# Abstracts for Funded SEA Projects – FY24

Ashraf, Fahmidah, CE, EGT
**SEA: Exploring Hydrologic Science for Engineering Hydraulic Applications: A Review and Future Direction**
This study undertakes an in-depth examination of the progressive developments in hydrology and hydraulics, aiming to identify both the similarities and differences, as well as points of agreement and disagreement, between these two closely related disciplines. Through a detailed review of the most recent studies, techniques, and technologies, this research endeavors to identify common foundations, approaches, and innovative trends that could serve as bridges between hydrology and hydraulics. Additionally, this research is designed to enhance our understanding of how scientific research and engineering practices interplay, thereby promoting more cohesive and efficient strategies for designing and managing water resources infrastructure. Ultimately, the goal is to develop a systematic framework or a collection of reliable and applicable hydrologic tools specifically for those working in hydraulic design.

Ghannad, Pedram, CEC, EGT
**SEA: Enhancing Autonomous Robotic Construction Efficiency through Risk-Based Multi-Agent Simulation.**
This proposal aims to enhance autonomous robotic construction efficiency through the implementation of a novel approach: Risk-Based Multi-Agent Simulation. The proposed project will contribute to advancing robotic construction technologies by developing an interdisciplinary approach by bringing together expertise from various disciplines, including civil engineering, construction, and computer simulation modeling. Building on an ongoing research project on robotic construction for Martian habitats, supported by programs like the CAT Fellowship and the ISGC, this proposal aims to expand our research and dive deeper into these topics, using what our team encompassing undergraduate and graduate students have learned to explore more challenges and opportunities in robotic construction. Our goal is to advance construction technology and improve our education programs, preparing students to meet the future challenges of the construction industry and contribute to its growth and innovation.

Johnson, Keith, BIO, LAS
**SEA: Search for a new antimicrobial compounds from bacteria collected from Asian Carp.**
This research will focus on developing the skills of undergraduate student researchers in the microbiological, chemical and genetic search for novel antimicrobial compounds. Students will screen bacteria for antimicrobial production. Antimicrobial extract will be isolated from the bacteria for chemical purification and analysis of activity. The genomic sequence of the isolated bacteria will be determined for bioinformatic analysis to target genes that are involved in the synthesis of the antimicrobial compound. This work is important in the search for new antimicrobial compounds (few have been identified in recent years). Students will gain experience in the research laboratory in a variety of techniques, be responsible for research experiments and initial interpretation, and be invaluable in the preparation of the resulting research manuscript(s).

Kuester, Deitra, EDU, EHS
**SEA: Developing AI Social Assistive Robots to Help Support Child Success: Predicting Meltdowns.**
There is no known research using AI Social Assistive Robots in a classroom to predict behavioral meltdowns before they occur. Academics have taken a backseat. Instead, teachers have to reactively address violent and aggressive behaviors as a priority. This project is an interdisciplinary collaboration between the Departments of CSIS and ECL. The first phase of this innovative project centered on physical features of a robot and exploration of software as part of a senior living capstone. Phase one concludes Spring 2024. Request for funding will provide support for a continuum of design and development of tasks during the summer 2024 for one of the students from the capstone team. He will imbue algorithms for machine-learning (the ability for the robot to learn different scenarios and proactively respond accordingly, before the child has a violent or aggressive meltdown), and prepare the robot for field tests for Fall 2024.

Drake, Teresa, FCS, EHS
**SEA: Implementation of a Campus Garden**
Implementing a campus garden with improve food security among students while providing other benefits related to sustainability, mental health, and social justice. Student(s) will gain research experience, skills such as time management, team work, and community service.

Moon, Jamie, BIO, LAS
**SEA: Genetic diversity within and between NW AR populations of the ringed salamander, Ambystoma annulatum.**
Ringed salamanders (Ambystoma annulatum), which are restricted to limited areas in the Ozarks, are considered species of conservation concern throughout their range. Habitat fragmentation due to rapid urbanization has threatened the mobility of these salamanders affecting gene flow between populations. The development of a data-driven conservation plan for endemic species such as ringed salamander is dependent upon understanding the genetic diversity both within and between populations. Thus, this study aims to determine the genetic variation found within populations and gene flow between populations of A. annulatum populations from NW Arkansas.  We will be extracting genomic DNA samples and utilizing 19 microsatellite loci to characterize genetic diversity. Information from this study will help to increase our knowledge of the current status of genetic variation in these vulnerable populations and inform conservation plans for the species.

Remmel, Megan, PLS, LAS
**SEA: At Death's Door: How Who Determines Death Matters.**
The general sense is that coronial systems with elected or appointed laymen are less desirable than medical examiner systems with physicians. For instance, coronial inquest juries cost the jurisdiction money, can slow down the process of death determination, and invite even more non-medical personnel into the decision-making process. In addition, coronial systems are sometimes housed within law enforcement agencies or county prosecutors' offices (though some medical examiners are, too). In fact, in some jurisdictions, the sheriff or the county attorney serves the dual function of chief law enforcement officer of a county and the coroner. But because of the lack of empirical data, we cannot currently answer whether these aspects of coronial systems are the disadvantages they are perceived as. A thorough investigation could provide evidence for future policy recommendations as to the utility of employing numerous medicolegal systems across the country.

Terreno, Saratu, CEC, EGT
**SEA: Investigating Scenarios in Construction for Enhanced Human-Robot Work Collaboration.**
The shortage of skilled labor in the construction industry is leading many companies to invest in construction automation through the use of robotics as a potential solution to augment the current and future needs of the workforce. However, research has shown that there is a dearth in understanding of the types of skills and competencies that construction workers need for safe and effective Human Robot Work Collaboration (HRWC). This proposed research project seeks to investigate scenarios that require HRWC from the literature. The scenarios will be investigated through a systematic review of literature that will categorize the environments, tasks, skills, safety needs and challenges of smooth implementation of HRWC. The results of this study will be used as seed data to enhance a current NSF proposal submitted by the PI, which aims to map the needed competencies by programming the scenarios into a Virtual Reality (VR) simulation for testing by human participants.

# 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 saves lives, time, money and reduces 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.

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 theneed 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).

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.

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.