PUMA-STEM Summer 2020 Faculty Research Descriptions

Biology:

Name of Mentor: Jim Fackenthal, PhD  
Institution: Benedictine University  
Department: Department of Biological Sciences  
Project Description: Students in the Fackenthal group study regulation of tumor suppressor genes at the level of alternate mRNA splicing. Students will use cancer and non-cancer derived tissue culture cells to learn basic cell culture techniques, end-point and quantitative RT-PCR, ELISA, and flow cytometry. We explore the effects of DNA damage repair pathways and epigenetic genomic modifications on regulation of alternative splicing, cancer risk models, and therapy outcome predictions.

Name of Mentor: Leigh Anne Harden, PhD  
Institution: Benedictine University  
Department: Biological Sciences Department  
Project Description: The Harden Lab conducts integrative ecological research on reptiles and amphibians (herps). Our lab’s central research questions revolve around of how these organisms function and interact with their increasingly modified environment, by studying them on a physiological, behavioral, and spatial/temporal level. We use field-intensive (e.g. aquatic surveys) and laboratory-based (e.g. ELISAs, microscopy) approaches to investigate how abiotic factors influence the physiology, behavior, and habitat preferences of herps, with applications to their conservation and management.  
Required qualifications/skills: Summer research projects will involve intensive outdoor fieldwork 4-6 days/week of trapping turtles in local wetlands to investigate their species diversity, population structure and demography. Students will have the ability to develop their own side projects of interest within this larger project. Much of this fieldwork may be done in hot, muggy, and buggy conditions, so a hardiness in this kind of weather is a must. Attention to detail is important for high quality science. Curiosity and an ability to troubleshoot will contribute substance as well as enjoyment to our shared work experience!

Name of Mentor: Robert McCarthy, PhD  
Institution: Benedictine University  
Department: Biological Sciences Department  
Project Description: The McCarthy Lab focuses on functional morphology of the primate skull studied using computed tomography (CT), magnetic resonance imaging (MRI), and 3D-digitization and -printing. Research on skull evolution during summer 2020 will be conducted at Benedictine University, the Field Museum of Natural History, and imaging facilities across the Chicagoland area.
Name of Mentor: Tiara Perez Morales, PhD  
Institution: Benedictine University  
Department: Biological Sciences Department  
Project Description: Undergraduate students in the Perez Morales lab research cell-cell communication or quorum sensing pathways present in *Lactobacillus* sp., a commensal microorganism of the gastrointestinal tract. Our focus is to determine how these quorum sensing pathways affect *Lactobacillus* sp. social behavior *in vitro*. Currently, our research projects provide students with knowledge in general microbiology techniques, bacterial genetics, cloning, 96-well transcriptional and phenotypic assays, RNA preparation, RT-PCR and qRT-PCR.

Name of Mentor: Jayashree Sarathy, PhD  
Institution: Benedictine University  
Department: Biological Sciences Department  
Project Description: The Sarathy lab works on two main projects involving how bile salts affect the physiology of colon cells. The first project investigates how the inflammatory environment often seen in bowel diseases impact reactive oxygen species (ROS) and mucin (Muc-2) expression. In the second project, the effects of bile acids on tight junction function and integrity of intestinal epithelial barriers. Students will use a variety of techniques in cell culture, fluorescent tagging and microscopy, ELISA assays, and flow cytometry.

Name of Mentor: Christopher Anderson, PhD  
Institution: Dominican University  
Department: Department of Biological Sciences  
Project Description: The Anderson lab’s research interests include ecology, evolution, and behavior found in natural systems. Our primary study subjects are insects in the order Odonata (dragonflies and damselflies). Our field sites have included locations in the Forest Preserve District of DuPage County (Illinois) and at the Sinsinawa Mound Center (Wisconsin). Our studies have included biodiversity surveys, documenting internal and external parasite prevalence & intensity, and experimental investigations of reproductive and territorial behavior. While primarily field based, our research group’s laboratory approaches have included population genetic studies (e.g. microsatellite development and analysis), laboratory dissections, and image analysis.

Name of Mentor: Irina Calin-Jageman, PhD  
Institution: Dominican University  
Department: Department of Biological Sciences  
Project Description: The Calin-Jageman lab’s research interests focus on the regulation of gene expression in the central nervous system. Understanding the biological mechanisms of memory is an important goal in neuroscience and fundamental to understanding how nervous systems adapt behavior to novel conditions. Specifically, we study the transcriptional changes that
accompany the maintenance and decay of long-term memory in the simple marine mollusk, *Aplysia californica*. Our research program integrates multiple methodologies, including bioinformatics, cell culture, molecular biology, and biochemistry.

**Name of Mentor:** Zomary Flores-Cruz, PhD  
**Institution:** Dominican University  
**Department:** Department of Biological Sciences  
**Project Description:** Both pathogenic and beneficial microbes utilize similar molecular “toolkits” to colonize and interact with their respective hosts. Likewise, eukaryotic hosts engage identical responses to both beneficial and pathogenic partners. Although beneficial microbes are necessary for host development, biology and health, most research has focused on pathogenic interactions. The Flores-Cruz lab’s research interests lie in understanding how beneficial host-microbe interactions are established and maintained. Currently, we examine the role reactive oxygen species (ROS) play in the beneficial Vibrio fischeri-Hawaiian Bobtail squid model system. Undergraduate students in the Flores-Cruz laboratory generate mutant strains in different oxidative stress response genes to determine their role in ROS stress response and symbiotic fitness. To test the role in oxidative stress response, mutant strains are exposed to different ROS and compare growth and survival to the wild-type strain. In addition, biochemical tests are performed to quantify oxidative damage and ROS generation and consumption.

**Name of Mentor:** Scott Kreher, PhD  
**Institution:** Dominican University  
**Department:** Department of Biological Sciences  
**Project Description:** The Kreher lab’s research is focused on the genetic basis of behavior. Our specific research goal is to investigate the molecular, genetic and cellular basis of the sense of smell, using the fruit fly, *Drosophila melanogaster*, as a model system. The sense of smell, or olfaction, is crucial for animals to find food, avoid predators and to find potential mates. Understanding the sense of smell is a fundamental question in neuroscience, as it relates to the mechanisms by which stimuli are coded by the sensory nervous system. It is especially worthwhile to investigate the basis of olfaction in insects, since pest insects use their sense of smell to find crops and blood-feeding insects use their sense of smell to find their hosts. We use various approaches in our research, such as classical genetics, molecular biology and behavioral analysis.

**Name of Mentor:** Dr. Amy Hebert  
**Institution:** Elmhurst College  
**Department:** Biology  
**Project Description:** In our lab we are exploring the role of inflammation and how it can affect learning and memory. We use the model organism C. elegans, which is a small nematode, to examine how exposure to inflammation changes various aspects of learning and memory such as gene expression, cell abundance, and synaptic function. Our hope is that exploring the
impact of inflammation on learning and memory, it can further our understanding of how neurodegenerative diseases work.

**Name of Mentor:** Dr. Eve Mellgren  
**Institution:** Elmhurst College  
**Department:** Biology  
**Project Description:** Undergraduate students in the Mellgren lab research how the plant pathogenic bacteria *Pseudomonas syringae* strain DC3000 causes disease on the model plant *Arabidopsis thaliana*. Students in the lab use DC3000 mutants and transgenic Arabidopsis plant lines to understand how DC3000 causes disease. They also learn important molecular techniques such as PCR, cloning, RT-PCR, DNA sequencing and infection assays to understand the interaction between DC3000 and its plant host.

**Name of Mentor:** Dr. Patrick Mineo  
**Institution:** Elmhurst College  
**Department:** Department of Biology  
**Project Description:** Climate change is already affecting biodiversity and these effects will continue to intensify. Because temperature affects biological processes at the molecular, cellular, and organismal levels of organization, organisms that allow their body temperature to change with the temperature of the environment (e.g. insects, fish, amphibians and reptiles) are particularly vulnerable to global climate change. My research aims to understand how these organisms can tolerate or adapt to climate change by investigating the molecular, cellular, and organismal responses to both short-term and long-term changes in environmental temperature in amphibians and reptiles.

**Name of Mentor:** Holly Snyder, PhD  
**Institution:** Lewis University  
**Department:** Department of Biology  
**Project Description:** To produce active Taq DNA polymerase in *Escherichiae coli* that is equivalent in activity to commercial Taq DNA polymerase. Research students will assist in the development of a workshop that will cover an area of biology that is taught in most classrooms as reading-intensive subject matter supplemented by a number of “dry labs”. Many high school level biology teachers lack the equipment, knowledge base and comfort level to carry out the lab activities that would go along with the study of DNA structure/function and current technology used to manipulate DNA. Despite its prevalence in the news and popular media (e.g. television shows such as CSI, etc.), most students do not experience these technologies during their high school careers. This workshop will offer high school biology students a chance to see and use some of the technologies being used in current cutting-edge research today. The goal of the workshop will be to engage and inspire learners and increase student interest and attitudes in STEM. As well this workshop can be offered to high school teachers to help advance their skills in molecular biology and provide them an opportunity for professional development. The development of the modules for this workshop is a great project for an undergraduate biology student who has taken genetics, microbiology and biochemistry. The
research student will be performing primer design, PCR, molecular cloning and protein analysis
and will be following established protocols that have been developed for use in the
undergraduate biology teaching lab. This project employs plasmids containing multiple
components of the lac operon thereby giving the research student practical experience with a
genetic regulatory system they learned about in the classroom. Having the student researcher
carry out this project will allow me to determine protocols that will need to be modified, the
time line for the workshop and development of teaching materials.

Chemistry:

Name of Mentor: David Rubush, PhD
Institution: Benedictine University
Department: Physical Sciences
Project Description: The Rubush Lab conducts medicinal and organic chemistry research to
create new organic molecules that investigate the following areas: cancer, malaria, bacterial
quorum sensing and irritable bowel syndrome. Undergraduate researchers use organic
chemistry techniques to synthesize, purify and characterize novel organic molecules, which are
tested for biological activity by research collaborators.
Required qualifications/skills: Passed Organic chemistry

Name of Mentor: Álvaro Castillo, PhD
Institution: Elmhurst College
Department: Chemistry & Biochemistry
Project Description: H₃⁺, Trihydrogen Cation: Exploring Density Functional Theory Methods to
Simulate Its Structure and Reactivity With Small Interstellar Molecules.
Most of the mass of the universe is made of hydrogen atoms in different forms. The most
common hydrogen ion in interstellar space is H₃⁺, perhaps one of most important sidereal
chemical species as it assisted in star formation. H₃⁺ is also involved in the formation of most
molecules found in space, including H₂O and CO₂, molecules that are thought to be early
precursors of organic compounds. The chemistry of H₃⁺ is very straightforward as it is a
universal proton donor, and the temperatures in space allow for a disregard of the entropy
term TS making the Gibbs energy nearly equal to the enthalpy H in most cases. Thus, calculating
enthalpy changes is sufficient to understand and predict its chemistry.

Enthalpy calculations can be carried out using computational chemistry, which is
becoming increasingly important in chemical research because of its ability to predict chemical
properties accurately. Additionally, computational chemistry can study systems that are
difficult to do experimentally (like molecules normally found in the conditions present in
interstellar space). There are many methods to carry out this type of calculations (depending of
the type of approximations being used), we are interested in exploring how effective Density
Functional Theory (DFT) (a family of calculation methods), are in computing the properties of
interstellar H₃⁺. Specifically, we wish to explore method performance in calculating geometries,
enthalpies of formation, proton affinities, ionization energies and bond dissociation energies.
We focus on these properties, as most of H$_3^+$ interstellar chemistry can be predicted by knowing those quantities. We will focus on species that play a pivotal role in interstellar chemistry: O$_2$, H$_2$, N$_2$, NO, CO$_2$, CH$_4$, CO, OH, HCCH, C$_2$, H$_2$O, HCN, CH, NH$_3$ and small atoms. The evaluation of DFT methods will allow us to be able to have a clear criterion to select appropriate methods of calculation, so we can predict reactions that might take (might have taken) place in space. Our goal is to investigate fast, yet accurate ways of calculating the chemical properties of H$_3^+$ and its more common substrates to further our abilities to predict chemical reactions taking place in interstellar space.

**Required qualifications/skills:** Students would need to be familiar with basic concepts of general chemistry such as: reaction thermochemistry, enthalpy and free energy. Similarly, students should have a basis proficiency on using computers and how to troubleshoot computer problems using the internet. Any other needed skills to carry out the computations/simulations will be learned during the summer experience.

**Name of Mentor:** Duy (Zoey) Hua, PhD

**Institution:** Elmhurst College

**Department:** Chemistry and Biochemistry

**Project Description:** The aim of this summer project is to standardize protocols for the characterization of interactions between antigen-binding fragment (Fab) of multiple antibodies and protein A or protein G. In order to reach this goal, the student researcher will 1) purify a set of Fab proteins using column chromatography and 2) test multiple experimental conditions to establish appropriate parameters for the study of Fab-protein interaction using immunoprecipitation.

**Required qualifications/skills:** The student will receive training on making buffers, immobilized metal affinity column (IMAC) chromatography, pull-down assay and/or immunoprecipitation assay, and protein gel electrophoresis. However, basic knowledge of biochemistry (first-semester) is required.

**Name of Mentor:** Dr. Colleen Munro-Leighton

**Institution:** Elmhurst College

**Department:** Chemistry and Biochemistry

**Project Description:** We know that many of our chemical feedstocks (petroleum and biomass, for example) are filled with unreactive carbon-hydrogen (C-H) bonds. In contrast, the structures of important pharmaceutical and agricultural compounds require these C-H bonds to undergo difficult reactions to make bonds between carbon and oxygen, nitrogen, sulfur or halogens. To address this challenge, the student will research C-H bond breaking reactions, in particular using palladium complexes to help weaken the C-H bond and favor the reactions. The project involves the reaction of a commercially available small molecule (with a prominent C-H bond) and palladium (II) chloride to form a new complex. Then, the complex will be studied under a variety of
conditions (heat, added base, etc) to attempt to break the C-H bond and yield a new complex with a Pd-C bond.

**Required qualifications/skills:** The work requires organic chemistry skill (reflux, filtration, purification by recrystallization or chromatography) as well as characterization by NMR spectroscopy. It is therefore ideal, although not required, that the student has completed organic chemistry.

**Name of Mentor:** Daniel Kissel, PhD  
**Institution:** Lewis University  
**Department:** Department of Chemistry  
**Project Description:** Undergraduate students in the Kissel research group at Lewis University explore research in inorganic chemistry and materials science. The Kissel group has two primary focuses: 1) Metal-Organic Frameworks (MOFs) and MOF-based materials for environmental and green energy applications, and 2) Metal-peptide interactions and coordination chemistry relevant to the bioinorganic mechanism of amyloid beta peptide aggregation observed in Alzheimer’s Disease. Driven by scientific curiosity, students in the Kissel group work to develop deeper mechanistic knowledge of these inorganic chemical systems and their applications.

**Name of Mentor:** Kari Stone, PhD  
**Institution:** Lewis University  
**Department:** Chemistry  
**Project Description:** Engineering Metalloenzymes for Catalysis. A research student for this project would work on would entail changing enzyme cofactors to impart new activity and function. Particularly we are interested in changing the active site of robust heme proteins with porphyrin derivatives that may display enhanced catalytic function. The production of industrially important biocatalysts will be a target of the study.  
**Required qualifications/skills:** Any student interested in Chemistry or Biology

**Name of Mentor:** Sharada Buddha, PhD  
**Institution:** Saint Xavier University  
**Department:** Chemistry  
**Project Description:** Triclosan was banned from personal care products in 2016 by the FDA due to the inability of companies to prove that it is an effective and safe chemical to be used for personal care, though it is still used in Hospital care products. The overuse of triclosan over the past years has increased the triclosan accumulation in water systems across the USA leading to biomagnification and toxicity to humans. In humans, triclosan is a known endocrine disruptor, particularly the thyroid hormone homeostasis and in some mammals, it is known to be a mitochondrial toxin. This research examines the anti-bacterial property of a possible substitutes for triclosan, that already being used like chlorhexidine and chemicals from a class of natural products called Chalcones. Chalcones are naturally occurring flavonoids in plants that are involved in a vast range of biological activities beneficial to humans. The anti-bacterial properties of chalcones will be evaluated by comparing the minimum inhibitory concentrations.
Once a comparable substitute is identified, it will be evaluated for degradation and persistence in aquatic systems.

**Name of Mentor:** Meilin Huang, PhD  
**Institution:** Saint Xavier University  
**Department:** Chemistry  
**Project Description:** We explore the impact of cooperative learning through analyzing mutual help networks among students. Students will learn to visualize and analyze the emergence, evolution, and structure of mutual help networks using Python, Social Network Analysis, modeling, and other tools.  
**Required qualifications/skills:** Motivated students with one or a combination of the following skills are encouraged to apply: (1) computer programming; (2) network analysis and visualization; (3) graph theory.

**Name of Mentor:** James Kiddle, PhD  
**Institution:** Saint Xavier University  
**Department:** Chemistry  
**Project Description:** Because of an increase in detection of many chemicals (industrial, pharmaceutical, agriculture) in waters, and the uncertain environmental fate of these contaminants, my research program, in collaboration with several colleagues, has established a diverse research focus to develop a thorough understanding of the chemistry associated with emerging contaminants in water. The primary aims of this project are to determine absolute reaction rate constants for specific classes of compounds of interest, assess structure-reactivity relationships, detect potential reactive intermediates, establish degradation efficiencies, and identify final stable products. Because the fundamental degradation chemistry of these compounds in water involves free radicals and we have examined several classes of pharmaceuticals these projects have also initiated several avenues of research investigating activation, toxicity, and reactivity of drugs in biochemical systems.

**Computer and Mathematical Sciences:**

**Name of Mentor:** Jeremy Nadolski, PhD  
**Institution:** Benedictine University  
**Department:** Mathematical and Computational Science  
**Project Description:** The Nadolski group focuses on three main topics: outlier detection in multivariate data, using Markov Chains to strategize on how to control an invasive species and the creation of topics and preliminary feasibility of capstone data science projects. These projects will use linear algebra, probability and statistics, stochastic processes and R programming.  
**Required qualifications/skills:** The minimal qualification is a course in statistics where probability and hypothesis testing has been discussed. Depending on the project, any
computer programming capabilities and/or use of a statistical package such as R would be a bonus.

**Name of Mentor:** Dr. Sam Abuomar  
**Institution:** Lewis University  
**Department:** Computer and Mathematical Sciences  
**Project Description:** Title: Data Analytics for Clustering and Statistical Modeling of Oceanography and/or Materials Science Data. In this project, data mining techniques will be employed to validate their efficacy in acquiring information about the physical properties of oceans, and/or bio-physical and mechanical properties of different materials such as nanocomposites polymers and preclinical/ clinical brain samples, from data derived from designed experimental studies. The dataset(s) that will be studied consist of different formulation and processing factors as inputs and different responses as outputs. The data analytics algorithms and techniques include visual assessment of clustering tendency (VAT), self-organizing maps (SOMs), and multivariate linear regression techniques (MVLR). VAT algorithm can be used to help discover if there are clusters (groups) in a given dataset. SOMs will be used to extract the input(s) of the most significant effect on the output responses. MVLR will be applied to the dataset to estimate the associations between different dimensions and input parameters with some of the dynamic responses in the dataset under certain conditions. Most importantly, the student should be able to use the results from data mining as either a proof of concept of previous theoretical studies related to the studied dataset(s) or as a new knowledge that has not been discovered a priori. This work will highlight the significance and utility of data mining and statistical analysis techniques in the context of informatics and knowledge discovery.  
**Required qualifications/skills:** Accepted student(s) should have an intermediate to strong computer programming skills. While Matlab is a preferred environment for this project, the student is free to use any programming environments (platforms) of his/her choice such as Python, R, Java, C++,...etc. In addition, a good mathematical background and skills are required, especially those related to linear algebra and calculus I and II.

**Name of Mentor:** Mahmood Al-khassaweneh, PhD  
**Institution:** Lewis University  
**Department:** Computer and Mathematical Sciences  
**Project Description:** With the advanced technologies in the automobiles industry including the auto-driving cars, there have been many challenges and demands to increase the safety of the drivers and people using the roads. The proposed method aims at developing an algorithm to warn the drivers of possible unintentional lane departure. This system can be integrated with old cars or embedded with new cars. For this sake, a simple camera is attached to the car and a processing unit receives, analyses and processes the images form the camera to warn the driver if the car is departing the lane. **Required qualifications/skills:** The students should have some programming experience. MATLAB or Python is a plus.
**Name of Mentor:** Amanda Harsy, PhD  
**Institution:** Lewis University  
**Department:** Department of Computer and Mathematical Sciences  
**Project Description:** Modeling DNA Self-Assembly Using Graphs. Motivated by the discovery of new laboratory techniques, formal graph theory has recently become useful in the study of self-assembling DNA complexes. One recent focus in DNA nanotechnology is the formation of nanotubes using lattice structures. These nanotubes are thought to have wide-ranging potential, such as containers for the transport and release of nano-cargos, as templates for the controlled growth of nano-objects, and in drug-delivery methods. This research involves determining design strategies for creating nanostructures. Students can start this research with little mathematical background.

**Name of Mentor:** Amanda Harsy, PhD  
**Institution:** Lewis University  
**Department:** Department of Computer and Mathematical Sciences  
**Project Description:** Predictive Modeling of Sports. Ranking sports teams can be a challenging task and using straight win percentage can be misleading at times. This research involves collecting sports data and writing software which tests the predictive power of different features and weights. The goal is to create and/or modify current models in order to predict sports outcomes.

**Name of Mentor:** Marie Meyer, PhD  
**Institution:** Lewis University  
**Department:** Mathematics  
**Project Description:** Polytopes Associated to Graphs. Polytopes are generalizations of polygons and polyhedra, polytopes of dimension two and three, respectively. In this research we will use the Laplacian matrix of a graph to form a polytope by considering the rows of the matrix as vertices of the polytope. The aim of this project is to classify families of graphs according to properties of their associated polytopes. We also experiment with known operations on graphs and study their effects on the polytopes. Our methods include tools from linear algebra, interpretation of lattice points as code words from coding theory, and minor computer computations.  
**Required qualifications/skills:** Students should have taken a Linear Algebra course

**Name of Mentor:** Brittany Stephenson, PhD  
**Institution:** Lewis University  
**Department:** Mathematics  
**Project Description:** Using Mathematical Models to Simulate and Control Disease Transmission. Infectious disease models can provide detailed insight into the transmission dynamics of pathogens and, thereby, facilitate the evaluation of disease surveillance, control strategies, and their effectiveness. Using mathematical models, together with appropriate parameter values, we can simulate outbreaks in order to predict emerging behaviors, assess the impact of
intervention strategies, and support decisions for disease control. Mathematical models can either be deterministic or stochastic and can either be discrete or continuous depending on the context. Different types of models can be used to model the same disease but focus on different aspects of disease spread. In this project, students will work on improving an existing model of the spread of *Clostridioides difficile* infection or focus on a disease of their choosing. Models can be in the form of differential equations or an entirely computational model, called an agent-based model (depending on the students’ skill set and previous experience). After the model is developed, students will simulate the model and use the resulting output to draw conclusions about how best to prevent the spread of the disease.

**Required qualifications/skills:** Students who have taken Calculus I. It would be really nice if the student had taken a course in Differential Equations

**Name of Mentor:** Piotr Szczurek, PhD  
**Institution:** Lewis University  
**Department:** Department of Computer and Mathematical Sciences  
**Project Description:** Determining Functional Roles in Networks through Link Analysis. This research aims to find metrics which can be used to determine the functional role that a node possess in a particular network. For example, it could be used to find people with specific influence in a social network. Also, it could be used to find important areas of a brain (which is a neural network). This study entails some experimental work and programming, as well as mathematical analysis.

**Name of Mentor:** Dr. Imad Al Saeed  
**Institution:** Saint Xavier University  
**Department:** Computer Science  
**Project Description:** Employers view for student’s accomplishment using mobile App. Employers are always looking for the best candidates for their job offering. They in need for a free tool that can help them find the best fit for their jobs offering from our students’ pool at United States schools. The purpose of this research project is to develop an employer website and convert it into an APP using CORDOVA to be ran on any mobile platforms and on any mobile devices. This app will be connected it to an online database system where any employers can access and download students resumes using their phones.  
**Required qualifications/skills, if any:** One prior web development course.

**Name of Mentor:** Jean Mehta, PhD  
**Institution:** Saint Xavier University  
**Department:** Computer Science  
**Project Description:** Artbotics explores the intersections between art, computer science, and robotics. The student will learn to program a microprocessor to:

- drive a small engine
- turn lights on and off
play music
control sensors for proximity, light, touch

The student will then put these skills into practice by creating interactive, tangible works of art. Examples of previous projects can be found at http://csmaster.sxu.edu/mehta/artbotics/artbotics.htm

**Required qualifications/skills:** One prior programming course. Any language. The programming will be in python, but his can be easily picked up as long as the student has a basic understanding of decisions, loops, and procedures (or methods).

**Name of Mentor:** Dr. James Vanderhyde  
**Institution:** Saint Xavier University  
**Department:** Computer Science  
**Project Description:** Virtual reality for STEM education. Three-D virtual worlds are easily accessible with new hardware technology for virtual reality. VR allows a user to move and view in 3D. This creates the opportunity for exploring new possibilities for learning computer science, science, and math. We will design and build an app for Google Cardboard and/or HTC Vive that students can use to explore new topics and build their own virtual worlds.