

Abstracts for Funded SEA Projects – FY23

Deshwal, Anant, BIO, LAS

SEA: The relationship between diet composition of grassland birds and available insect diversity

Studies have documented drop in natural history knowledge among younger generations. I plan to increase natural history knowledge in students. There is rapid decline in invertebrate populations. Thus, speculating that decline in insect populations is a major driver for the decline in grassland birds (Grassland birds are fastest declining birds in the US). However, no study has provided evidence linking decline of insects to decline of grassland birds. The current study aims at addressing that knowledge gap. We will quantify insect diversity and abundance at protected areas around Peoria, IL. We will also quantify diet composition of common grassland birds at same sites as above. Comparing the results from two will help us figure out if birds modify their diet to compensate for changes in insect diversity and abundances or not. If birds are not modifying their diet to compensate for the changes in insect diversity means that they are more susceptible to decline along with the insects.

G G MD Nawaz Ali, CSIS, LAS

SEA: Performance analysis of 5G New Radio and DSRC networks for V2X Communications

Connected and autonomous vehicle (CAV) is an important emerging technology of the future intelligent transportation system which can save lives, time, money and reduce fuel consumption and traffic congestion. An efficient vehicle-to-everything (V2X) communication is a key player for the successful deployment of future CAV. Fifth generation new radio (5G NR) and dedicated short range communication (DSRC) are the two main technologies for the V2X communication. However, very few or a little work has been done to study the performance on these technologies using the actual radio devices. Nonetheless, the actual test has a very high value to understand the success of deployment of different applications in CAV. The PI bought a pair of radio devices of both the technologies from his seed grant and wants to perform the measurement study with the cars on the road. The result will be documented and published which would have a high value for the fellow researcher and CAV industry.

Sadat, Mohammad N. CSIS, LAS

SEA: Quality of Experience (QoE) Model for Video Streaming Applications

The popularity of video services has increased dramatically over the past decade due to the rise in streaming platforms such as YouTube and Netflix and, more recently, social media sites such as Facebook and Instagram. Consequently, providers have shifted their focus from traditional quality of service metrics to quality of experience (QoE)-based video delivery. Many video quality assessment models have been proposed to predict QoE at the end user. However, changes in video streaming technologies and how consumers watch videos (i.e., device, content, applications) have necessitated new QoE model development. This study will conduct a set of experiments to record evaluation scores from human viewers for a wide range of network and hardware settings. Then, a new automated QoE prediction framework will be designed by incorporating video encoding data, network metrics, and human viewer input. Successful outcomes will contribute to providing better QoE to video consumers.

Abstracts for Funded SEA Projects – FY23 (cont.)

Vollmer, Rachel, FCS, EHS

SEA: Development of a Community Nutrition Undergraduate Research Lab

This project aims to start an undergraduate student research lab under the direction of Dr. Rachel Vollmer focusing on college student food insecurity. Specifically, it will provide opportunities for Family & Consumer Sciences students to a) participate in faculty-mentored research, b) improve research skills, c) connect research with their classes, and d) increase their sense of belonging at Bradley University. Students who engage in the lab will not only benefit from faculty mentorship, but also peer mentorship. Additionally, because the research conducted in the lab will be focused on college student food insecurity, the results of the studies completed by the lab could improve retention and academic success of students that are struggling financially. Using the results of the initial studies undertaken by the lab will lay the groundwork for external funding proposals that may make Bradley a model for mitigating student food insecurity.

Li, Ye, IMET, EGT

SEA: Robotic Arm Assisted Volumetric Additive Manufacturing via Acoustic Levitation

This project proposes the implementation of a robotic arm assisted volumetric additive manufacturing setup via acoustic levitation. The aim is to overcome the limitations of traditional 3D printing processes such as the fixed build direction and the need for support structures, thus enabling a more flexible and efficient additive manufacturing process. The proposed setup eliminates the need for support structures and allows for contactless manufacturing, making it suitable for creating complex structures. The project will give students the opportunity to advance their knowledge in several fields of engineering, including acoustic interaction with polymer material, photo-curing reaction, robotic kinematics, robotic arm programming, computer aided design, 3D printing, experimental design and engineering data analysis.

Zietlow, David C., ME, EGT

SEA: Optimization of Power Plants and Global Warming

Currently, in the United States, there is an ongoing debate about where to generate our power to address global warming. Renewable sources are intermittent. One of the options to provide reliable power is the use of nuclear fuel. However, nuclear power is very costly which this project addresses. The project will compare the net thermal efficiency of nuclear power plants with their initial and operating costs. From this, our goal is to determine the optimal nuclear plant. Essentially, we are building a model to minimize total life cycle costs. Once our model is constructed, we will present it to industry and academia. Provided this project is approved and successful, our research can lead to the construction of more nuclear power plants in the U.S., an increase in their economic efficiency, and an overall increase in the value and prosperity of the nuclear power industry.

Abstracts for Funded SEA Projects – FY22

Ashraf, Fahmidah Ummul, CEC, EGT

SEA: Bridge Collapse Risk and Predictive Trends

The proposed work explores the bridge collapse data for 211 historic collapse events over water. The work would identify structured and unstructured data sources for bridge collapse events from crowd sourcing, and the collected and processed data would provide opportunities for data-based risk study. If any trend and/or characteristics can be identified across all sites, that would lead us to a better understanding of hydraulic collapse events. Linking the trends/anomalies to watershed characteristics would help the study results to be extrapolated to the U.S. bridge stock. The study results have implications not only for the risk study of bridge collapse but also for bridge design/maintenance in a more rigorous and practical way. Such analysis provides preliminary data to assess future collapse risk as it can be highlighted that the collapse event emergence should be expected in a specific manner (not as a surprising outlier).

Abstracts for Funded SEA Projects – FY22 (cont.)

Cady, Craig J, BIO, LAS and Nair, Kalyani, M E, EGT

SEA: Investigation into the activation of ovarian cancer stem cells following exposure to chemotherapy

Ovarian cancer is the leading cause of gynecological cancer deaths due to the hidden nature of this disease and rapid spread. Cancer stem cells (CSCs) have been identified in all tumors and resistant to chemotherapy. Recent research suggests CSCs are a major mediator in the spread of cancer after chemotherapy. In this study, we investigate the influence of chemotherapy on the activation of CSCs relative to ovarian bulk cancer cells (BCCs) that are vulnerable to chemotherapy drugs. Both cell types will be exposed to 5-FU chemotherapy agent and analyzed before and after using AFM to determine changes in biomechanical properties and an aggression/migration assay to determine changes in cell aggression. Our goal is to correlate changes in biomechanical properties to changes in cell aggression after chemotherapy. Successful outcome will contribute to understanding how ovarian CSCs activate after therapy causing the lethal aspects of advanced disease.

Dominguese, David J, PT, EHS

SEA: How environmental factors and different levels of muscle fatigue during exercise effects movement

Space exploration has shown that weightlessness has adverse effects on a number of biological structures. Studies have shown that microgravity causes atrophy, reduced functional capacity, and increased fatigue in limbs, particularly of antigravity skeletal muscles. A study on rodents reported losses of soleus muscle mass of >30%, after 2-3 weeks in space. Research has not yet addressed detailed characterization of muscle tone in antigravity muscles. Such studies performed before, during, and after spaceflight are still in infancy. The purpose of this study is to investigate how environmental factors such as temperature and humidity affects muscle characteristics of certain lower extremity muscles while performing common functional exercise under different levels of muscle fatigue. Such studies will provide a baseline in developing a better understanding of the effects of microgravity conditions on the musculoskeletal system and how it may relate to injury and exercise performance.

Faulkner, Melinda J, BIO, LAS

SEA: Examining the substrate specificity and regulation of three stress response proteins in *B. subtilis*

Organisms that live in oxygen-rich environments generate toxic molecules such as peroxides. Furthermore, our immune systems generate similar toxins to combat bacterial infections. These molecules can severely damage cells, and therefore all cells must sense and respond to these molecules to survive. The bacterium *Bacillus subtilis* produces at least nine enzymes that degrade peroxides and other similar toxic molecules; three of these enzymes are alkylhydroperoxide reductase A, thiol peroxidase, and bacterioferritin comigratory protein. I seek to investigate the substrates of these enzymes and the factors controlling their production. This information will help us to better understand the unique function of each of these enzymes in defending bacteria against toxic molecules. Since similar enzymes and antioxidant defense systems are found in all cells, both bacterial and human, these studies will contribute to the understanding of how all cells sense and respond to stressful conditions.

Glassmeyer, Danielle Susan, ENG, LAS

SEA: Engaging Students in Digital Humanities Research Production through the Mapping Modernism Project

This is a 1-year project to launch a multi layered, iterative, expandable digital humanities project that visualizes data from Modernist authors' biographies (geolocations, patterns of movement correlated with intensity of creativity, clustering of authors in particular regions), in correlation with data from novels about characters' movement. Phase 1 focuses on Hemingway's *Sun Also Rises* and Faulkner's *Sound and the Fury*. With a student co researcher, I will: create a stable, consistent framework for coding qualitative data using TEI protocols (open source tools for text markup, and qualitative coding); construct and design a robust, flexible, expandable database for data collection; integrate data into map layers using QGIS (free, open-source mapping software); each semester thereafter, my classes will add data to the mapped layers to produce a growing, interactive, animated map that visualizes Modernist artists and their works in space and time.

Abstracts for Funded SEA Projects – FY22 (cont.)

Jost, Jennifer A, BIO, LAS

SEA: Evaluating the short and long-term effects of aerial exposure on the invasive zebra mussel

My research examines zebra mussel physiology during unfavorable conditions. Zebra mussels cause significant habitat damage and research that can help limit their spread is desirable. Studies show mussels attached to boats can withstand aerial conditions for several days, allowing for transport and introduction to new sites. Yet, little is known about their physiology during aerial exposure and few studies have tracked the animals over time once they are re-submerged in water. This project aims to quantify the cellular markers involved in aerial survival and to track mussel survival and growth post-exposure in both the field and lab. I will engage four students in this study, and we anticipate results will be presented at Bradley Expo, Illinois State Academy of Sciences, and Society for Integrative and Comparative Biology, and disseminated through peer-reviewed publication. This project will contribute a comprehensive understanding of stress physiology while fostering research skills.

Keist, Carmen N, FCS, EHS

SEA: From Client to Product: Creating a Walking Billboard through Apparel Experiential Learning

The proposed project will further enhance apparel product development skills for students majoring in Apparel Production and Merchandising. Two students will work one-on-one with a client (the Dean of College of Education and Health Sciences) to create a garment from design to the finished project. The benefits of this project is to give students a unique experience to further learn the nuances of apparel product development. In addition to student learning, the Dean will have a visual representation of what FCS AP students do in the classroom for recruitment and retention purposes.

Marino, John A, BIO, LAS

SEA: Quantifying the hidden diversity of wildlife parasites and the influence of environmental factors

Infectious diseases greatly affect wildlife, and global changes are influencing interactions between wildlife and disease agents (i.e., parasites). However, much parasite diversity is poorly described, and the influence of environmental factors on parasite distributions needs to be quantified. Tools including molecular approaches and geographic information systems (GIS) offer a solution. The goal of this project is to employ these tools to characterize the local diversity of an important group of wildlife parasites (trematodes) and assess the influence of major environmental factors (e.g., land use, water chemistry). To meet this goal, we will perform a field survey of trematode distributions in more than 30 wetlands in central Illinois. Both graduate and undergraduate students will be deeply engaged in all aspects of this collaborative project and receive extensive training in ecological research. Results will be informative for wildlife conservation in light of ongoing global change.

Soltani, Mahmoodreza, CEC, EGT

SEA: Nonlinear Model of Interface Shear Transfer Test Methods in Reinforced Concrete Connections

Interface shear transfer (IST) is critical for achieving composite behavior in many connections of concrete structures, such as the connection between precast girders and cast-in-place decks. This proposed research project seeks to perform nonlinear finite element analysis on four common methods for testing IST, including: push-off, beam, slant-shear, and Iosipescu four-point-bending. Additionally, this analysis will be performed to model the actual connection of cast-in-place deck and bridge girder. The objective of this study is to compare the behavior of the test methods to determine the best test method representing the actual connection behavior. The criteria used for this selection are similarities in stress statuses, strengths, and failure modes. In recent years, this concept has become a center of attention for many researchers. This is because of catastrophic events, such the 2018 FIU pedestrian bridge collapse, on which failure of its IST connection was to blame.