Poster Abstracts

April 18 & 19, 2017

Earlham College
Posters listed by placement in display area.

Bonner Scholar Experiences: Engaging, Serving, Learning and Developing in Richmond and Beyond
Sam Kahsay, Jordan Bartolo, James Johnson, Imani Lewis-Morelle, Regan Lowring, Tyrian Robertson, Brandon McClendon, Ava Obrecht, Will Reynolds, Michelle Zhang, Brytnie Jones
These posters showcase the school year and summer service experiences of senior Bonner Scholars. Students describe skills they have gained and reflect on how their service connected with their life and academics at Earlham and how it has influenced their future plans.

Debunking Food Myths: Health Benefits of Coffee
Carley Carpenter
The health claim that I have chosen to write about is that coffee does not have any health benefits. I am going to debunk this myth with the research from scientists and doctors and the articles from interested authors. This is a myth because a lot of research on coffee does not have clear "proof" that it has benefits. There are many speculations and assumptions that coffee is beneficial to human health, and I am going to dig deeper to find out the truth. I am interested in this topic for a few different reasons. The first reason is because coffee is a huge part of my daily routine. I love coffee! I cannot go a day without coffee and I want to know if what I am putting in my body is helping me or hurting me. The second reason is a bit more scientific. I want to research this topic because I am on track to pursue a degree in biochemistry and this topic directly correlates with my major. Coffee contains chemicals that can react within the body and the brain in different ways. This topic relates to my personal life and my scholarly life.

Debunking Food Myths: The Bulletproof Coffee Diet
Kelly Mayhew
A study by the National Coffee Association indicates that 54% of Americans over the age of 18 drink coffee every day; and of those who drink coffee, the average daily intake is approximately 24 ounces. The Bulletproof Coffee Diet took the United States by a storm beginning 2015. Dave Asprey initially created the recipe in 2009, inspired by yak-butter tea on Mount Kailash in Tibet. Since then, the diet has evolved to include 2 cups of coffee (specifically Certified Clean Coffee Beans), 1-2 tablespoons of unsalted grass-fed butter (specifically grass-fed Ghee), and 1-2 tablespoons of Brain Octane or XCT oil. The following claims have been made by Asprey regarding the Bulletproof Coffee Diet: Certified Clean Coffee Beans minimizes coffee contamination by mycotoxins; Brain Octane Oil, purified medium-chain triglyceride, bypasses processing by the liver allowing for increased energy availability; and grass-fed butter contains more vitamins, omega-3 fatty acids, and CLA than regular butter. This coffee concoction quickly became a fad diet, claiming to improve cognitive performance and increase weight loss. As a regular coffee drinker and active young woman, I am curious to see if this fad really holds up, or if it is simply a myth to be debunked.
Does organic food possess substantial clinically-significant health and nutritious benefits?

Khai M Nguyen

All the food we eat are organic. They are made up of molecules that are composed of Carbon and Hydrogen among other elements. "Organic" food, as promoted, are those that are produced to the standards of organic farming, some of which include the restricted use of pesticides, prohibition of additives or chemical irradiation. In short, organic food are produced using less invasive, and more "natural" methods. Although people buy organic for multiple reasons, it is mostly due to the widespread public belief of the health and nutritious benefits of these products (Kareklas and Muehling). This has led to a massive surge in organic sales, more than doubling in a decade, from $18 billion in 2006 to $43.3 billion in 2015. In a Colby College study, the prices of organic food have been found to almost always be considerably higher than those of their non-organic counterparts. This has led to the question of whether the prices consumers are currently paying are worth the health benefits, which necessitates the investigation of the health and nutritious advantages of these products. I will be studying whether organic products possess the substantial clinically-significant health and nutritious benefits that consumers are paying a premium for.

How Berries Effect Your Memory

Kaitlyn Funck

For my topic, I choose how eating berries can benefit your brain. There is evidence that suggests that eating blueberries, blackberries, strawberries, and other types of berries is beneficial to the brain and can help prevent age-related memory loss and other changes. The human brain is prone to oxidative damages. Peroxynitrite nitration caused by tyrosine residues present in enzymes and proteins are responsible for brain damage. Nerve receptor sites are blocked by nitrated tyrosine. Active ingredient pelargonidin in Anthocyanidin prevent the nitration of tyrosine and restrict occurrence of any neurological damage caused to the nervous system.

Does Potato Chip Consumption Increase Cancer Risk?

Hannah Franklin

Despite not having much of a nutritional value, potato chips are a highly consumed food in the United States as well as many other countries. Most potato chips are salted and fried in hydrogenated oils. Trans fats have been linked to cancer and the hydrogenated oils that the potatoes fried in contain trans-fat. Another cancer link is found due to the fact that the potatoes are fried at such a high temperature, and foods heated above a certain temperature have been shown to have high levels of acrylamide. In various studies, acrylamide has been linked with an increased risk of various types of cancer.
What's the Deal with Yogurt and the Gut?

Abou-Nica Fomukong

The health claim I decided to research is: "Yogurt With Active Cultures Helps the Gut" (Magee, 2017). This topic caught my interest because I enjoy eating yogurt with granola. As I researched about the claim, I discovered that yogurt could assist with colon cancer, Inflammatory Bowel Disease (IBD) and constipation, etc. Also, another source claims that vitamin D, calcium and lactic-acid bacteria (which is in yogurt) can decrease the chance of getting colorectal cancer (Arnarson, 2017). On the other hand, I have learned that colon cancer is prevalent amongst the African American population (38-43%) in comparison to the White population (Dimou, Syrigos, Saif, 2009). It is important to note that the treatment for colon cancer such as radiation therapy is a beneficial regimen for White people than it is for Black people. The socioeconomic and educational status plays a role in the differences between African Americans and Caucasians regarding the treatment of colon cancer.

The PERIE Approach to Tuberculosis

Abou-Nica Fomukong

The Tuberculosis (TB) disease is a causative agent of the bacterium known as Mycobacterium tuberculosis. TB affects the lungs as well as other areas in the body such as the kidney, spine, and brain. Although TB is a significant cause of disability, people who get the TB bacteria do not necessarily have to get ill. Interestingly enough, there are two types of types of TB: latent TB Infection and TB disease. Unfortunately, if either condition is not treated carefully, TB can result to death. Latent TB infection is when the bacteria remain in the body, but the individual does not become sick, hence the name “latent”. Moreover, when a person has the latent TB infection, the individual does not display any symptoms or spread the bacteria to others. However, the person can still have a positive test when being tested for TB. Most importantly, when a person develops the latent TB infection, it is possible that the person will not develop the TB disease.

Artificial Sweeteners

Rachel Wilkins

Artificial sweeteners have became a public controversy over their health benefits and concerns. Artificial sweeteners were introduced as a cheaper sweetener that did not cause tooth decay and had no calories to help with controlling weight gain. Over the years, artificial sweeteners have been included in manufactured produced to help with Calorie consumption and promote weight loss. In my research, I want to look into the claims that have been made against artificial sweeteners and their effects on the body such as their affect on the sensitivity of taste buds and their effect on satisfying the body's cravings while also questioning the psychological affects calorie free foods can present to those who are consuming them.
Detection of Inorganic Arsenic Accumulation in Rice from Soil
Smirthy Ganesan, Michael Cho, Minhwa Choi, Amber Liu
Arsenic is a toxic metal that can be found in groundwater supplies across the world. Cultivation of rice involves flooding the soil with water through which it is then absorbed into rice crops. According to the FDA, long term exposure to concentrations as low as 0.010 ppb of arsenic has known health consequences such as cancers of skin, lung and bladder as well as heart diseases. Rice is a staple crop in countries like India and South Korea and large immigrant populations in the United States consume rice as their primary source of carbohydrate. Graphite Furnace Atomic Absorption Spectroscopy will be used to determine the concentration in rice samples from the United States, India, and South Korea. It is expected that arsenic concentrations in rice will be compliant with the regulation, since it has been highly monitored within the United States.

Ethanol-induced behavioral plasticity and epigenetic effects of teratogen in developing C. elegans.
Yejin Ki, Minhwa Choi, Smirthy Ganesan
In this experiment, the effects of ethanol in developing C. elegans will be tested. As a teratogen, ethanol will reduce the motility in parent generation exposed to different concentrations of ethanol as well as post-generations raised in the normal environment. This experiment is related to developmental biology because previous research tested chronic effects of ethanol and showed C. elegans’ development of tolerance and ethanol dependence. So, this experiment will be conducted to determine ethanol-induced behavioral plasticity, and epigenetic effects of teratogens carried down to progeny. As a result of this experiment, it is possible to see the transmitted behavior of ethanol dependence and preference in post-generations, which are not treated with ethanol.

Synthesis of nickel nanowires by electrochemical deposition
Yejin Ki, Jacob Cope, Mubi Talha
Nanomaterial can have vastly different optical, magnetic and reactive properties than bulk material. Nickel Nanowires have an increased magnetic property as opposed to the nickel metal. The directionality and intensity of the nickel nanowires makes them very intriguing for advanced instrumentations and medical devices. Synthesis of Ni nanowires is accomplished through electrochemical deposition of the nickel ions into silver coated membrane. Relationship between the length of the nanowires and experimental conditions, such as current applied and deposition time, will be analyzed. Atomic force microscope will be used to image the nickel nanowires.
Making Nanoscience Accessible: Atomic Force Microscopy for Undergraduate Education
Linh My To Toan, Yejin Ki, Tian Tian
Atomic Force Microscope (AFM) is a powerful tool for both material research and undergraduate Nanoscience education. The purpose of this poster presentation is to share the experience of Earlham students operating AFM from trips to Ball State University. AFM provides three-dimensional surfaces profile of any given materials with nanometer resolution. With the surface profile AFM offers, the information can be used to manipulate samples' mechanical or electrical properties to fit application purposes. Therefore, AFM has a wide range of application in different branches of natural sciences, including molecular engineering, solid-state physics, semiconductor science and technology, molecular biology, etc. For our research this semester, AFM provides information for imaging and manipulating the Pyridinium Ylide Dye for Dye-sensitized Solar Cell. The objective of our research is to increase the efficiency of the dye-sensitized solar cells.

Earlham Peace Prize 2016
Ananda Mishra, Maniz Shrestha
The Earlham Peace Prize 2016 was a rehabilitation project to restore peace in a post disaster village of Bhimtar, Sindhupalchowk, Nepal through entrepreneurship training, women's empowerment, and resources for quality education. These different but interconnected objectives were fulfilled through a series of workshops and establishment of a resource center, the Center of E-Learning (CEL), at Bhimeswari Higher Secondary School, Bhimtar.
Project accomplishments:
1. Establishment of the "Center for E-Learning" at Shree Bhimeshwori Higher Secondary School with computers, books and an E-Library system.
2. Trained students, teachers, and inhabitants of Bhimtar with computer skills.
3. Conducted women's empowerment and income generating programs in Bhimtar.
4. Incorporation of internet-based learning programs for the students in the school.

Growth of Adherent Cancer Cells in Two Types of Nutrient Sources
Emi Smith, Sarah Bean, Faith Jackobs, Chiranthanin Mahayotheecharak, Ananda Mishra, Shahed Sbeta
We tested the growth of two different human cancer cell lines (Caco2 and Calu3) given two differing nutrient sources. One nutrient source is Fetal Bovine Serum (FBS), the industry standard. The other nutrient source is a brand new artificial serum called FB Essence, created by the life science company VWR. FBS is very expensive (costing more than $1.00 for 1 milliliter), and FB Essence is about half the price. We decided to compare the growth and response of Caco2 and Calu3 cells using FBS or the new, synthetic nutrient source. Which one worked best? Come by our poster to find out!
Levels of Lead in Soil Surrounding Springwood Lake
Natalie Blatz, Sydney Barnes, Megan Hedinger, Shahed Sbeta, Yunjoo Shin
High levels of lead have been known to impair the development of the nervous system, especially in children, and cause chronic illnesses. Lead is of local importance because of the industrial background of the area. We plan to examine the presence and concentration of lead in the soil surrounding Springwood Lake in Richmond, IN. More specifically, we will take samples from quadrants radiating from the playground. We will analyze these samples using X-Ray Fluorescence. We will then compare the concentrations to the acceptable lead standard level of 400 ppm for areas where children play. We predict that there will be a higher concentration of lead in areas closer to the lake than near the volleyball courts and nature trails.

Living Lab at Earlham College
Seung Hyo Ki, Yunjoo Shin, Leticia Maganga
The two studies our lab is currently focusing on, the Fixed Mindset and Disgust studies, both take place in the Joseph Moore Museum with participants from the local community that we work to recruit. There are definite challenges to collecting data and conducting studies in this manner, but there are also larger benefits that can be gained from involving the community in the research process. For example, we recruit our participants by approaching visitors to the museum who have younger children, so it is very difficult to recruit large numbers of participants. This means that our researchers generally put in more time and effort into the data collection aspect of the studies, however, we are able to heavily involve the participants and the general community in the process and results of our studies. We collect demographic information about our participants, and our researchers also make sure to communicate our hypotheses and data collection processes thoroughly. The results of our studies can be used to increase academic performance in local programs such as Head Start and the Boys and Girls Club, and this would directly benefit the children in Richmond.

Acrylamide Analysis in Different Potato Strains
Katie Jacobs, Ernesto Cabrera, Zoe Wallis
Acrylamide is a potential carcinogen found in starch-rich products, notably potatoes. Acrylamide forms by heating asparagine and reducing sugars. Acrylamide becomes visible at temperatures as low as 248 F. Studies have been done to determine the carcinogenic effect of Acrylamide in rats with positive results, but when tested on humans, results become inconclusive. This study will investigate the effect of a potato’s strain on the level of acrylamide present. Gas Chromatography with Flame Ionization Detector (GC-FID) and a set of acrylamide standards will be used to determine the concentration of Acrylamide in three different strains of potatoes. Future research could determine the level of acrylamide considered safe to consume.
Culture Clash: Integration of Traditional and Alternative Medicines into Western Medicine
Serenity Crowley, Camryn White, Padgett Gustavson, Ernesto Cabrera

Our group will look at current integration of traditional practices and alternative medicine into Western biomedicine. The first of the four topics we will be exploring will be how traditional practices, in particular those dealing with plants and herbs, have been accepted into modern drug creation and discovery. Second we will explore the history of the encounter between alternative medicine and allopathic medicine. We will also be looking into how CMAs (Contemporary/Alternative Medicine) have been used in the cancer treatment process. Finally we will talk about a specific alternative medicine called Artemisinin which is being used to cure malaria and a few other diseases.

A look at the $f$- and $h$-polynomials of non-pure simplicial complexes
Kellan Steele

In Richard Stanley's paper, Subdivisions and Local $h$-vectors, he focuses on classes of general subdivisions of non-pure simplicial complexes. We study the uses and effects of changing certain restrictions set forth by Stanley. Instead of finding the $h$- polynomial of a pure dimensional complex with subdivisions, we find the $h$-polynomial of a non-pure dimensional complex with simple subdivisions. This change creates a need to extend Stanley's definition to non-pure simplicial complexes with simple subdivisions. In this case, we found that Stanley's original definition does not extend naturally as there is an amount, called the error, missing from the equality. We proved results and theorems describing the error piece and the additive nature of the error.

Low-cost, high-resolution sampling across a range of disciplines and technologies; what we can do now with modern sensors, quadcopter, maths, and software.
Nicholas Arnold, Kellan Steele

The confluence of higher resolution, lower cost sensors and more capable aerial platforms has created new opportunities for domain scientists to perform multi-modal surveys in a wide variety of field contexts for less cost, at higher resolution, than previously. A wide variety of disciplines have benefited greatly from the ability to remotely collect sensor data and produce information-dense analysis and visualizations. We present a complete workflow for collecting sensor data from an aerial platform: sensor choice and mounting, route planning, data collection, georeferencing, analysis, and visualization in the context of surveying for archaeological sites. We also show how the workflow can be applied to studies in ornithology and ecology.

Islamophobia in the French Context: A Case Study
Martin VanderHoeven

Islamophobia is, sadly, a pervasive sociological phenomenon in many Western liberal democracies throughout Europe. The etymology of the word provides a simple definition - "an irrational fear of Islam," perhaps, but when pursuing Islamophobia as an object of scholarly analysis, how should we compare Islamophobia across multiple countries? My thesis uses France as a case study to analyze and interpret how a history of colonialism, Orientalism, and secularism affects the French articulation of Islamophobia and the implications for considering Islamophobia elsewhere.
Stress and Performance
Anthony Maggard

Stress is a form of mental tension or emotional difficulty that is accompanied by physiological changes in heart rate and blood pressure. The aim of this on-going investigation is to assess the effects of stress on individual participant performance. Thirty-five participants (22 female and 13 males; age M = 21, SD = 1.24) underwent a variation of the Trier Social Stress Test (TSST) protocol. Half of participants were given an easy math task (subtracting by 5s) and half were given a difficult math task (subtracting by 13s). Following the TSST participants completed the State-Trait Anxiety Inventory (STAI) questionnaire, an online non-verbal cognitive reasoning assessment, and a physical assessment in the form of the Hasbro Perfection game. Blood pressure and heart rate were measured throughout the protocol. Results have indicated an effectiveness of the TSST in producing a stress response for both difficulty groups, as blood pressure (F(5,155) = 7.69, p &lt; .001, partial eta squared = .199) and heart rate (F(5,165) = 15.27, p &lt; .001, partial eta squared = .316) significantly increased during the stress task. However, analyses indicated that the difficulty of the math task did not influence subsequent performance on the cognitive (t(33) = -.28, p = .780) or motor task (t(33) = .03, p = .978). Results indicated that the varied TSST protocol was capable of inducing a stress response in participants. The use of different math difficulties did not illicit definitive results in performance differences for either assessment, perhaps due to a small sample size.

Robyn: A Natural Language Interface to Database System for Medicine
Ashutosh Rai

Found in various platforms such as smartphones, computers, web platforms and popular commercial software, natural language interface to database (NLIDB) systems are ubiquitous in today's world. Despite the rapid growth of the field, the limited availability of resources to learn about building such systems creates a high entry barrier. Additionally, scarcity of a reliable NLIDB system that is dedicated to medical health, which is a topic of uttermost importance, persists as well. Robyn is a web application that attempts to solve both these issues. It is built with easily accessible software tools and architecture. Robyn uses AI/ML as the NLP engine, SQLite as the database engine, and Python to put all the components together as well as to provide the interface for the users. Bottle, a micro web-framework written in Python, is used to host Robyn on the server side while HTML/CSS and JavaScript is used for Robyn's web interface.

Medicine, "Magic," & Maladies
Abhay Chaudhary, Brittany Timmerman, Kirah Morrison
What makes medicine "magic?" What makes "magic" medicine? Does belief have the power to heal? Join us to find out how three different traditions: Ayurvedic medicine, Navajo medicine, and homeopathy incorporate the power of belief in their healing practices. What are the parallels between these traditions? How are they different?
A Non-invasive Appliance and Application for Remote Washing Machine Monitoring
Bret Marshall

Non-invasive Appliances are devices that do not require the opening of a machine for installation. This project involves the creation of a non-invasive appliance to be used on washing machines to determine if and when the machines are in use. This appliance and its associated web application will remove the problem of students in dorms having to repeatedly carry their dirty clothes to various washing machines to see if they are available. Existing solutions require expensive pieces of hardware and specific applications that do not integrate easily with other applications and platforms. Data was collected, an algorithm for detecting a running machine was implemented, and a device based on the Arduino platform was utilized to collect and send data to a database through an API implemented in this project. Lastly, a web application was designed to display information about the monitored washing machines. In this paper, an algorithm, appliance, and application based on collected data are presented to solve the aforementioned problem.

Family Structure
Cody Allen Krumlauf

I plan to describe the traditional family structure in the United States, while comparing it to other countries family structures. Then I plan to present policy solutions that would benefit some of the issue within the family structure.

The Utilization of a Vapor Pressure Osmometer (VAPRO) in the Determination of Solute Osmolality of Polyethylene Glycols (PEGs) and Milk Products
Stephanie Petry, Hannah Munro

This research aimed to examine the function of a vapor pressure osmometer (VAPRO) and its applications in laboratory contexts. A typical osmometer analyzes the osmolality of liquid solutions, meaning that it tracks the number of solute particles per kg of solution. This allows for the concentration of analyte within a certain solution to be measured. Osmolality in two different solute types has been investigated: the determination of the molecular weights of PEGs (Polyethylene glycols), and the change in osmolality of various milk samples during fermentation and dilution. This study implies larger applications and implications in food science and polymer chemistry and will serve as foundational chemical education research in the use of the VAPRO in the Thermodynamics and Kinetics laboratory course.
**Observing the Impact of Interface Design on User Choices**  
Craig Earley

This poster explores human-computer interaction with an emphasis on how an interface affects the human user's behavior. It describes a history of academic and popular research about the topic, which borrows from psychology but occupies a growing body of research in computer science. It then articulates the motivations and design of software application currently under development that will allow a web developer to easily test these principles with their own websites in a straightforward, rigorous way without the need for a large-scale usability test. It concludes with a look to the future and a few thoughts on the impact of this knowledge for both social and computational sciences.

**Optimizing Number of Keyframes to Improve Compression of MPEG-4 Files**  
Daniel Wilson

Improvements in video resolution and color mean more hard drive space is required to store the necessary data, increasing the importance of minimizing the storage requirements of video files. The MPEG file format uses keyframes to lessen storage requirements by representing frames as changes from previous frames instead of building the frame from scratch. One problem that currently exists is that it is difficult to determine the optimal number of keyframes to use. Adding keyframes is computationally intensive, and their effectiveness at lowering storage requirements is very inconsistent. In this paper, we perform experiments to evaluate the effectiveness of keyframes in different types of videos, to find the optimal number of keyframes in various situations. We measure the compression ratio for different videos at varying keyframe values, and the time it takes to compress them using ffmpeg. We show that how much a video benefits from keyframes depends on the image content of the video. Finally, we demonstrate that we can apply this knowledge to improve MPEG codecs to better calculate the optimal number of keyframes for various videos.

**Showcasing Campus Creativity to Form Meaningful Library Aesthetics: Building and Curating a Unique Collection of Art Created by Students and Faculty**  
Amy Bryant, Mary Bogue

Over the past 40+ years Earlham Libraries annually acquire new artwork created by students through the Senior Purchase Prize. They also display a rotating collection of pieces on loan by current Visual Art Faculty. Learn how the libraries leverage this collection through marketing and outreach to highlight unique campus programs and strengthen department relationships. Presenters will offer practical advice on conceptual issues including facing censorship challenges, copyright considerations, building a balanced collection, and physical logistics including record keeping, maintenance, and handling non-traditional mediums.
Environmental impacts of the fashion industry
Emma Madaket Patterson
A study on the water consumption, CO2 emissions, and other environmental impacts of various textiles in the clothing industry.

The Pathogen Box: Catalyzing Drug Discover: Screening for anti-Acinetobacter baumannii activity
Eric Nicholson
With the recent discovery of the mcr-1 gene conveying resistance to colistin in the US, bacteria have developed resistances to all known antibiotics. The need for novel antibiotics is vital, and the Pathogen Box, a free research tool provided by the Medicines for Malaria Venture (MMV), aims to catalyze drug discovery. As a prevalent bacteria in hospital infections, Acinetobacter baumannii is commonly found and isolated from soil and water samples. There is a high documentation of multi-drug resistance and has been isolated from nearly every clinical surface, making it a target for health care systems around the world.
Using the Pathogen Box, 400 drug-like compounds were screened against A. baumannii in search for compounds with antimicrobial activity and compared with screens against standard antibiotics. The IC50 was determined for 8 known antibiotics and the organism's growth in media and agar was documented for the purposes of the experiment. Of the compounds with promising activity, known FDA approved drugs were shown to have antimicrobial activity, whereas previously none had been reported. Additional compounds that have no literature references were found to have antimicrobial activity, suggesting the possibility for novel antibiotics.

Effects of Different Hydrogen Concentrations on the Chemical and Mechanical Properties of Alpha-Annealed Zircaloy-4.
Fadilah Ibrahim
Zircaloy is often used as structural material for water reactors in the nuclear power industry. This is because of its unique properties such as high mechanical strength and excellent resistance to corrosion. Zircaloy reacts with H2 produced from the cooling water in reactors to form hydrides which adversely affect the mechanical properties of Zircaloy. To investigate the effects of hydrides, we hydrogen-charged SS-3 type α-annealed Zircaloy-4 (Î±-Zry-4) specimens to different concentrations. Using tensile experiments and electron microscopy, we observed material hardening and a decrease in ductility with increase in hydrogen levels of the samples. We also noticed the presence of hydrides at grain boundaries at which tensile fracture occurred. This indicated the effects of grain boundary hydrides on the tensile properties. While these results showed important details regarding the properties of hydrogen-charged Î±-Zry-4, additional characterization using X-ray diffraction and electron microscopy is underway to understand the effects of these hydrides.
Making Solar Power Competitive: Research in Dye-Sensitized Organic Photovoltaics
Leah Johnson, Emma Hoffmann, DaeYong Kim
The world faces a potentially-devastating environmental crisis, which will only intensify if we continue to depend on fossil fuels for our growing energy demands. Research into alternative energy, therefore, is imperative, and solar energy offers the most promise as an alternative to fossil fuels. While conventional silicon photovoltaic cells are efficient, they are expensive to construct and install, which limits their implementation. Our research focuses on dye-sensitized solar cells, which use organic dyes and metal oxides to generate electricity. These materials are much cheaper than those used for silicon cells, and they are fast becoming competitively efficient with conventional photovoltaics. This poster presents a procedure and preliminary results of the research in test cells made with titanium dioxide and manipulated organic dyes.

Postwar reconstruction in Norway after WWII: tensions between economic development and foreign policy
Fredrik William Lyford
After the Labor Party won a majority of the seats in the Storting1, the centralization and planning of the postwar economy was done unilaterally. The theme of the economic policies was pragmatism, not ideology. It therefore seems that the Labor Party was not concerned with the foreign perceptions of the economic policies, and that the planners were rather concerned with the degree to which the Labor Party goals were being cemented into Norwegian political culture. Furthermore, the Labor Party government expressed a deep ambivalence towards ratifying European economic treaties, because the agreements would ease monetary restrictions and tariffs, and the LP policies would not have the same direct impact. The ambivalence is evident of the pragmatic emphasis the Labor Party policies embodied, because although the treaties and agreements could signify unity and solidarity, the loss of control over the economic forces weighed heavily against the potential positive public significations of the multilateral European economic agreements. The Labor Party was aware that the nature of the planned economy could seem to follow Soviet model. However, the ostensible perception that the Norwegian economy were communist was rendered unimportant in light of other pressing foreign policy issues.

Compliance Reviews: A Cornerstone Enforcement Mechanism in Title IX
Genesis Galo
Despite the fact that Title IX is one of the major gender equity legislation in the United States which recognized the barriers that women faced in academia, it has yet to foster a truly gender-equitable environment in STEM. I argue that limited enforcement has been the central reason that Title IX has not achieved gender-equality in STEM. I look at the various federal grant-making agencies that are mandated to conduct Title IX compliance reviews.
**Molecular Dynamic Studies of Z[WC]-DNA and the B to Z-DNA Transition**

Ahsan Ali Khoja, Lam Nguyen, Sunil Pun

Although DNA is most commonly found in the right-handed B-DNA structure, it is known that biologically active systems also contain left-handed Z-DNA. ZII-DNA is the most common form among left-handed structures. However, little is known about the transformation from right- to left-handedness. These DNA structures are too small to view physically. Hence, using molecular dynamics we investigate the B to ZII transition with a possibility of Z[WC]-DNA serving as an intermediate structure. Molecular simulations indicate that Z[WC] structures are stable with the current AMBER nucleic acid force field. Along with targeted molecular dynamics we use umbrella sampling to produce potentials of mean force for the B to ZII transition along both pathways.

**Evidence Based Public Health through Bhopal Gas Tragedy**

Hanh My Le

Bhopal Disaster is a gas leak incident that happened in India in 1984. Through the P.E.R.I.E (Problems, Etiology, Recommendation, Implementation, Evaluation) approach in public health, we would explore how the incident was discovered, resolved and how it made an impact on regulations and public health both in India and the world.

**Emotion Detection Using OpenCV for Automatic Facial Recognition**

Jonathan Hicks

Facial recognition is a very useful tool and has been researched extensively in recent years. The applications for facial recognition vary from use in security cameras to emotion detection. Emotion detection in particular is a facet of facial recognition that has great potential in a wide range of fields. In order to tailor the software for emotion detection, a series of steps were taken. Starting with a database containing positive images (images portraying a specific emotion), a second database was created that contained negative images (images without a face); allowing the software to accurately distinguish between what it should detect and what it should not. Following this, a classifier was trained from the two databases, which was then implemented into the software via a function. This process ultimately allowed for successful emotion detection that can eventually be used in many different applications.
The Interrelationship Between Family Planning and Migrant Labor in China Institution
Truman McGee, Dante Petti, Hao Nguyen, Jake Breen
The past 40 years of rapid economic development in China has been facilitated by the rapid inflow of migrant labor from the rural West into the urban East. The high rates of population growth that accompanied China's success led to the passing of the One-Child Policy (OCP) in 1979. A consequence of such legislation is the imbalanced age demographic of China where older generations vastly outnumber younger ones. Because this imbalance poses a strain on social welfare and economic growth, China passed the Two-Child Policy in 2015. The implementation of this policy created avenues for research on how both policies have affected the social attitudes and life choices of Chinese citizens. This is where our research was focused. Our group of six students and two faculty members hoped to explore how family planning and migrant labor affected the lives of Chinese people of varying genders, age, socioeconomic standing, and profession.

Failed Japanese Apologies
Joseph Slucher
My senior capstone research is on failed Japanese apologies to South Korea. By looking at three cases of failed apologies in 1993, 1994, and 2016, I determine the reason for their failures. Then using these three cases I determine how Japan could successfully apologize to South Korea.

The Discursive Political Legitimacy of the Chinese Communist Party
Justin Ko
Since undertaking economic reforms in 1978, China seen drastic socio-politico-economic transformations. Economic reform and opening paved the way for market liberalization that saw the transition away from a command economy to an export-centric market economy. China has embraced market capitalism, yet remains to have an authoritarian one-party structure of governance controlled by the Chinese Communist Party (CCP). Since the founding of the People's Republic of China in 1949, the CCP has been confronted with two major existential crises in regards to their political legitimacy: 1) the cumulative aftermath of Mao Zedong's leadership tenure, notably with the failed Great Leap Forward, and the Cultural Revolution; 2) the violent crackdown of the Tiananmen Square Protests in 1989. In this thesis, I analyze the political discourses of the CCP's top party chiefs to demonstrate how the CCP's political legitimacy is built and sustained through discursive practices primarily with the rationale of economic development.
**What Keeps You Younger? A Comparison of Antioxidant Content Between Blueberry Food Products**

Khyrul Khan, Nam Nguyen, Arish Mudra Rakshasa, Maleeka Shrestha

Antioxidants are man-made or natural substances that delay certain types of cell death, and are thus vital in anti-aging processes. Primary sources of antioxidants in diet include various kinds of berries, dark chocolate, and artichokes. This study aimed to compare the antioxidant content in blueberries (a well-known source of natural antioxidants), blueberry jam, and frozen blueberries, to determine whether processing has significant effects on the antioxidant content of food products. Antioxidant concentrations in the samples were determined using 2,2′-Azino-bis(3-ethylbenzthiazoline-6-sulfonic acid) (ABTS) assay and visible spectrophotometry. This study has implications in nutritional science and anti-aging research.

**Correlated Motions in the DHFR-NADPH Complex**

Arish Mudra Rakshasa, Paul F. Maxson

Correlated motions are thought to be related to the catalytic step for dihydrofolate reductase (DHFR). We performed several molecular dynamics studies of the DHFR-NADPH complex, the analog of an apo structure existing prior to the binding of dihydrofolate. We compare correlated and anti-correlated motions and their timescale to motions previously observed in the catalytically active state. We also compare correlated motions across several DHFR mutants.

**Virtual Reality and Self-Confidence**

Kamari Hunter

This project seeks to utilize virtual reality as a way to increase self-confidence. Studies have shown that having faith in one's abilities can elevate an athlete's performance level. Increasing self-confidence from within can be difficult; the scope of my project is to find ways to expand confidence without having to depend on reassurance from others. I've researched articles related to the importance of confidence in athletics, virtual reality and how it can be translated to real live applications. Theories such as the Proteus Effect and Self-Perception Theory help clarify the possibilities of confidence being inherited through virtual world interactions. The conclusions from this project present the idea that self-confidence can be boosted subconsciously without needing to seek consultation from others.

**The Empathy Failure: Finding Authenticity in a Digital Age**

Lily Fishleder

My Senior HDSR Problem Analysis is about our social struggle to find authenticity in a digital, that is leading to our failure to be empathetic. Looking at various theories, research data/articles, inspirational speakers and scholars in related fields I have analyzed our issue of creating human connections in the Age of Information. My HDSR Problem Analysis focused on the problem, but for this presentation I will focus more evenly on the problem and my proposed methods for mitigating the "empathy gap."
The Tradition of Yoga and Its Expansion in the West
Mallory Crosby, Davonte Williams, Fang Li, Geneva Bedell
This poster focuses on the evolution of yoga, the physical and mental benefits and how it is used by other religions. Yoga is an ancient practice. What many people think of as yoga today is only a fraction of its true meaning and purpose. Like in ancient times, yoga benefits the whole person, both physically and mentally. Because of these benefits, other religions have incorporated yogic practices into their worship.

Automatic Activation of Prejudice towards Depression - Difference between Japan and the United States -
Minori Itabashi
A number of existing articles claim that prejudice towards people with mental disorders have been an issue in Japan due to lack of understanding, and in addition to people suffering from prejudice towards mental disorder in the United States. The purpose of this study is to investigate the difference between Japan and the United States on the preconceived prejudice towards depression. The hypothesis of this study is that Japanese participants show more prejudice to people with mental disorders than American participants. The study was conducted with the total of 154 undergraduate students (63 American and 91 Japanese). The independent variable was the brief personal history of a person. The participants were randomly assigned to one of the three conditions: current depression, previous depression, and control. The dependent variable was how much participants agreed to the sentences, which indicated the impression of the person (measured by 1-5 likert scale). The result showed that the hypothesis was slightly supported by one item.

Osiris Gene Expression in Harvester Ants and German Cockroaches
Moataz Noureddine
The Osiris gene family is a cluster of genes present in all insect genomes and is the result of multiple ancient duplications of a single ancestral gene (the cluster typically includes twenty Osiris genes). The order of the genes is highly conserved among insects, and deletions of the cluster are fatal. Our experiment focused on the expression of multiple Osiris genes in Pogonomymex barbatus, harvester ants, and Blattella germanica, the german cockroach. The choice of these two species is strategic and allowed us to examine expression patterns in organisms differing in development and lifestyle. The ants have complete metamorphosis and are social while the cockroaches have incomplete metamorphosis and are solitary. We assayed gene expression in whole bodies spanning developmental stages using quantitative polymerase chain reaction (qPCR). There are transient peaks in transitional stages to adulthood in both species, the last nymphal instar of the cockroach and the pupal stage for roaches and ants, respectively. In the ants, the expression peak only occurred in workers. Together, these data suggest a role of Osiris genes in the transition to adulthood, and this is conserved across hemi- and holometabolous insects. The worker-only peak in ants suggests a possible role for these genes in suppressing typical adult characteristics, such as those present in queens.
**Free and Fair American Elections**  
Nicolas Starr  
I am presenting a poster on voting rights, access and redistricting reform for the purpose of my senior capstone. As someone who is passionate about free and fair democratic institutions, I am eager to answer any questions people may come across while looking at my work.

**Ocean Acidification and its effect on the growth of phytoplankton**  
Olivia Bispott  
The advent of the Industrial Revolution in the late 18th- early 19th century has slowly increased the concentration of CO2 in the atmosphere. However, with the fossil fuel industry, CO2 emissions increased exponentially and the concentration has reached its highest in 2016. The implications of increased CO2 results in ocean acidification causing a decrease in the pH. Phytoplankton community assemblages have become affected by this accelerated increase and have begun to change as global warming occurs. The phytoplankton community upon which this experiment used comes from the North Atlantic Ocean. Four treatments were conducted in 2L filter flasks under a 12-hour diurnal light cycle and operated in Chemostat mode. The experiment induced elevated temperatures of 30°C and ambient temperatures 15°C, alongside elevated CO2 concentrations of 2000 µatm and ambient CO2 concentrations of 200 µatm. The analyses that investigated in the experiment are Chl a, CO2 production, nutrient colormetric analysis and microscopy. Results show that Chl a concentration decreased with elevated CO2 concentrations and increased CO2 concentrations. Temperature had no effect on the either Chl a, CO2 production, nutrient concentration and microscopy analyses. Nutrients were depleted in all treatments and there were significant differences between elevated and ambient CO2 conditions.

**Heavy metals in cigarettes tobacco on Earlham College campus**  
Abduselam Kedir Awol, Leonora Lomoki Akporyoe, Mirza Dzanan, Swati Pant, Chu Thet Ywe  
The consumption of cigarettes and tobacco products has been increasingly popular all over the world. Smoking can lead to many health-related diseases due to the inhalation of many toxic heavy metals. For our project, we are going to analyze some of those heavy metals present in tobacco such as Arsenic, Cadmium, Chromium, Nickel, and Lead to determine the concentration of those metals in different cigarette brands consumed on Earlham College campus. To determine heavy metals content in cigarettes, we will be using ICP- AES multi-elemental analysis.

**An Improved Synthesis of Avenic Acid**  
Paul Beasley  
Graminaceous plants, when grown in iron-poor soil produce and secrete low molecular weight iron-chelating compounds (phytosiderophores) for the sequestering and active transport of iron to the plant itself.1-3 We continue to be interested in synthesizing avenic acid (the phytosiderophore produced by oats) and related analogs in order to study this iron-transport system. Although we have previously prepared avenic acid, we now present a slightly modified and more efficient total synthesis.
**P.E.R.I.E. approach**

Rana Hummas Sarwar

I will use PERIE approach to demonstrate my knowledge regarding a particular disease.

**Treating More Than the Symptoms: A Look at Structural Violence in the US and Haiti**

Eva Newman-Coley, Nadine Guyot, Della Walters, Hannah Roman, Kobe Walker

The group will discuss the role structural violence plays in perpetuating sickness and disease in the United States and in Haiti, explain necessary actions that need to be taken at the societal and structural levels to improve overall health nationwide, and describe the reality of what is already being done in these nations to address structural violence as it relates to health.

We will also explore the historical relationship between the U.S. and Haiti through the lens of structural violence and consider the consequences that have resulted from the interaction of the governments of these two nations.

**EARL: Earlham Augmented Reality Campus Tour Application**

Saw Yan Naung

Visiting an unfamiliar place is not always a comfortable experience for many people. In fact, the lack of knowledge about the surroundings can hinder one from being able to explore and learn about the new place. Even with the assistance from a guide or some local people, the information an individual can obtain about his or her surroundings is limited and depends hugely on the availability of such people. By using Augmented Reality technology, this application will serve as a virtual tour guide for all visitors of Earlham College. Visitors will be able to learn more about Earlham by interacting with the augmented virtual information and explore the campus freely without any other aid. With EARL, the application for better campus tours, all information you need is at your fingertips.

**Reshaping the U.S. Policy towards ISIS: Turkish-American Cooperation and the Kurdish Question.**

Selen Ozturk

I will be presenting my policy-brief on the US's foreign policy towards Syria, which specifically focuses on Turkish-American cooperation against ISIS and the Kurdish Question.
Thermal and Energy Modeling of Cluster Systems
Tuguldur Baigalmaa

The purpose of the research was to investigate the performance, thermal behavior, and power consumption of a cluster computing system. We studied the impact of different workloads on power consumption by taking into account of the key components of a cluster. By conducting experiments with three benchmarks (Whetstone for CPU, nvidia-smi for GPU, and STEAM for memory), we generated statistical models that predict temperature and power consumption based on real-time utilizations. The experimental results indicated that a Polynomial model worked best for predicting CPU power consumption in terms of CPU utilization. While for predicting GPU temperature in terms of fan speed, the Support Vector Regression (SVR) model (which had a Mean Square Error of 5.86) performed better than the Polynomial model. With the memory-intensive benchmark STEAM, SVR model has the best predictions in memory power consumption with the Residual Sum of Squares is 1134.90 and the coefficient of determination R2 of the prediction is 0.62. Experiments were then designed to identify the power consumption models. Furthermore, we improved the monitoring system for the cluster by adding support for the export of experimental data and the comparison between experiments on different data nodes among different time periods. The new monitoring system enables users to analyze the performance and energy consumption of scheduling schemes more efficiently.

Avian species richness and composition in three mid-western successional forest habitats in Richmond, Indiana
Yelitza Garcia, Marwah Saleh, Malia Staab, Julia Freeman, Andrea Ball, Wendy Tori

Over the past half century, the midwestern United States has seen a rapid increase in the creation of agricultural fields. The decrease of native habitats has resulted in the loss of native biodiversity. Earlham College’s satellite properties are a microcosm of different successional stages, making them well suited to study the effects of anthropogenic habitat alteration on bird species. We sampled birds from three different habitats: a tree plantation with native saplings, a prairie consisting mostly of goldenrods, and a young Prunus serotina forest. Though we found significant differences in abundance, trophic guild composition, and species diversity, we found no significant difference in species richness among habitat types. Our results suggest that different habitat types are integral to maintaining diverse avian communities. The forest habitat exhibited the highest level of species diversity and distinct species composition, potentially due to the habitat being richer in resources and ecological niches. Understanding the composition of different avian communities and their utilization of different habitat types is crucial to making informed conservation management decisions, especially in the face of anthropogenic change.
The Effects of Sleep Deprivation on Spatial Memory Recollection in Mice
Akul Sharma

At the molecular level, memory is essentially a product of brain plasticity: the structural changes within synapses that create associations between stimuli. Once a memory has been acquired it is has to stabilized via a process known as memory consolidation. A lot of studies have linked sleep to memory consolidation but still a scientific consensus has not been achieved correlating these processes. Hence, we investigate the link between sleep and memory by hypothesizing that sleep deprived mice will show significantly more signs of memory impairment as compared to non-sleep deprived mice. For this study, mice were trained to complete a maze and were subsequently sleep deprived. After sleep deprivation they were put back in the maze and their performance was measured as a factor of time. Our results showed that sleep-deprived mice showed significant signs of spatial memory impairment. Next we investigated the effects of rolipram(a research chemical supposedly with cognitive enhancement properties) on negating the effects of sleep deprivation. Our results indicated that rolipram-treated sleep-deprived mice showed some evidence of memory consolidation as compared to the non-treated sleep-deprived mice.

An assessment of lead contamination in water at Earlham College, Richmond, IN
Eliza Balch

This project connects geologic and hydrologic analyses to pre-existing lead contamination issues in Wayne County. According to Indiana Health Department's 2015 lead risk assessment, Wayne County was in the 95th percentile for the number of children with Elevated Blood Lead Levels (EBLL). In other words, Wayne County has more children with EBLLs than 95% of Indiana. The magnitude of EBLLs in Wayne County is associated with the 79% of the residential houses that were built before lead paint and lead piping were outlawed in 1986. Sources of lead include paint, water pipes, and bedrock. Sampling water for lead helps determine how much of the contaminant lead is from pipes and bedrock. I am sampling academic buildings and college houses for lead contamination, as an extension of a testing campaign conducted in 2016 by Earlham College Facilities. Using lead electrode analysis of water samples, I will determine if there are harmful levels of lead in the water that require filtering and/or pipe replacement. These data will set the stage for assessment of Richmond's water and its connection to lead poisoning in children. Future projects could assess lead contamination in locations where there are children with EBLLs, and prevent future poisoning.
**Perceptions of Personality and Sexual Behavior of Two Dance Forms**
Montana Ross

Senior research study focused on the perception of a dancer's personality and sexual behavior based on movements in a ballet style and modern style dance form. The study took place on Earlham campus, involving 69 participants. The study questioned if a modern dancer's style will be perceived as more extroverted and sexual exploitative than a ballet dancer. The modern dance was reported more outgoing, and was more likely to practice deviant sex than ballet dancers. These results can be applied to the possible effect of typecasting of a dancer and potentially be dangerous and affect the sexual perception of female dancers.

**Geographic Metadata Management and Visualization**
Benjamin Liebersohn

Many researchers are interested in finding better ways of exploring boundaries between physical spaces and digital spaces. Social media users continue the trend towards sharing more information relevant to crime monitoring, civil unrest, and human mobility patterns. With a scalable social media event detection model, we can better extract the relevant interaction between cyber-events and real-world phenomena. Because over 500 million Tweets are published annually, sifting through such an enormous database has proved nontrivial. Though database size reduction, this Hadoop based tool makes it possible to examine a reduced size database, making more computationally intensive datamining possible. First, I define what constitutes a cyber-event. While we could consider all Tweets as cyber-events, for our purposes we will classify Tweets by time and spatial density. By studying daily sets of messages, which combined total over 200 million messages per day, a study of the metadata from certain times and places can be further examined as part of an event, allowing us to run further analysis with a specified event in mind.

**Data Modeling Across Social Media Platforms**
Deeksha Srinath

Today, use of social media is generating unprecedented amounts of social data. Mining this data is allowing businesses, users, and consumers the opportunity to extract useful patterns. Increasing proliferation of social media platforms makes mining across multiple platforms relevant and useful. This project aimed at creating a unified data model that is able to house both Facebook and Twitter data, and creating a clean, unified, query ready dataset across these platforms.
**Breaking Barriers**

Caitlin Corrigan-Orosco, Rachel Sames, Selina Hardt, Louisa Perry-Farr, Aishat Sadiq, Deeksha Srinath, Samual Araya Kahsay

Our project is focused on challenging white supremacy. We are comprised of a social media campaign, a ‘curriculum’ that we plan to integrate into our immediate community, and online educational tools and resources. Our project aims to challenge white supremacy by spreading information about it and related issues (e.g. white privilege, racism, intersectionality, etc.). Furthermore, our campaign will counter the recruitment of at-risk youth by white supremacist groups in a more efficient way than traditional medias could. Our target audience will be at-risk white youth (14-22) that are statistically vulnerable to white supremacist propaganda and recruitment. Our public engagement is based on social media networking outlets, including Facebook and Twitter. Using graphic designs, we will develop memes and comics to start discussion on intersectional justice by creating awareness on the issues surrounding white supremacy movements and ideologies. We will also be developing interactive quizzes that relate to our social media posts and the curriculum we are currently developing.

**Automating the Organizing Process for PDF Files**

Samual Kahsay

The progression of technology is exponentiation in almost all fields. Technology makes many aspects of human life simpler, and less complex. The progress and the intent of innovation within technology/computers has in no way stopped, however some components within these systems have been forgotten. File organization is very much still a manual task. Whether these files are virtual or not the task of organizing them is equally tedious and labor inducing, There is a lot of room and need to create a space withining virtual data that takes the physical labor of organizing.

This paper presents a solution for automating files. The focus is PDF files in particular, however the general idea and algorithms used are capable of expanding to many other file formats. Using and expanding on a Open source program (tagspaces) that shares the same general idea to make organizing easier and more automatic. The expansion to the program includes similarity and metric learning to create an algorithm and source code for organizing PDFs and files types.
Kenlee Ray Fellowship Presentation
Sarah Spodek

The Kenlee Ray Library & Archives Fellows program fosters undergraduate students exploring interests in library science related career opportunities. Through a combination of immersion experiences, alumni networking, reflection on scholarship, and job shadowing, students gain a broad exposure to academic librarianship and develop a launching platform for their future careers. As the 2017 Kenlee Ray Fellow I will share my experience exploring work in public services/research, technical services, and archives.

I will also give an overview of one of the many projects that I worked on during my fellowship. During my Tech Services/Archives time I worked on the Quaker Pamphlets project. The library is cataloging the large collection of Quaker Pamphlets that the archives has. The goal is to highlight these unique materials and make them available to researchers.