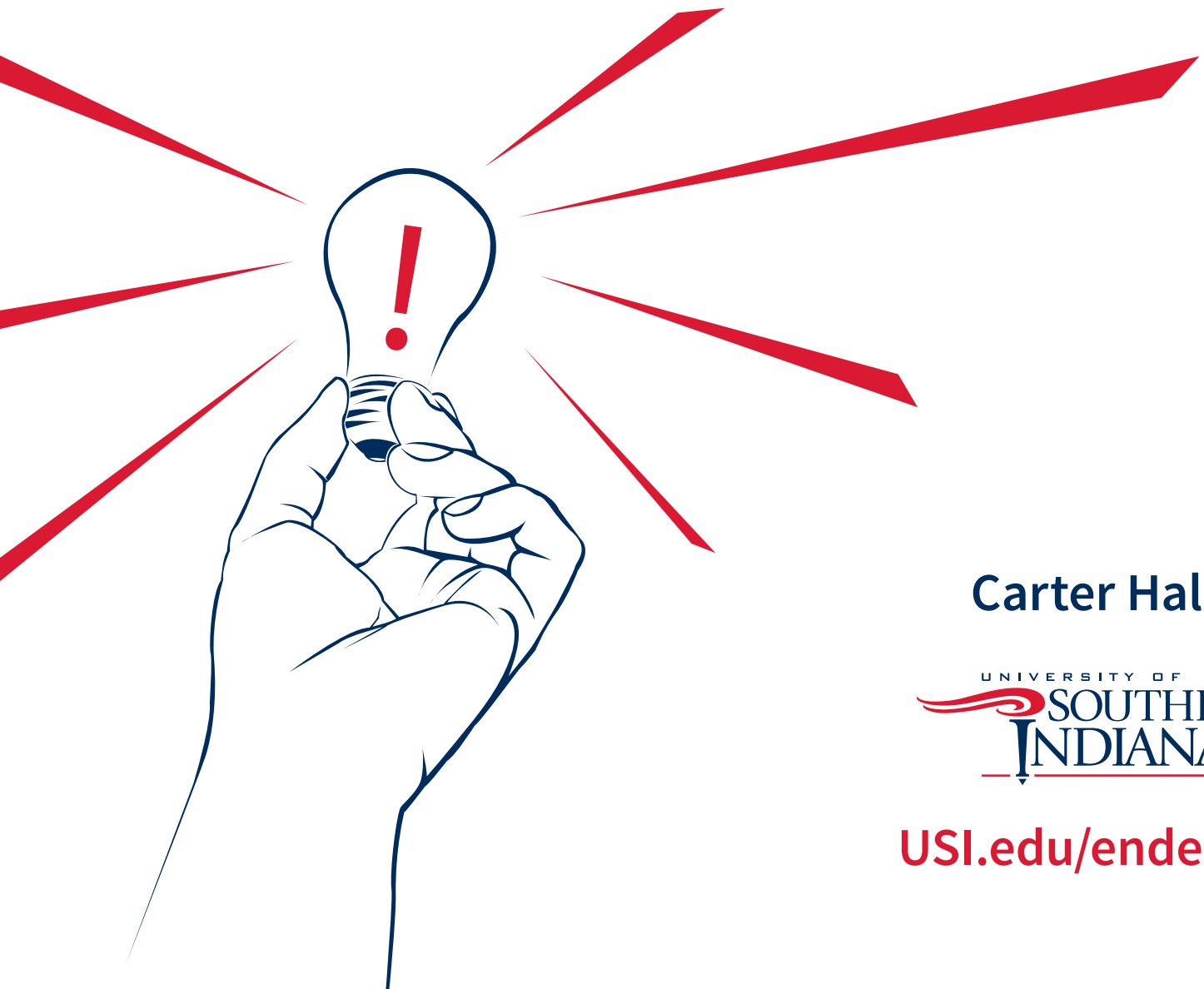


17th Annual Symposium

2018

USI
ENDEAVOR

AWARDS *for*
RESEARCH & CREATIVITY



Carter Hall



USI.edu/endeavor

Endeavor Symposium Program

Thursday, April 12, 2018

- Beginning at 7:45 **Check-in** for all presenters and sponsors: Pick up your programs and ID badges at registration table (located in the hallway outside Carter Hall).
- 9:00 – 10:00 a.m. **Oral Presentations**, Room UC 226-227 (near Carter Hall).
- 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
- Mr. Rob Millard-Mendez 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
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- College of Nursing and Health Professions
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- Mr. Brett Anderson
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- Ms. Emily Holt
- Dr. Glen Kissel
- Ms. Sue Krieg
- Dr. Tony Maria
- Dr. Kent Scheller
- Dr. Susan Seibert
- Dr. Melissa Stacer
- Dr. Edmir Wade

8-9 a.m. POSTER SESSION

Carter Hall D

Bethany Bremer, Alley Gilliland, and Sidney Heldt	Ongoing Oral Care for Oncology Nurses
Cynthiana Dillman, Brittany Benningfield, and Makenzie Norris	Unintended Oral Benefits of Bisphosphonates
Maverick Grayer	Geometry, Electronic Structure and Physico-chemical Properties of the Carcinogenic NNK Diazonium Ion
Jessica Gudorf	Extraction of Quercetin from Onions
Breanna Hampton, Coradrian Lopez, and Kylee King	Routine Dental Care Keeps the Bad Grades Away
Jessica Jensen, Laura Baker, and Kyla Borden	Periodontal Treatment and its Effects on Alzheimer's Disease
Ryan Loehrlein, Collin Runnion, and Kegan Miller	Undergraduate Nano Ionospheric Temperature Explorer (UNITE)
Jessica Miller, Marisa Volkman, and Kate Whitaker	Preventive Dental Care: The Impact on Cystic Fibrosis
Jonah Quirk	Langmuir Plasma Probe Measurements in a Simulated Atmospheric Plasma
Megan Ritterskamp	XRF Analysis of Trace Elements in Soils Surrounding a Coal-Fired Power Plant, Posey County, Southwestern Indiana
Molly Schmahl, Alexa Shoemaker, and Hannah Buley	Enamel Erosion: Adding a Basic Routine to Combat Morning Sickness

Laura Unfried

Advances in the Timing of Reproduction in Two Species of Cavity Nesting Birds in Response to Climate Change

9-10 a.m. POSTER SESSION

Carter Hall D

Bethany Bremer,
Alley Gilliland, and
Sidney Heldt

Ongoing Oral Care for Oncology Nurses

Cynthiana Dillman,
Brittany Benningfield, and
Makenzie Norris

Unintended Oral Benefits of Bisphosphonates

Dakota Eble

Conversion of Blue-green Light to Red Light on a Glass Slide

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Periodontal Treatment and its Effects on Alzheimer's Disease

Rachel Louviere,
Brooke Teike, and
Emily Wonnell

Fostering Oral Health Care

Payton Lykins

Evaluating the Source of Anomalous Earth-tide Signals in the Inglefield Sandstone

Jessica Miller,
Marisa Volkman, and
Kate Whitaker

Preventive Dental Care: The Impact on Cystic Fibrosis

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Langmuir Plasma Probe Measurements in a Simulated Atmospheric Plasma

Megan Ritterskamp	XRF Analysis of Trace Elements in Soils Surrounding a Coal-Fired Power Plant, Posey County, Southwestern Indiana
Jacob Robbins	The Hybrid Account of Knowledge-how
Kody Russelburg and Ryan Hopf	Development of a Dithiepin Framework for Novel Host Molecules
Molly Schmahl, Alexa Shoemaker, and Hannah Buley	Enamel Erosion: Adding a Basic Routine to Combat Morning Sickness
Laura Unfried	Advances in the Timing of Reproduction in Two Species of Cavity Nesting Birds in Response to Climate Change

10-11 a.m. POSTER SESSION

Carter Hall D

Brian Cantwell, Rayce McClary, and Andrew Roth	USI SAE Baja Club Suspension Behavior
Justin Cecil	Industrial Plate Aluminum and its Use as a Lithographic Matrix
Dakota Eble	Conversion of Blue-green Light to Red Light on a Glass Slide
Livia Hopper	Patterns of Cutaneous Water Loss and Stratum Corneum Lipid Interactions during the Development of Japanese Quail
Rachel Louviere, Brooke Teike, and Emily Wonnell	Fostering Oral Health Care
Payton Lykins	Evaluating the Source of Anomalous Earth-tide Signals in the Inglefield Sandstone
Maxia Monge and Kassie Robinson	Caries Prevention in Homebound Elders
Jacob Robbins	The Hybrid Account of Knowledge-how
Kody Russelburg and	Development of a Dithiepin Framework for Novel Host Molecules

Ryan Hopf

Samantha Sellers,
Madalyn Schadler, and
Katelyn Sheneman

Preliminary Analysis of Non-Muscle Motor Protein

Hannah Walker

Using GIS to Develop a Comprehensive Natural Hazards Inventory
for the Indiana-Illinois-Kentucky Tristate Area

11 a.m. - noon POSTER SESSION

Carter Hall D

Brian Cantwell,
Rayce McClary, and
Andrew Roth

USI SAE Baja Club Suspension Behavior

Justin Cecil

Industrial Plate Aluminum and its Use as a Lithographic Matrix

Livia Hopper

Patterns of Cutaneous Water Loss and Stratum Corneum Lipid
Interactions during the Development of Japanese Quail

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Using GIS to Develop a Comprehensive Natural Hazards Inventory
for the Indiana-Illinois-Kentucky Tristate Area

Oral Presentations

UC 226-227

- 9:00 – 9:20 **Kimberly Bell, Rachel Smith, Lucinda Hardison, Anne Kiboi, Grace Voyles, Allison Schroering, Sarah Mehringer, and Anna Heckman** - A Collaborative Approach to Educating Evidence Based Practice among BSN Students and Rural Hospital Nurses
- 9:25 – 9:40 **Lydia Moll** - “They are People Like You and Me”: Student Perceptions of Inmates
- 9:45 – 10:00 **Ethan Duncheon** - Disordered Skin Lipids Increase Cutaneous Water Loss in Pigeons at High Temperatures

Oral and Poster Presentation Abstracts

A Collaborative Approach to Educating Evidence Based Practice among BSN Students and Rural Hospital Nurses

Kimberly Bell, Rachel Smith, Lucinda Hardison, Anne Kiboi, Grace Voyles, Allison Schroering, Sarah Mehringer, and Anna Heckman

Faculty Mentors: **Dr. Susan Seibert, Dr. Jennifer Evans, and Ms. Sue Krieg**

The Chief of Nursing Officer (CNO) of a small rural hospital expressed a need for the nursing staff to gain proficiency in Evidence Based Practice (EBP). Through networking within a nursing research consortium, a partnership was established with the University of Southern Indiana's nursing program. The teaching strategy used was a student-driven interactive learning model. The goal was to increase the BSN students' confidence in teaching and to increase the RN's knowledge of EBP in order to implement EBP into their practice.

Nursing students met with the CNO and devised a timeline to introduce EBP to the nursing staff during the unit staff meetings. Students attended unit staff meetings offered at two different times, to accommodate varying shifts. Each educational session built on the previous one. Nursing students created educational handouts and provided tools to aid in interactive learning. The topics included EBP definitions, the process of EBP, finding scholarly resources in the hospital database, and how to appraise evidence. Interactive strategies included guided PICOT question formation, facilitated database searches, and demonstrations of article appraisal.

The project established a relationship between the university and a rural hospital. The staff RNs gained an understanding of EBP and implemented EBP into their practice by utilizing the resources used within the educational sessions for unit projects. The project also benefited the students by creating an opportunity for them to develop and deliver educational in-services and increase their own confidence with EBP. Furthermore, the students gained experience with other leadership and professional behaviors such as writing abstracts, creating posters and PowerPoints, applying for funding, developing budgets and delivering presentations. This project is ongoing and includes a formal research agenda to collect quantitative outcomes.

A collaborative partnership with neighboring nursing programs provides an innovative solution for rural hospitals who may not have robust educational resources for staff. BSN students can be EBP ambassadors and effectively create and facilitate EBP in the hospital setting.

Ongoing Oral Care for Oncology Nurses

Bethany Bremer, Alley Gilliland, and Sidney Heldt

Faculty Mentor: **Ms. Emily Holt**

Oral complications may arise throughout or after cancer treatment, including mucositis, dysgeusia, and infectious diseases. It is the ethical and legal responsibility of oncology personnel to prevent and treat the

oral complications associated with cancer treatment. Individuals with cancer spend more time with oncology personnel than dental providers, so oncology personnel should be equipped to identify and treat these oral complications. Healthcare providers receive varying levels of education on oral care and treatment of oral complications from cancer treatment.

Are oral complications from chemotherapy lessened when oncology nurses receive ongoing training pertaining to oral care recommendations compared to only receiving education on oral care during college? When patients receive care from oncology personnel who completed ongoing education relate to oral care, the patients experienced improved oral health outcomes. Preventive measures of oral complications are often overlooked by oncology personnel. This may be due to their limited knowledge of the oral cavity. Oncology nurses are not receiving adequate education pertaining oral care. Surveys demonstrate oncology nurses receive less than three hours of oral health related education/training. It is pertinent that oncology personnel further their education relating to oral health, in order to provide better health outcomes for their patients.

While nurses acknowledge a disparity exists in training on oral care and prevention of chemotherapeutic conditions, evidence is lacking to determine if training will reduce the frequency and severity of oral conditions from chemotherapy. Nurses with clinical requirements regarding oral care are more competent and confident in examining oral complications compared to nurses who are not required to maintain education on oral care. There is a need for interprofessional oral health care education and collaboration with nursing and dental professionals. Dental hygienists can provide in-service training to oncology personnel. Educational strategies should include dental products deemed beneficial to the patient's needs, brushing and flossing techniques suitable for patient, and nutritional needs.

USI SAE Baja Club Suspension Behavior

Brian Cantwell, Rayce McClary, and Andrew Roth

Faculty Mentor: **Dr. Julian Davis**

The Society of Automotive Engineers (SAE) Baja competition is used to promote experience in collaborative and practical applications of engineering education. It is focused on designing, building, and competing with a small off road vehicle, a Baja car. The USI SAE Baja Club tested the influence of three different sets of springs on the suspension behavior of our Baja vehicle. The first set of springs was borrowed from an old All-Terrain-Vehicle and have stiffness, $k_r=96$ lbf/in. The second set of springs are a composite of motorcycle and car springs combined in parallel. The have stiffness dominated by the motorcycle spring, $k_m = 113$ lbf/in. The last spring set are custom made springs with stiffness $k_b=125$ lbf/in.

In terms of suspension behavior, we are interested in 1) body roll, 2) dive stability, and 3) impact damping. Body roll is defined as the lateral angular deflection of the body of the car when turning. Dive stability is a measure of the change in pitch angle when braking. Impact damping is a measure of the car's vertical deflection in response to a drop test.

Three experiments were created and performed to test the suspension behavior. The first test, the body roll test, measures body roll at three speeds and three turning radii. This test indicates the least amount of roll came from the custom spring set. The dive stability tests indicate similar performance between the custom springs and the motorcycle springs at a range of speeds. Finally, the drop test shows similar performance amongst each set of springs. This paper reports the results of these tests and indicates the best springs based on these performance criteria.

Industrial Plate Aluminum and its Use as a Lithographic Matrix

Justin Cecil

Faculty Mentor: **Mr. Brett Anderson**

Traditionally Bavarian limestone blocks have been used for fine art lithography for more than 200 years. These limestone blocks are no longer quarried. Commercially available ball-grained plates have also been used in the production of lithographs, but they can only be used once. Both limestone blocks and ball-grained plates have become cost prohibitive because of resource scarcity or commercial obsolescence. Current prices for second-hand, large lithographic stones can cost upwards of \$5000. A sheet of industrial aluminum alloy of similar size can be acquired locally for less than \$80. We have successfully grained the surface of these aluminum plates for repeated use and have found them to accommodate most traditional lithographic drawing materials quite well. Though the grained surface of these aluminum alloy sheets is processed for lithographic printing like commercial ball-grain plates, artists should be able to resurface an alloy plate hundreds of times. From our research we have completed a studio manual for this lithographic technique, providing a valuable learning resource for future students who take printmaking, making the process more approachable.

Unintended Oral Benefits of Bisphosphonates

Cynthiana Dillman, Brittany Benningfield, and Makenzie Norris

Faculty Mentor: **Ms. Emily Holt**

Osteoporosis is a condition in which individuals lose bone density and become prone to fractures. Low bone mineral density results in a greater risk for periodontal disease, with bone loss surrounding the teeth. Bisphosphonate drugs alter or inhibit the ability of osteoclasts to reabsorb, thereby suppressing bone turnover. They are used to treat osteoporosis by slowing down osteoclastic activity and allowing osteoblasts to build more bone.

Do post-menopausal women who have osteoporosis and are using bisphosphonates have less alveolar bone loss than post-menopausal women with osteoporosis not using bisphosphonates? Studies have shown that postmenopausal women with osteoporosis are more susceptible to alveolar bone loss and loss of periodontal attachment and that bisphosphonates can improve the periodontium in this population. Bisphosphonates have increased bone mineral density and prevented periodontal ligament destruction. Bisphosphonates have showed to decrease the progression of osteoporosis and halt alveolar bone loss. A study done by Scardina and Kribbs, showed that when there is a decrease in bone density there can be attachment loss and tooth loss especially in those in advanced stage osteoporosis. A study done by Dodd and Rowe, showed that postmenopausal women with osteoporosis experience more clinical attachment loss than women with normal bone densities.

Bisphosphonates have shown to benefit the periodontium by decreasing alveolar bone loss and increased bone health. Proper preventive actions, evaluation, and treatment can lead to reduced tooth loss, less periodontal disease, and less loss of bone mineral density. Dental hygienists should see these clients before, after, and during bisphosphonate treatment in order to continually monitor their oral

cavity. Radiographs should be taken regularly to monitor alveolar bone levels. Dental hygienists should also be more proactive by going out into the community to serve this specific population.

Disordered Skin Lipids Increase Cutaneous Water Loss in Pigeons at High Temperatures

Ethan Duncheon

Faculty Mentor: **Dr. Alex Champagne**

As ambient temperature (TA) increases, many animals increase total evaporative water loss (TEWL) to maintain a constant body temperature. In Passerine birds, the increase in TEWL is mainly attributed to an increase in respiratory water loss, whereas water lost through the skin as cutaneous water loss (CWL) increases only modestly. However, pigeons and doves (Columbidae) exhibit an opposite trend, greatly increasing CWL with only a small increase in respiratory water loss. The unique ability of pigeons and doves to greatly increase CWL at high TA may be attributed to the inherent thermal properties of the skin barrier. In birds, the barrier to CWL is the stratum corneum (SC), the outermost layer of skin comprised of dead cells called corneocytes embedded in a matrix of lipids packed together in layers called lamellae. The ability of lipid molecules to pack tightly together in an ordered arrangement determines the permeability of the SC to water and thus CWL. We measured the CWL of pigeons (*Columba livia*) at 25, 30, 35, 40, and 45°C. We then isolated the SC and used Fourier transform infrared spectroscopy to assess lipid ordering and phase state at the same temperatures. Our results indicate that CWL in pigeons increases as TA increases, and this increase is associated with a concurrent increase in lipid disorder. Furthermore, lipids in pigeon SC undergo a greater increase in disorder than Passerine birds, further supporting the hypothesis that thermal properties of skin lipids determine an organism's physiological response to increased TA.

Conversion of Blue-green Light to Red Light on a Glass Slide

Dakota Eble

Faculty Mentor: **Dr. Priya Hewavitharanage**

Materials that can absorb many different colors of light are valuable for a variety of applications such as solar energy conversions and biomedical sensors. In such systems, each individual molecule absorbs different wavelengths of light and transfers its energy to neighboring molecules. Producing such materials requires synthesis of individual molecules that absorb light at different wavelengths and chemically connecting them together. Such synthesis processes are tedious, time consuming, and often produce low yields. The transfer of energy does not take place when molecules are more than 10 Å apart. Therefore, mixing individual molecules in solution does not result in energy transfer. However, in solid state, energy transfer may occur due to the proximity of molecules.

Compounds that emit blue-green light, green light, and red light were synthesized. They were dissolved in toluene to give a homogenous mixture and spin coated on glass or quartz slides. According to our results, these thin films are capable of harvesting light at multiple wavelengths and transferring to the neighboring molecules. Theoretical calculations were used to explain the transfer process.

Geometry, Electronic Structure and Physico-chemical Properties of the Carcinogenic NNK Diazonium Ion

Maverick Grayer

Faculty Mentor: **Dr. Christos Deligkaris**

The compound 4-methylnitrosamino-1-3-pyridyl-1-butanone, abbreviated NNK, is a carcinogen found in tobacco products. Although NNK does not directly form DNA adducts, it is metabolized by cytochrome P450 into a variety of intermediates that can methylate and pyridyloxobutylate DNA. The NNK diazonium ion is a carcinogenic intermediate that is produced when α -hydroxylation occurs at the methyl carbon of NNK, creating α -hydroxymethyl NNK. α -hydroxymethyl NNK can spontaneously produce formaldehyde and pyridyloxobutyldiazohydroxide, the latter of which can form the diazonium ion. The ion is of particular interest, as it can either directly react with nucleophiles, or it can become a cyclic oxonium ion or α , β -unsaturated ketone, both of which react with nucleophiles. This study involves the analysis of the NNK diazonium ion's ground state geometry and electronic structure, along with physico-chemical properties such as atomic partial charges, molecular dipole moment, and electrostatic molecular surface using the B3LYP hybrid generalized gradient approximation density functional and the 6-311G basis set. We will present the results and discuss the implications the data has on the diazonium ion's physical binding and damage to DNA.

Extraction of Quercetin from Onions

Jessica Gudorf

Faculty Mentor: **Dr. Edmir Wade**

A traditional medicinal remedy that has been used for centuries to help cure the common cold or other viruses is through the use of an onion. The onion is sliced and placed on the bottom of the foot with a sock as a cover, and the onion is left on overnight. In the morning, it is believed that the symptoms should have subsided. Upon researching the cause of this folk remedy, it was determined that the main antioxidant in onions, quercetin, is the reason for the resolution of these viral symptoms. Quercetin plays a role in regulating the immune system's response to outside stressors through cell signaling pathways. Research was conducted to determine the presence of quercetin in red onions. Extraction of quercetin from onions was conducted by using methanol, and analysis techniques of Thin Layer Chromatography (TLC) and Liquid Chromatography (LC) were performed on the extract. The proper mobile phase for each of these analysis techniques had to be determined, which was a 4.0:3.5:0.5 ratio of ethyl acetate, toluene, and methanol. The TLC analysis technique produced an indication at a retention factor of 0.428, and the literature retention factor for quercetin for this mobile phase is 0.43. The samples that were collected from the LC analysis will be subjected to other analysis techniques, such as Nuclear Magnetic Resonance (NMR) and Infrared Spectroscopy (IR), to determine the identity of the product that was eluted from the column.

Future research for this project would be to replicate the data and results from the extraction of quercetin from onions when subjected to TLC and LC. However, other analysis techniques should be

implemented to help support that quercetin was in fact extracted from red onions. These techniques could include Gas Chromatography coupled with Mass Spectrometry (GC/MS) or High Performance Liquid Chromatography (HPLC). Lastly, determining the amount of quercetin in red onions would be beneficial because the data can then be compared to the amount of quercetin in other onion species or in different fruit and vegetables.

Routine Dental Care Keeps the Bad Grades Away

Breanna Hampton, Coradrian Lopez, and Kylee King

Faculty Mentor: Ms. Emily Holt

Dental caries is the most prevalent childhood disease. Worldwide it has been concluded that 60-90% of children have dental caries. Dental pain can result from untreated dental caries. While 64.6% of parents report that their child had visited the dentist every six months, 10.7% said that their child had not visited the dentist in the last few years. Children who experience dental pain are likely to miss school and perform lower in school.

Do children who receive preventive dental care twice a year perform better in school than those who only seek dental care for emergencies? Research shows that children who go to the dentist only for emergency based dental pain miss more school than children who go to the dentist routinely for preventive care. Absences that are caused by dental pain and irregular care are associated with poorer school performance, whereas absences for routine care are not. Chronic pain from untreated dental caries decreases a child's ability to concentrate. The combination of missing school and being unable to concentrate has been proven to result in a lower grade point average. In another study, children with poor oral health are nearly three times more likely than were their counterparts to miss school as a result of dental pain. Students with toothaches were almost four times more likely to have a low-grade point average.

Applying fluoride to teeth is one preventive measure against caries development. Two or more professional applications of sodium fluoride varnish each year are effective in preventing dental caries in children of all ages with a high caries risk. This procedure is completed during preventive dental care visits. There is evidence to suggest that children who receive preventive dental care twice a year are more likely to have less dental pain than children who do not seek routine care. As a result, these children are more likely to perform better in school than children who only seek dental care for emergency cases.

Patterns of Cutaneous Water Loss and Stratum Corneum Lipid Interactions during the Development of Japanese Quail

Livia Hopper

Faculty Mentor: Dr. Alex Champagne

The development of regulatory mechanisms that prevent water loss is critical to survival in terrestrial organisms. In birds, over half of water loss occurs through the skin as cutaneous water loss (CWL). As birds develop from hatchlings to adults, their ability to regulate CWL may be affected by ontogenetic,

evolutionary, or environmental factors. The primary barrier to CWL is the SC, the outermost layer of the epidermis, composed of corneocytes surrounded by a matrix of lipids. The ability of these lipids to pack together and interact with water molecules may influence the rate of CWL. In this study, we hatched Japanese Quail (*Coturnix japonica*) and measured CWL every 2 days for 14 days. After isolating the SC, we used infrared spectroscopy to investigate lipid packing structure and hydrogen bonding in SC samples. Our results indicate that CWL is constant during development in Japanese Quail, results that differ from similar developmental studies in House Sparrows (*Passer domesticus*). This difference may reflect the environmental and ontogenetic differences associated with precocial development compared with altricial development. Additionally, we find that properties of hydrogen bonding and lipid packing throughout the developmental trajectory of quail underlie patterns of CWL.

Periodontal Treatment and its Effects on Alzheimer's Disease

Jessica Jensen, Laura Baker, and Kyla Borden

Faculty Mentor: **Ms. Emily Holt**

There is currently research that periodontal disease and Alzheimer's disease are related. It is thought that chronic periodontitis may be a risk factor for increased cognitive damage in patients with Alzheimer's disease. Do patients who forego treatment of chronic periodontitis have more symptoms of Alzheimer's disease compared to those who receive treatment?

Multiple studies and clinical trials have suggested that periodontal disease and chronic inflammation are associated with the risk of dementia, including Alzheimer's disease. Chronic periodontitis raises the levels of pro-inflammatory cytokines in the blood stream, which feeds the progression of Alzheimer's disease. Microorganisms from the mouth enter the blood stream when bleeding occurs, allowing the bacteria to enter into the blood brain barrier. One animal study proved that *P. gingivalis* can migrate to further organ sites such as the brain which can cause inflammation. This neuroinflammation can contribute to the initiation and progression of Alzheimer's disease and increased cognitive decline. A research study showed that cytokine levels are increased in gingival crevicular fluid (GCF) from sites with periodontal disease and periodontal treatment results in reduction of the cytokines. However, in another study, changes of GCF cytokine levels after periodontal treatment did not reach a statistical significance until month three when the levels started to decrease significantly. The results were still much higher than the levels measured in a healthy patient who was free of periodontal disease.

The association of chronic periodontitis and Alzheimer's disease is still in its early stages. The evidence of *P. gingivalis* infection in the brain autopsy specimens of demented individuals requires additional research. Therefore, there is not enough significant evidence to support that the symptoms of Alzheimer's disease will be more pronounced if no treatment is performed for chronic periodontitis compared to those receiving treatment. If the longitudinal studies become confirmed, treatment of chronic periodontitis may prevent the progression of Alzheimer's disease.

Undergraduate Nano Ionospheric Temperature Explorer (UNITE)

Ryan Loehrlein, Collin Runnion, and Kegan Miller

Faculty Mentor: **Dr. Glen Kissel**

These Endeavor grants are in support of the USI's CubeSat team effort to design, build and fly a CubeSat, called the Undergraduate Nano Ionospheric Temperature Explorer (UNITE). This small spacecraft is designed to probe the plasma in the Earth's lower ionosphere and measure the temperatures on and within the spacecraft's structures while monitoring the orbit via the GPS. Through this project, the team has applied for multiple Endeavor grants, all of which were helpful to the UNITE team. The first two Endeavor grants supported two design features on the CubeSat: the Printed Circuit Board (PCB) and the procurement of a GPS. The third Endeavor grant supported Ryan Loehrlein, Kegan Miller and Colin Runnion's trip to the SmallSat Conference, in Logan Utah.

The first grant funded the design, prototyping and purchase of the solar panel PCBs for the UNITE spacecraft. The solar cells were attached to the PCB and were then wired into the EPS unit. The PCBs each held one temperature sensor; three of the PCBs had eight solar cells and one PCB had six solar cells. The second grant supported the procurement of a GPS unit that will be used to give UNITE the position, velocity, and time data of the CubeSat in orbit. The final grant allowed three members of the UNITE team to interact with professionals and companies within the aerospace workforce at the SmallSat Conference.

Fostering Oral Health Care

Rachel Louviere, Brooke Teike, and Emily Wonnell

Faculty Mentor: **Ms. Emily Holt**

Foster care is a term that describes a situation where a person or family takes on the responsibility of caring for a child that is not biologically their own. The research shows that dental neglect and periodontal disease are common disorders found among children entering the foster care system. Many barriers arise in neglected and foster children from receiving adequate dental care needs. Some of the barriers include lack of finances, absence of means for transportation, lack of dental records, and insufficient basic and primitive knowledge of oral health.

For children in the foster care system, does their oral health improve after entering the system, compared to before they were in the foster care system? In order to find resources to support the clinical question, keywords were searched within the Trip database and as well as PubMed. Nine peer-reviewed articles and one website were used to answer the clinical question. Finding research within the past ten years was difficult to obtain, as for this topic matter has not been recently investigated.

The evidence found exemplifies the need for interprofessional work in order to extend the best care towards these children. Dentists, dental hygienists, and social workers should all collaborate to create a feasible care plan for these children. It is also evident that oral health education is something that needs to be stressed to social workers, parents, and children alike. Although it can be generalized that many children, prior to entering the foster care system, have experienced a problematic past and have had several barriers in the path of receiving adequate oral care, even after entering the foster care system

there are blockades as well. The improved oral health of a child after entering the foster care system is too circumstantial to prove conclusive.

Evaluating the Source of Anomalous Earth-tide Signals in the Inglefield Sandstone

Payton Lykins

Faculty Mentor: **Dr. Paul Doss**

Water-levels from a deep-shallow piezometer nest in the Inglefield Sandstone portray a dynamic groundwater system. Ground water-levels at the 33.5 and 18.3 m depths fluctuate significantly, and indicate high frequency and high amplitude barometric effects and low amplitude periodicity from Earth-tide stresses. Barometric influences were removed from water-level data using the Kansas Geological Survey-Barometric Response Function software (KGS-BRF). Fast Fourier Transform (FFT) analysis of tidal periodicities in corrected water levels suggests that the solar stressor signal was stronger than the lunar stressor signal, yet the moon is the dominant tidal force on Earth. We hypothesize that the higher-amplitude solar stress periodicity may result from an anthropogenic influence operating on a solar cycle, such as the diurnal loading of campus by people and vehicles. FFT analyses for 2016 hourly water-level data for the deep (WMW) and shallow (EMW) piezometers, and hourly data from winter 2015, fall 2016, and winter 2017 were evaluated by a FFT method which identified periodicities of water-level change at 12.4 hrs and 12.0 hrs for WMW, 12.5 hrs and 12.0 hrs for EMW, 12.0 hrs for winter 2015 and fall 2016, and 12.2 hrs for winter 2017. Periodicities of winter and fall water-level data correlate with a solar stress. Lunar stressors were observed for both wells in the 2016 year dataset. Solar signal amplitude remained unchanged between winter 2017, fall 2016, and winter 2015 datasets. Our hypothesis suggested we would observe a smaller amplitude solar signal in the winter data because no daily aquifer loading was occurring on campus. However, our results provide no conclusive evidence to suggest that daily aquifer loading is the source of the stronger solar stress signal.

Preventive Dental Care: The Impact on Cystic Fibrosis

Jessica Miller, Marisa Volkman, and Kate Whitaker

Faculty Mentor: **Ms. Emily Holt**

Cystic Fibrosis (CF) is an inherited disorder that affects multiple organs of the body, especially the lungs. Breathing problems and increased lung infections occur in these individuals. Medications taken by CF patients suppress the immune system and cause xerostomia. Patients with CF are frequently hospitalized due to infections from *Pseudomonas aeruginosa*. *P. aeruginosa* can be aspirated from the oral cavity into the lungs, leading to development of pneumonia, bronchitis, and asthma attacks. Respiratory infections are the most important cause of morbidity and mortality in CF patients.

In patients with CF, will routine preventive dental care reduce the risk of developing recurrent lung infections from *P. aeruginosa* compared to those who don't receive routine preventive care? Several studies were conducted to determine the effects of *Pseudomonas aeruginosa* in the oral cavity. A cross-

sectional pilot case-control study was conducted to see if *Pseudomonas aeruginosa* was recovered in saliva, sputum, and subgingival plaque using quantitative polymerase chain reaction (PCR). Another study showed the connection between CF medication (tobramycin) and *P. aeruginosa*. From the cross-sectional pilot case-control study ten patients were tested. Five were found to be chronically colonized and five were found to be not colonized. In this study, sixteen different strains were found. When *P. aeruginosa* is found in samples, it indicates that the oral cavity is at an increased risk for harboring a lung infection. *P. aeruginosa* can build up resistance to tobramycin, a strong antibiotic.

Overall, reducing the amount of *P. aeruginosa* can decrease the number of lung infections in those with cystic fibrosis. Since routine preventive dental care reduces the bacterial load of *P. aeruginosa* present in the oral cavity, it is likely that routine preventive care for CF patients will reduce the risk of developing recurrent lung infections. Studies so support this conclusion are not available, so further research is needed to validate the conclusion.

“They are People Like You and Me”: Student Perceptions of Inmates

Lydia Moll

Faculty Mentor: **Dr. Melissa Stacer**

It is not uncommon to hear an “us versus them” dichotomy when criminal offenders are discussed among the public. This attitude is also prevalent among criminal justice students, who often hold negative views of offenders and inmates. Despite an abundance of television and “infotainment” shows introducing prisons to the public, the correctional facility and those confined within remain largely unknown and thus subject to negative stereotypes and generalizations. Tours of correctional facilities are often used in criminal justice curricula to introduce students to the reality of corrections so they have a more realistic idea of what to expect when they work in the field. In this research, we examine 80 essays written by undergraduate students about their experience touring a jail or prison to explore their perceptions of inmates prior to and after the tour. Many students held stereotypical views of inmates before visiting, believing inmates were “bad people,” but for some students these views were challenged by their experiences on the tour. We discuss the implications of our findings for the undergraduate criminal justice student population, who represent future criminal justice professionals.

Caries Prevention in Homebound Elders

Maxia Monge and Kassie Robinson

Faculty Mentor: **Ms. Emily Holt**

Research indicates that the oral status of homebound elders is poor regardless of their health conditions or access to dental services. Elders may be taking medications that cause xerostomia, which raises the possibility of developing dental caries. Not all cases of xerostomia lead to the development of dental caries. There are many contributing factors including systemic conditions, immune response, health of the dentition and oral cavity, and lifestyle choices.

Are homebound elders less prone to dental caries when xerostomia is treated compared to those who do not treat xerostomia? Literature Search- ProQuest, PubMed, EBSCOhost, Nursing Resource Center, and the American Dental Association were used as search engines for evidence to answer the clinical question.

Seven peer-reviewed journal articles, one non-peer reviewed journal articles, three websites, and one book were used to answer the clinical question. It was difficult to find literature on the dental conditions of homebound individuals but many sources validate the increased risks on the health of the oral cavity associated with xerostomia. Because therapeutic treatment of both, over the counter and physician prescribed medications is fairly new, research has not been conducted on dental caries formation as a direct result of untreated xerostomia compared to those who properly treat xerostomia. Therefore, to directly answer the clinical question, more studies are required.

Unfortunately, research has not determined if the incidence of caries is reduced when xerostomia is treated in homebound elders. Most data reflects adequate salivary flow has a positive impact on sustaining proper oral health. Dental clinicians and caregivers should assess homebound patients for xerostomia. They should educate the homebound elder on how to treat xerostomia and the risk of developing dental caries. Because of the decrease in dexterity, some elder patients may need the dental hygienist to incorporate patient specific modified dental products to promote plaque removal.

Langmuir Plasma Probe Measurements in a Simulated Atmospheric Plasma

Jonah Quirk

Faculty Mentors: **Drs. Kent Scheller and Eric Greenwood**

The ionosphere is a region of the atmosphere made of partially ionized gases due to solar radiation. These ionized gases constitute a plasma. This region of the atmosphere is critical to the propagation of electronic signals for communications purposes. The plasma in this region can severely hinder this propagation depending on its temperature and electronic properties. The motivation for this project was to model the plasma in the ionosphere using a plasma chamber and to measure the characteristics of this plasma utilizing a Langmuir plasma probe. These probes are used to measure parameters such as the plasma temperature and density.

Langmuir plasma probes operate by immersing a probe in a plasma and varying the electric potential (voltage) applied to the probe. As the potential is varied, electrons from the plasma flow into or out of the probe. The rate at which the electrons flow depends on the temperature and density of the plasma as well as the potential applied to the probe. A plasma chamber and Langmuir probe have been constructed in the University of Southern Indiana Physics Research Lab. The plasma chamber was constructed to simulate the ionosphere, while the temperature and density of the plasma was measured using the Langmuir probe. These measurements took place in a vacuum with an absolute pressure of 1.5 mbar to closely simulate the pressure of the lower ionosphere. The electron temperature and density measured was 11800(970) K and $1.105(100) \times 10^{16} \text{ m}^{-3}$. Based off of two standard deviations, the percent error of the electron temperature and density measurements were 8.17% and 9.02% respectively. These measurements agree with past measurements conducted at similar pressures. The results confirm that measurements of plasma can be conducted fairly accurately in a lab.

XRF Analysis of Trace Elements in Soils Surrounding a Coal-Fired Power Plant, Posey County, Southwestern Indiana

Megan Ritterskamp

Faculty Mentors: **Drs. James Durbin and Tony Maria**

Our research uses a PANalytical X-ray Fluorescence (XRF) Spectrometer to conduct a trace element analysis to identify potential chemical contaminants in soils surrounding a coal-fired power plant near the University of Southern Indiana. Eighteen upland forested soils were collected from sites within an 8 km radius of the power plant. Sites were selected to minimize the influence of agricultural and roadway inputs and avoid homogenizing effects of lowland fluvial systems. Soils were sampled at ~ 30 cm intervals within the A and B-horizons to a depth of ~ 1 m. Initial data indicates concentrations ranging from 0 to 130 ppm for As, Pb, Cr, Cd and Se. These elements are known to cause adverse health effects when concentrations exceed established guidelines. The EPA reports naturally occurring concentrations (in ppm) of As, Pb, Cr, Cd, and Se in surface soils range from 1-50, 2-200, 1-1,000, 0.6-1.1, and 0.1-2 respectively. Our data (in ppm) shows averages of 111.4 (As), 35.8 (Pb), 65.8 (Cr), 9.3 (Cd), and 4.1 (Se), with values commonly exceeding naturally occurring levels. This indicates an external source is contributing to the higher trace element concentrations. Contour maps of concentration data for the study area demonstrate a pattern with a southwest to northeast trend, aligned with persistent surface winds, and with notable concentration peaks at 2.5 to 5 km downwind of the coal-fired power plant. Given our requirements for sample site placement, and the orientation and alignment pattern of concentration contours with surface winds, it appears the nearby power plant is a potential source of the trace element contaminants, either from smokestacks or from on-site fly ash pits. The power plant's scrubbers are not 100% efficient at capturing pollutants, and at various points in its history, the capture technology advanced becoming more efficient with time. In addition, on-site fly ash storage is known to become airborne, and as regulations regarding fly ash have evolved, the storage of the materials has changed as well. Thus, either of these mechanisms could be contributing to increased concentrations of trace elements examined in the study area.

The Hybrid Account of Knowledge-how

Jacob Robbins

Faculty Mentor: **Dr. Chad Gonnerman**

Philosophers have diverged into two popular views on the study of the nature of knowledge-how. While intellectualists attribute propositional knowledge (a person knows that *w* is the way to do something) for one to have knowledge-how, praxists attribute requisite ability. More recently, both views have accrued respective support from the intuitions of non-philosophers (or folk) through the use of thought experiments. Moreover, there exists reason to believe that the folk concept of know-how has both intellectualist and praxist elements to it, concocting a hybrid concept. We explored this possibility using three between-subjects studies, each utilizing reading probes. Our results support the notion that the folk conceptualize know-how as having both praxist and intellectualist elements.

Development of a Dithiepin Framework for Novel Host Molecules

Kody Russelburg and Ryan Hopf

Faculty Mentor: **Dr. Edmir Wade**

The dithiepin molecule is highly conjugated and is an electron rich organo-sulfur aromatic framework. Consequently the dithiepin molecule exhibits a large amount of UV activity. A difference in UV activity would allow for electron deficient aromatic guest molecules, such as trinitrotoluene (TNT) or buckminsterfullerene, to be more easily detected. The portability and ease of use of UV spectrometers could provide an easy way to test for explosives. Currently, our research on the synthesis of the framework of the dithiepin molecule. After the framework is created, the various pieces will be added to each other in order to create the large dithiepin molecule.

Enamel Erosion: Adding a Basic Routine to Combat Morning Sickness

Molly Schmahl, Alexa Shoemaker, and Hannah Buley

Faculty Mentor: **Ms. Emily Holt**

Morning sickness/frequent vomiting can negatively affect the oral cavity, specifically the enamel of the teeth. Enamel erosion is permanent loss of enamel from chemical erosion. The longer the time span and severity of morning sickness during pregnancy, the more likely enamel erosion is to develop. Action should be taken to prevent enamel erosion. A traditional suggestion to prevent enamel erosion is to swish with water following a vomiting episode. While this is a common suggestion, better options may exist to prevent enamel erosion.

Are pregnant women experiencing frequent vomiting less likely to develop enamel erosion if they rinse with baking soda and water, compared to rinsing with water alone following a vomiting episode? PubMed resources were used to locate literature to answer the clinical question. Seven peer-review articles, four websites, and one textbook were reviewed. Resources that connect vomiting during pregnancy to the incidence of enamel erosion are lacking. Baking soda increases the pH of the saliva to prevent the potential risk for enamel erosion. A study investigated whether sodium bicarbonate solution could control enamel erosion. Study volunteers wore devices in their palate that contained enamel. The devices were taken out and exposed to hydrochloric acid for 2 minutes twice a day. Immediately afterwards, the devices were re-inserted in the mouth and volunteers rinsed with either a sodium bicarbonate solution or deionized water for 60 seconds. Less enamel was lost from the devices when they were rinsed with a sodium bicarbonate solution compared to the devices rinsed with deionized water.

While rinsing with just water following a vomiting episode is beneficial, the high pH of baking soda and water rinse appears to neutralize the mouth faster which may prevent enamel erosion better than simply rinsing with water alone. Dental hygienists should inform pregnant women of the need to rinse with a mixture of 1 tablespoon of baking soda and at least 8 oz. of warm water immediately after vomiting.

Preliminary Analysis of Non-Muscle Motor Protein

Samantha Sellers, Madalyn Schadler, and Katelyn Sheneman

Faculty Mentor: **Dr. Jeannie Collins**

The main object of our research is to isolate and analyze non-muscle motor proteins found in slime mold. The non-muscle motor proteins are thought to be present because, in its life cycle, the slime mold can move across an agar plate to reach its food source even though it lacks muscle tissue. Once the slime mold has matured, the proteins will be isolated and analyzed through the use of western blotting. The goal is to isolate and identify the non-muscle motor proteins present that allow for slime mold locomotion in the absence of muscle proteins. The results gathered from this experiment may be used in future analysis of the movement of other types of cells such as metastasized cancer cells.

Advances in the Timing of Reproduction in Two Species of Cavity Nesting Birds in Response to Climate Change

Laura Unfried

Faculty Mentor: **Dr. Alex Champagne**

The timing of breeding is critical in determining reproductive success. As global temperatures have increased in recent decades, many animals have modified their breeding behaviors. Among birds, some species have advanced the timing of reproduction in accordance with temperature increases, whereas other species have failed to adjust breeding time, resulting in mistimed reproduction. We analyzed 25 years of nesting data from Eastern Bluebirds (*Sialia sialis*) and Carolina Chickadees (*Parus carolinensis*), from 38 nest boxes on the University of Southern Indiana campus in Evansville, IN. Between the years of 1973 and 2017, the onset of breeding, measured as the date of the first egg laid by each species, advanced by more than 7 days in bluebirds and 11 days in chickadees. In both species, the advancement in breeding correlates with average surface temperature at the time of breeding. This correlation suggests that Eastern Bluebirds and Carolina Chickadees can adjust breeding phenology based on proximate cues, and may be able to adjust to a changing climate.

Using GIS to Develop a Comprehensive Natural Hazards Inventory for the Indiana-Illinois-Kentucky Tristate Area

Hannah Walker

Faculty Mentor: **Dr. Paul Doss**

Natural hazards include geological and meteorological events that threaten human health, life, economic security, and property. Tools such as Geographic Information System (GIS) have been used to create

natural hazards maps to improve prediction and mitigation techniques and lessen risk to communities in the United States. The intent of this study is to create a comprehensive inventory of natural hazard occurrence in the Indiana-Illinois-Kentucky tristate area from 1997 to 2017. The tristate area includes 36 counties from Indiana, Illinois, and Kentucky. These states seek to share stable and secure business, work force, and financial resources and will benefit from a comprehensive natural hazards map of the area. Natural hazards to be included in this study are droughts, earthquakes, floods, winter storms, severe storms, and tornadoes. Droughts defined by several drought indices including the Standard Precipitation Index and the Palmer Drought Severity Index will be included, as will all earthquakes and tornadoes that occurred in this region during the time frame. Winter and severe storms designated as disaster declarations by FEMA will be included. It is unclear at this point how flood events will be designated, but they may be defined by flood inundation areas and/or FEMA disaster declarations. The development of a map that locates the occurrence and distribution of natural hazards from the previous 20 years can be used by local and regional governments and emergency responders to improve economic development and prediction and mitigation responses to natural hazards. The findings of this study will be an important educational tool and can be useful for proactive land-use planning. Further efforts might include mapping the occurrence of human-caused natural hazards such as seismicity induced by mining activities or deep disposal of waste fluids and mine subsidence.

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