red, partition boards (Sakuragi and Sugiyama, 2011). Understanding how the colors around us effect our emotions is important to improve work place environments to improve employees' mental health and their productivity.

The current study explored how colors of single pictures – as opposed to the entire room – affect one's mood and whether there are gender differences in the color effects. Participants viewed pictures, one at a time, and filled out a questionnaire. I manipulated the color scheme (warm or cool) and measured students' perceived mood via questionnaires. My hypothesis is that the color a single picture can alter one's mood and that there would be a gender differences in the mood-effects of colors. I predict that the color scheme would affect females more than males. Additionally, I predict that warm colors, more than calm colors, will make participants feel more alert while cool colors, more than warm colors, will make them feel calmer. I am still collecting data for this study, but I foresee presenting the results at the 2017 Endeavor Symposium.

Synthesis Strategies for Developing a Dithiepin Framework for Host Molecules

Bryson Jenkins

Faculty Mentor: **Dr. Edmir Wade**

Dithiepins are great molecules to use in order to detect changes in a UV spectrum. This change is what allows researchers to identify if the cage molecule was successful in binding with its target. This is important in identifying the structures and electron accepting ability of target molecules. This method also provides a way to identify and detect nitrotoluenes, which are heavily used in chemical applications for agriculture and industry. The changes in the UV spectrum caused by dithiepins binding to their host molecule also has applications in other branches of chemical study, such as in analytical chemistry, where changes in UV spectrum are applied for the determination of different analyt. Dithiepins are large, electron donating molecules that specifically target electron accepting species that have aromatic rings. The research into dithiepins was conducted using one of two available methods that consisted of various filtration methods in order to further purify the dithiepin. NMR spectra were obtained to characterize each step of the reaction scheme and were consistent with literature values, signifying that each reaction step was successfully completed. Further research will still be needed in order to drive the synthesis to completion and reach a further degree of purification in order to construct a full dithiepin ring.

American Society of Civil Engineers Concrete Canoe 2016 - Calypso

Jacob Jones and Lauran Ledbetter

Faculty Mentor: **Dr. Kerry Hall**

The American Society of Civil Engineers (ASCE) student chapter has the unique academic and physical challenge of designing, testing, and constructing a concrete canoe. The purpose of this canoe is to compete in the ASCE Great Lakes regional and national conference as well as develop an understanding of concrete construction, interdisciplinary cooperation, and problem solving. The reoccurring challenge is to improve upon last year's design to create an improved canoe. This year, ASCE moved to use a hybrid-female mold. This is a new step undertaken by this year's members of ASCE. For the past few years, ASCE has used a male mold design. In this method, foam would be cut into three inch by thirty-six inch sections to form a structure that was the length of the boat. This method was uniquely called male, due to the mold being on the inside of the hull of the canoe. However, in the new mold design, the hull was poured into a hollow mold construction. ASCE also innovated by utilizing a water jet in the Applied Engineering Center to segment the mold out of Styrofoam. USI's ASCE team will present our findings and our finished concrete canoe. This year's canoe was more cost-effective and easier to construct compared to previous years.

Applied Techniques in Three-Dimensional Cloisonné Enameling

Carli Kempf

Faculty Mentor: **Ms. Jane Vickers**

Glass enamels are a very tricky art form to work with. They require a tremendous amount of studying, practice, and patience. Introducing other elements into enameling becomes far more complicated. I decided to add three dimensional designs and cloisonné into my enamel studies. I studied under one of the best enamelists in the world, and gained far more knowledge than I ever anticipated. I have spent countless hours learning the science behind enameling. There are many little things you can do that will make a huge difference with an enameled piece. These guidelines and tips will save an enamelist many hours of mishaps and frustration. I will be sharing the helpful information I have learned over the past year along with the enameled pieces I have created. I hope this will help guide any future enamelist in their own studies and projects.

Illustrated Survey of the Sonoran Desert

Philip Kuhns

Faculty Mentor: **Ms. Nancy Raen-Mendez**

Many people think of deserts as lifeless wastelands, but the Sonoran Desert in the United States is an incredibly biologically rich part of the country. The desert receives more annual rainfall than any other desert in the world, allowing it to host over 560 species of animals and over 2,000 species of plants, one of which is the iconic Saguaro cactus. Springtime in the Sonoran Desert yields an explosion of colors as the many species of cactus and native wildflowers come into bloom. I traveled to Tucson, Arizona over spring break to photograph and observe the wildlife of the Sonoran Desert. Working from my reference material, I have filled a sketchbook with drawings and watercolor illustrations depicting the cactus, flowers, birds, reptiles, and mammals I encountered on my trip. I have also created one larger, fully rendered scientific illustration. My intent in illustrating life in the desert is to show the great diversity and beauty of plants and animals in Sonoran Desert biomes that many people, especially in the Midwest, may have never considered. This project was an exploration in traditional illustration techniques and methods.

Alberta Energy Challenge Case Competition

Ryan Loehrlein

Faculty Mentor: **Dr. Brandon Field**

The Alberta Energy Challenge (AEC) is a business case competition focused on exploring the opportunities and challenges present in the dynamic energy sector. The AEC brings together top students from around the world and provides them with an unparalleled opportunity to further develop and explore their interests in energy and the environment. The competition targets business scenarios focusing on the Oil Sand Industries in the Northern Alberta Territory. Teams of four undergraduate students from each participating institution research and develop a comprehensive and innovative solution to a real-time challenge presented by one of Alberta's energy companies. This year's competition focused on increasing sustainability while decreasing the environmental impact of an oil extraction facility. An interdisciplinary panel of industry and academic consultants were available to the delegates to augment their understanding of key problems and comment on the feasibility of proposed alternatives. At this event, we achieved an increased level of self-efficiency and competency in business financial strategies while correlating our engineering skills to innovate the Oil Sands realm. We represented our university on an international platform for the third time. Unfortunately, our team did not place at the competition.

Effect of Seasonal Changes on Antimicrobial Defenses in the Avian Stratum Corneum II: Antimicrobial Activity in Lipids

Tabatha Lopnow

Faculty Mentor: **Dr. Alex Champagne**

The stratum corneum (SC) is the most superficial layer of skin, and is composed of several layers of flattened dead cells called corneocytes embedded in a lipid matrix. These lipids are known to play a critical role in regulating cutaneous water loss. However, these lipids may also play a role in regulating bacterial composition of the SC, as many lipids exhibit antimicrobial activity. In this study, we assessed the antimicrobial activity of lipid extracts of known composition taken from the SC of House Sparrows (*Passer domesticus*). We used bacterial assays to measure minimum inhibitory concentration (MIC) of these lipids against several species of bacteria common on the avian epidermis including *Staphylococcus aureus*, *Escherichia coli*, and *Bacillus licheniformis*. We found that the antimicrobial activity of lipids depends on fatty acid composition and the target bacteria. Our results clarify the role of lipids in regulating bacterial community composition on bird skin.

Development of Extraction Methods for Active Compounds in Botanical Species

Rachel Miller and Lexis Schue

Faculty Mentor: **Dr. Edmir Wade**

Often referred to as “traditional medicine,” herbal remedies are used worldwide for various ailments. These herbal remedies often seem eccentric to many in the western world who rely heavily on pharmaceuticals. However, many of these pharmaceuticals used today have been extracted from some of the most fundamental herbal therapies. From aspirin, which was derived from willow bark, to fungus derived lipid-lowering agents, a large percentage of the western world’s pharmaceuticals began as herbal remedies. The research being conducted for this project will focus on generating techniques to extract the chemicals from these herbal therapies. Separation techniques will be used to produce an organic and aqueous layer. Techniques such as Nuclear Magnetic Resonance and Infrared Spectroscopy will be utilized to examine the organic layer. These methods will then be analyzed to determine which is best-suited for extracting the components from the herbal remedy. After the method is refined, herbal remedies from different parts of the world will be studied.

New Opportunities or Closing Doors? How Correctional Facility Tours Impact Students’ Thoughts about Correctional Careers

Lydia Moll

Faculty Mentor: **Dr. Melissa Stacer**

Children may say they want to grow up to be police officers, but we typically don’t hear children saying they want to work in a prison or jail when they grow up. Given negative media attention of correctional facilities, it may not be surprising that many students enter criminal justice programs uninterested in correctional careers. Correctional facility tours can be useful for exposing criminal justice students to careers they may not have previously considered. Using student essays exploring their perceptions before a correctional facility tour, how the tour impacted their perceptions, and how interactions with various people on the tour (both staff and inmates) helped them better understand corrections, this presentation examines student statements about how their exposure to a correctional facility impacted their thoughts about correctional careers.

Undergraduate Students' Ability to Evaluate Arguments: Emphasis on Game Theory and Peer Pressure

Taylor Patty, Chelsea Pfister, Desirae Hanna, Katelyn Heaton, Gunnar Lynch

Faculty Mentor: **Dr. Srikanth Dandotkar**

Many factors determine how undergraduate students make decisions under uncertainty. Whether that decision pertains to an argument, homework assignment using inductive or deductive reasoning, or a conflict among their peers, students must think critically in order to evaluate the situation. Although many undergraduate students learn evaluative skills over the course of their academic career, but has their evaluation of an argument improved? Courses that require students to use analytical and critical thinking skills include business strategies as well as research methods and statistics. Positive argument evaluation skills in students show critical thinking, appreciation for opposing views, decision-making abilities, and improved reasoning (Stanovich, 1997). Exceptional argument evaluation skills allow undergraduate students to excel in the workforce, personal relationships, and everyday situations (Gardner, 2005). More importantly, lack of evaluative skills adversely affects other parts of students' lives, not just academically. Understanding the factors that contribute to students' decision-making is necessary to help them improve their evaluative skills.

The purpose of the research project is to investigate the strategies that undergraduate students use when making evaluative decisions presented in two different contexts: Game theory and game theory with peer pressure. Game theory is the analysis of strategies for dealing with situations where the outcome of a participant's choice of action ultimately depends upon the other participant (James and Cohen, 2004). Participants read contextual scenarios (game-theory; game-theory and peer-pressure) then used the information provided to make a decision. Participants took a demographic questionnaire and flawed-judgment task that measured students' ability to evaluate everyday situations. We examined whether students are egocentrically or altruistically motivated to reach a decision, whether peer pressure influences their decisions, and whether one's argument-evaluative and analytical skills from academic courses facilitate their decisions. We are still in the process of collecting data but we expect to present our results at the 2017 Endeavor Symposium.

Student Instruction and Understanding

Chelsea Pfister

Faculty Mentor: **Dr. Srikanth Dandotkar**

Gender stereotypes are prevalent in today's society and often times can be seen in the educational setting. Many gender stereotypes exist attaching certain subject areas to specific genders; for example, men are typically seen as being strong in STEM subjects such as math and science whereas women are stereotypically seen as doing well in subject areas such as English. These gender labels often times manifest themselves in these learning environments such as schools and universities and often times affect the way students take instruction and learn from their professor(s). The primary goal of this particular study is to determine whether college students will show a significant learning difference

when being taught subjects by professors that are not consistent with typical gender stereotypes. This study assesses gender stereotypes prevalent in the educational setting and aims to look at whether or not student's performance, as well as student attitudes toward the instructor, shows a significant difference when being taught by professors of the same sex who follow gender norms or professors of the opposing sex who violate these norms. There are many benefits of researching gender-subject typicality and its effects on student performance. It can cause students to reevaluate their own gender biases and reframe the way they take instruction and learn, or it can reshape the way that we are teaching students dependent to the results of the study. If we know students are exhibiting these gender stereotypes and it is affecting their learning experience, we can change the way that we teach students and possibly limit these gender biases. Students will be assessed on both their attitude and performance by use of quizzes and attitude surveys to assess whether they show learning and/or attitude differences due to the typicality/atypicality of their professors in this study. Data is currently being collected and I hypothesize that students will show both performance and attitude differences regarding professors who are atypical in nature.

Effects of Ambient Temperature on the Organization of Lipids of the Avian Stratum Corneum

Victoria Pigg

Faculty Mentor: **Dr. Alex Champagne**

The stratum corneum (SC) is the outermost layer of skin in birds, and is composed of corneocytes embedded in a matrix of lipids. These lipids are arranged in phase states ranging from highly ordered orthorhombic phase to a more disordered liquid phase. The specific phase state of lipids in the SC may determine the rate of cutaneous water loss (CWL), with the orthorhombic phase providing the greatest barrier to water loss, whereas more disordered phases allow for higher rates of water permeation. In this study, we captured House Sparrows (*Passer domesticus*) in winter and summer in central Ohio. After isolating the SC, we used infrared (IR) spectroscopy to assess the phase state of SC lipids from 25 to 50°C. Analysis of the CH₂ scissoring region revealed that lipids in the SC of birds exist predominantly in the orthorhombic phase at these temperatures and only a subset of lipids change phase as temperature increases. This minor phase change corresponds with the minor increase in CWL observed in passerines as temperature rises. Additionally, our results imply that lipids in the skin of some birds are more robust to temperature changes than lipids in mammalian SC, suggesting a fundamental difference in lipid organization.

Correlation of the Thickness of Enamel and Diet Between Carnivores, Herbivores, and Omnivores

Mananchaya Potchanant

Faculty Mentors: **Drs. Rex Strange and Tony Maria**

Mammalian teeth consist of enamel, dentin, a pulp cavity, and cementum. The outer most layer consists of enamel, the hardest substance in the body. The thickness of enamel relative to tooth size can vary among populations and species. Teeth also have different shapes to perform different functions and are specific to each animal species. Such differences in tooth structure reflect differences in species diets. In this research, tooth (molar) samples from a carnivore (dog), two herbivores (deer and beaver), and three omnivores (raccoon, pig and human) were collected to observe the enamel thickness and any structural differences that might exist. We embedded each tooth in epoxy resin, used a rock grinding machine to cut the tooth in half, mounted the specimen onto a microscope slide, and ground the tooth to a minimum thickness of 30 μ . The thin sections were then observed with a bright field microscope with polarizing filters. We found a general correlation between enamel thickness, structure and diet. Our representative carnivore and omnivore species have a brachydont tooth structure. Humans have the thickest enamel relative to tooth size, while the raccoon has a relatively thin enamel layer. The dog (carnivore) also had a relatively thin enamel layer relative to tooth size. Our representative herbivore species have a more complex tooth structure. Deer have a selenodont structure in which enamel and dentin are arranged in parallel folds. The beaver has a similar tooth structure (lophodont) that includes folds of cementum along with enamel and dentin. Selenodont and lophodont tooth structures are associated with diets that require the grinding of plant material.

The Hybrid Account of Knowledge How

Jacob Robbins

Faculty Mentor: **Dr. Chad Gonnerman**

Some epistemologists appear to maintain that the folk can serve as a source of dialectical advantage in debates between intellectualists and anti-intellectualists about the nature of knowledge how. The common assumption seems to be that the philosophical account of knowledge how that best accords with the folk concept of knowledge how has a dialectical advantage over its competitors such that it enjoys a strong (though defeasible) presumption in its favor. Work in experimental philosophy on the folk concept has thus far been rather conflicted, with some reporting results suggesting that the concept is intellectualist and others that it is anti-intellectualist. In this report, we present results in line with the claim that the folk concept is in fact a hybrid concept, embodying both intellectualist and anti-intellectualist features. This suggests that the folk are unlikely to serve as an uncomplicated source of dialectical support for either intellectualism or anti-intellectualism.

Creating Resources for the Community Utilizing Interprofessional Collaboration

Shayna Roos and Anna Riebel

Faculty Mentor: **Ms. Jody Delp**

There is a lack of disease specific resources for patients in the community healthcare setting. In order to create resources, the team facilitated direct care to tailor patient needs by discipline, collaborated and created appropriate management tools to positively affect health outcomes, and supported team members through effective communication. Research suggests predominant challenges in working with interprofessional teams. One challenge is the ability to effectively manage communication in an effort to reduce performance errors and increase patient safety. This requires transformative changes in educational and healthcare delivery systems. Another challenge includes delineating professional hierarchies in interprofessional teamwork to overcome the barrier of respect and trust. To overcome these challenges, successful interprofessional collaboration should include promotion and development of interprofessional competencies.

In order to implement interprofessional strategies, the team utilized TeamSTEPPS[®]. TeamSTEPPS[®] is an evidence-based set of teamwork tools aimed at optimizing patient outcomes by improving communication and teamwork skills among health care professionals. The team focused on the communication, teamwork, and leadership components of the TeamSTEPPS[®] model. Evaluation of the project centered on witnessing successful interaction with patients. The team completed evaluations through reports from the team and patients with further discussion to improve unforeseen challenges or barriers. Additionally, evaluation also focused on patient self-management improvement. The team performed evaluations by stressing the importance of a care plan, providing additional resources and information at follow-up, and focusing on decreasing clinic visits associated with acute illness.

One example the interprofessional team created and utilized was the Asthma Management Tool. The tool was implemented in order for various disciplines to contribute to patient's overall biological, psychological and social well-being associated with an asthma disorder. This tool was distributed in the community healthcare clinic and can be utilized for all asthmatic patients both in the adult and pediatric populations. The team improved knowledge and understanding of distinct healthcare philosophies and expanded community knowledge with exposure to a diverse client population. The team accomplished group cohesion through better understanding and perceptions of individual disciplines by supporting team members with resources, encouragement, and continued respect.

Effect of Seasonal Changes on Antimicrobial Defenses in the Avian Stratum Corneum I: Changes in Lipid Composition with Season

Rachel Silliman

Faculty Mentor: **Dr. Alex Champagne**

The most superficial layer of skin, the stratum corneum (SC), is composed of several layers of flattened dead cells called corneocytes embedded in a lipid matrix. Several studies correlate lipids in the SC with cutaneous water loss, and have shown that the composition of lipid classes changes in response to

changes in ambient humidity. In addition, a potential dual role of lipids in the SC has recently emerged, as many lipids in the skin exhibit antimicrobial activity. In this study, we collected House Sparrows (*Passer domesticus*) in the summer and winter in southern Indiana and extracted lipids from the SC. We then used thin layer chromatography to identify and quantify these lipids. We found that winter birds had fewer lipids in the SC than summer birds, and the composition of lipid classes differed between seasons. These differences in the amount and composition of lipids may have implications for the ability of birds to regulate bacterial community composition on their skin.

Crawling Through History: An Investigation of RNA Bindings in Worms

Alexis Skelton

Faculty Mentor: **Dr. Kim Delaney**

A vital aspect to studying cell function is the understanding of cellular process. These processes are regulated by the interaction of molecules such as RNA and proteins. If these molecules are mis-regulated or mutated, different disease states such as cancer, heart disease, and aging can occur. To understand the mechanisms of these disease states, it is necessary to study the molecular biology of RNA-protein interactions. In the present study, we have specifically studied the SNF family of proteins. These proteins contain an RNA recognition motif that happens to be the most common RNA binding domain in human cells.

Due to the vast amount of information available regarding this family, we have had plenty of means to identify the evolutionary changes contributing to the functional modifications of these proteins. We introduced amino acid changes identified from previous studies on the evolutionary reconstruction of the SNF family. These changes are critical to understanding the functional changes seen in SNF proteins. We have specifically focused on the SNF family in nematodes (worms). Thus far, we have used molecular biology to introduce amino acid changes in the worm proteins. We have successfully expressed and isolated two ancestral variants of the protein using site-directed mutagenesis and DNA purification. From here, we will express and isolate two additional variants of the ancestral protein. Finally, we will measure the resultant change in RNA-binding activity via biochemical assays. This information can be further used to understand the relationship between amino acid sequence, protein structure, and RNA-binding ability. Eventually, this understanding will be applicable to appreciating other RNA Recognition proteins and thus disease states and cellular process.

Advanced Study in Dynamic Pixelmapping Techniques

Nicholas Smith

Faculty Mentor: **Mr. Eric Cope**

Pixelmapping is taking huge strides in the theatre and performance worlds, allowing lighting designers to create crisp and incredible images and designs using LED lighting units as individual pixels on a much larger canvas. LED lights are set up in such a way so as to create a fluid frame for these designs and images to be broadcast on. Once the lights are in place, a recreation of the setup is formed on a lighting

control console in order to create a map for which the designs will be displayed. The images on the console are then displayed via the LEDs, using each node as an individual pixel of the image. This technique has been widely used in rock concerts and big events all over, but is now being incorporated more and more into everyday theatre and architecture. This is taking the number of options and opportunities for lighting design to a whole new level. Each lighting console presents its own unique challenges and advantages to pixelmapping, and no one console is best for every design.

Advanced Study in Flexible LED Panel Design

Nicholas Smith

Faculty Mentor: **Mr. Eric Cope**

More and more today, LED lights are taking over the lighting industry. With their long-life capability and improving quality in brightness and color, they are becoming more useful with each passing year. With innovations constantly being made, the price of this technology has dropped significantly, and the flexibility of the product has grown as well. Not only are LED lights incorporated into the fixtures that have been around for years, but they are forming their own category of lights as well, never before seen. Pixelmapping is also growing a huge following, and allows the user to line up each LED node like pixels on a television screen. Images and video are then broadcast on this display. This technique is being used for large concerts, televised events, and is growing in other disciplines as well. With flexible LED strips, this pixelmapping technique has reached a whole new level, with the ability to form countless shapes and designs with which to broadcast these images. The resolution of the images, and possibilities for content have grown exponentially as well, making this industry even more competitive than ever.

The *E. coli* inner membrane protein YhiM is necessary for efficient attachment of bacteriophage T4

Paige Spieth and Megan Evans

Faculty Mentor: **Dr. Rebecca Sparks-Thissen**

The T4 bacteriophage infects the gram-negative bacteria *Escherichia coli* (*E. coli*). We are interested in finding *E. coli* genes that are necessary for T4 infection. Our experiments identified an inner membrane protein, YhiM, as being required for T4 replication. YhiM has been shown to be necessary for growth in a wide range of growth conditions including low pH, low osmolarity, and high temperatures (Nguyen 2011, Anderson 2017). Our data indicates that YhiM is also necessary for replication of T4. We next carried out attachment assays to test whether an attachment defect explains the lack of T4 replication in YhiM-deficient cells. Our data indicates that T4 does not attach efficiently to YhiM-deficient cells. We then tested to see whether increasing the amount of virus per cell would complement the lack of attachment. Our data suggests that T4 does not efficiently attach to YhiM-deficient cells. We tested a range of viral concentrations from 10 phages per bacterial cell to 10 bacterial cells per phage. In all cases, T4 did not attach efficiently to YhiM-deficient cells compared to wildtype *E. coli* cells. Taken together, our data suggests that YhiM may play a role in pathways involved in T4 attachment. As part of

its lifecycle, T4 attaches to lipopolysaccharides (LPS) and the outer membrane protein, OmpC, of *E. coli*. Further experiments will determine whether YhiM-deficient cells have decreased levels of LPS or OmpC or whether the attachment defect is due to another mechanism.

Detailed Sedimentological Study of the West Franklin Limestone Member (Desmoinesian to Missourian) of the Shelburn Formation (Upper Pennsylvanian) of Southwestern Indiana

Grace Stone

Faculty Mentor: **Dr. William Elliott**

Southwest Indiana is underlain by gently, westward dipping (2° to 3°) Middle to Upper Pennsylvanian strata on the southern margin of the Illinois Basin consisting of recurring deposits of limestone, sandstone, shale, and coal. USI 1-32, an exploratory coalbed methane well drilled in 2009, is located south of the campus of the University of Southern Indiana in Vanderburgh County, Indiana. The total depth of the well is 237.7 m with a West Franklin core recovered from 23.2 to 30.5 m.

From the cored interval, the basal unit of the West Franklin consists of skeletal packstone with broken and abraded brachiopods, crinoids, and fusulinids. This basal unit is overlain by 0.41 m of dark gray, laminated to bioturbated claystone. The middle limestone (4.96 m) is made up of 2.77 m of mottled, brecciated skeletal wackestone to packstone overlain by 2.19 m of interbedded skeletal packstone, grainstone, and rudstone containing nodular chert with broken fragments of brachiopods, bryozoans, rugose and tabulate corals, and crinoids. The middle limestone is overlain by 1.31 m of light greenish gray, bioturbated silty claystone with sparse organic stringers. The uppermost limestone is composed of skeletal packstone with broken and abraded algae, brachiopods, bryozoans, crinoids, forams, and gastropods. The geophysical well log from USI 1-32 suggests a thickness of 0.51 m for the basal limestone; and another core from the USI Groundwater Lab (less than 3 km from USI 1-32) provides a thickness of 2.41 m for the upper limestone of the West Franklin.

The alternation of siliciclastic and carbonate sediments in the West Franklin Limestone Member may be due to: (1) the complexity of shallow transitional marine settings; (2) interruption of carbonate deposition by avulsion and subsequent delta migration with increasing influx of detrital sediment; and/or (3) localized variation in depositional environments due to penecontemporaneous grabens that formed from reactivated faults of the Rough Creek-Shawneetown Fault Zone. The latter is further supported by thickness variation and limited lateral extent of the overlying Inglefield Sandstone. Finally, there is no evidence of deep water deposition in this part of the Illinois Basin during the late Desmoinesian to early Missourian.

Down Syndrome Awareness Today: Healthy Smile for a Lifetime

Taylor Swisher, Haley Pierce, and Danny Schurman

Faculty Mentor: **Ms. Emily Holt**

Down syndrome is an intellectual disability, exhibiting decreased mental capacity. In the dental world, this impacts the individual's ability to understand and perform oral care. Deficient oral care can lead to periodontal disease. Severe, early-onset periodontal disease is the most significant oral health problem found in individuals with Down syndrome. The prevalence rate of periodontal disease in adults under 30 years of age with Down syndrome is 60-100%. Poor oral care is one of the contributing factors for the development of periodontal disease.

Should alternative oral care strategies be considered for patients with Down Syndrome compared to patients with periodontal disease who do not have an intellectual disorder? PubMed resources and government websites were used to locate literature to answer the clinical question. Four publications and eight websites were used to answer the clinical question. It was difficult to find current literature on this topic. Involving the caregiver in the oral health education during a dental appointment is the first step to achieve improved oral care. The caregiver has a key role in the care for the individual with Down syndrome. The technique for how to perform oral care education with a patient who has Down syndrome doesn't vary from the technique for those without Down syndrome. The difference is found in selecting the proper oral tools for the patient. Controlling the level of oral microorganisms is key to controlling oral disease. Recommending toothbrushes with large handles will allow for better grasp. Powered toothbrushes are proven to remove more biofilm than other models. It is advantageous to implement a daily chlorhexidine gluconate rinse if the individual can rinse without swallowing. While a powered toothbrush and daily rinsing with chlorhexidine gluconate are not required for all individuals with periodontal disease, they are effective tools for controlling oral disease. Individuals with intellectual disorders are more likely to provide less effective oral care, so these tools can provide a more level playing field for control of oral disease.

Enhancing Scientific Literacy through Writing: Effects of Informal In-Class Writing Assignments in Introductory Geology Courses

Destiny Tannahill

Faculty Mentor: **Ms. Carrie Wright**

Geoscience educators have recognized the importance of incorporating writing in the classroom to obtain scientific literacy. Early pioneering research includes ideas of using writing as a valuable, unique way to learn material with successful learning described as being personal and engaged. Other research includes the use of low stakes writings that are frequent, informal, and graded as such with their focus on the students' understanding of course concepts. Research on these writing-to-learn techniques provides data vital to our own research including that of increased conceptual understanding and enhancing scientific literacy. The main gap within previous research is conclusive data on the use of these techniques in geoscience education particularly, and the overall effects of informal in-class

writings on the internalization of geological concepts. The foci of our research are on the low stakes writings and writing-to-learn techniques, and whether or not they have a recognizable impact on student learning and obtainment of scientific literacy in geology courses. Within this research, our three goals are to study student perceptions of the nature of science, whether their perceptions can be improved through informal in-class writings, if there was a differential effect for our treatment group to control group, and lastly what the students' attitudes were towards this technique. This study is focused on in-class writings by students in introductory geology classes during the Fall 2016 semester. Participants in the treatment group were given 10 writing assignments and allotted a 10-minute period to write their answers to questions pertaining to geology concepts, and the nature of science. The last assignment was a student perception survey and reflection on the educational value of these techniques. Initial data suggests that there is an improvement in student conceptions of the nature of science. Student perceptions were notable as all values for each question averaged favorable. More results and analysis will be presented including statistical comparisons between our control and treatment groups, and a qualitative analysis of student writings. This research provides further vital information on the impact of informal in-class writing assignments on scientific literacy in geology courses.

Meth Mouth: The Oral Findings and Treatment

Allen Thomas and Katie Gross

Faculty Mentor: **Ms. Emily Holt**

The oral effects of methamphetamine use include rampant caries, gingivitis, periodontitis, bruxism, and xerostomia. This is referred to as meth mouth. Dental professionals recommend treatment options to patients, so they should be familiar with the treatment options for meth mouth, the average cost of these options, and barriers to completing these options.

The purpose of this research was to determine what treatment options exist for restoring the mouth when damage from methamphetamine use has occurred as well as the average cost of these options. Pub Med and the Cochrane database were searched with the key words "meth mouth," "meth in Indiana," "systemic effects of meth mouth," and "treatment of meth mouth." Thousands of hits were found, but only nine journal articles and one professional website were included in the results. Four dental offices from the Evansville area were surveyed for the average cost of treatment options.

The journal articles indicate that restorations, such as composite resins, are an easy fix for caries that is confined to the enamel of the tooth. This option costs an average of \$263 per tooth. A root canal and crown are the best treatment options when pulpal infection develops. This treatment option is also the most expensive one, costing an average of \$2,080 per tooth. For this reason, patients with pulpal infection frequently elect to extract the tooth instead of completing a root canal and crown. The average cost of extracting one tooth is \$192. Partial or full dentures are used to replace teeth that have been extracted. The cost for a complete set of dentures ranges from \$2,800- \$3,760. The average cost for full mouth extractions and a complete set of dentures can reach \$8,500, while restoring the mouth with restorations, such as composite resins and crowns, could cost much more. Dental professionals need to recommend various levels of treatment options to patients with meth mouth since cost may be a barrier for the best level of treatment.

Solar Splash 2016

Jackson Traylor

Faculty Mentor: **Dr. Paul Kuban**

The Solar Splash competition is considered the world championship of solar electric boating. The competition is designed to showcase the feasibility and applications of solar energy. Universities from all over the country compete with vessels that have been perfected by the research and hard work from their teams of engineering students. While the competition has a large electrical portion, large aspects are mechanical based as well. The boats presented by each team can only be powered by the sun's rays and are judged on speed, maneuverability, and endurance. This is achieved through three races, each of different nature. A slalom race is designed to test speed and handling, a sprint race is conducted to test acceleration and top speed, and an endurance race is made to test the limits of the solar design. For the 2016 team the focus was directly on the outdrive mechanism, which was designed to transfer a maximum amount of power to the propeller shaft.

Tailoring the Solid-State Emission of BODIPY Dyes

Jason Vaal

Faculty Mentor: **Dr. Priyadarshine Hewavitharanage**

BODIPY is a versatile highly fluorescent organic molecule that has many biomedical and electronic applications. It glows (fluoresces) with high intensity in solution but generally loses its fluorescence in the solid-state. Many applications, such as dye sensitized solar cells, require solid state fluorescence but molecules that fluoresce in solid state is rare. BODIPY molecules tend to stack on top of one another which results in reabsorption of emitted light and quenching of fluorescence. This can be overcome by adding bulky groups on various positions around the BODIPY core. These bulky groups can reduce stacking by acting as spacers between the BODIPY molecules. In this study, we synthesized BODIPY molecules with different groups on the 2, 6 and 8 positions of the BODIPY core and examined their impacts on solid state emission.

Dental Care in Dogs

Kimberlyn Vennekotter, Rachel Scofield, and Paige Hall

Faculty Mentor: **Ms. Emily Holt**

The prevalence of periodontal disease is 80% higher in dogs than in humans. Periodontal disease can lead to halitosis, bleeding gingiva, alveolar bone destruction, tooth mobility, deep pocketing and/or recession of the gingiva, furcation involvement, and ultimately tooth loss. Veterinarians stress the

importance of yearly dental cleanings as well as daily homecare. Homecare encompasses many ways to reduce oral microorganisms, including proper food, chewing on toys that can remove biofilm, and brushing the dog's teeth.

The purpose of this research was to determine if dental cleanings along with consistent homecare maintains a healthier mouth compared to homecare alone. The databases used were PubMed and ProQuest. Key words used were "dog," "canine," "periodontal disease," "gingivitis," "dental hygiene," "veterinary dentistry," and "prevalence." Thousands of results were found, but only 13 journals were included in the results.

Evidence shows that hard dog food is preferred to soft diets. Meat-based foods are the best type of foods for dogs. Some dog food contains chemical agents to reduce oral microorganisms, thus slowing the formation of calculus. Although antimicrobials are helpful in preventing calculus formation, most studies suggest that chewing hard food is mainly responsible for the positive outcomes of periodontal health. Research suggests that giving dogs chew toys will assist in the mechanical removal of biofilm. The most assuring form of the removal of biofilm is brushing the dog's oral cavity once a day. Dental cleanings are necessary for the removal of calculus that has formed in the dog's oral cavity. It is suggested that dental cleanings should be performed at least once a year to prevent calculus build up.

While homecare is a good start for control of biofilm, it doesn't remove calculus on the teeth. Allowing calculus to remain on the teeth is proven to irritate gingival tissues. Therefore, annual dental cleanings combined with daily homecare may prevent or control periodontal disease in dogs better than homecare alone.

Comparison of Extraction Methods for Capsaicin

Jonathan Will

Faculty Mentor: **Dr. Edmir Wade**

Chemical compounds found in plants are utilized as the main components in many medications and herbal remedies worldwide. The vast diversity of plant structure and chemical composition makes unstudied plants ideal candidates for medical research. Our investigation will compare the quality of various extraction methods, measuring isolation quality, ease of extraction, cost, and reactive functional group species for the plant compound capsaicin (E)-N-[(4-Hydroxy-3-methoxyphenyl)methyl]-8-methylnon-6-enamide). Known for causing a burning sensation when eaten, capsaicin is a chemical compound in peppers that has been linked to medicinal applications in weight loss, cancer cells, and blood pressure. Extraction of this compound will be done via two different solvent separation pathways that remove organic matter from the aqueous layers. Capsaicin will be confirmed as isolated from the mixture through processes of NMR, IR, and Mass Spectrometry. After confirming the isolation of capsaicin, the two methods of solvent separation will be compared. The preferred method will then be used on local and tropical plants with similar compounds to that of capsaicin that have not been studied.