List of Faculty CRS Projects for 2018

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Name: Ebonics, the “N-word,” and Civil Rights

Mentor Name: Danielle Boaz

Mentor Department: Africana Studies

Abstract:

This project will focus on the importance of language in court cases involving African Americans. The research will be divided into two parts. The first part will explore the history of the “n-word” and its use in cases of employment discrimination. It will explore whether a single use of the “n-word” by employers or co-workers is sufficient to prove a hostile work environment and whether courts also interpret the modified term “nigga” as discriminatory.

The second part will explore controversies about Ebonics or African American English in US court cases. In 2017, an African American male told police officers, “give me a lawyer, dawg.” The police refused to call an attorney for this man, claiming that they thought he was asking for a “lawyer dog.” An appellate court recently sided with the police officers, finding that they reasonably could have been confused by the man’s request because he could have been asking for a dog that was a lawyer. This part of the research project will explore this and other cases where the use of African American English or Ebonics has led to a denial of rights.

Minimum Qualifications:
None.
Abstract:
This research project explores the rights and freedoms of practitioners of African derived religions such as Candomblé and Umbanda in Brazil. In the last few years, drug dealers have been targeting practitioners of Afro-Brazilian religions, holding them up at gunpoint and destroying their homes and temples. Legislators have introduced statutes that would ban some of the central practices of Afro-Brazilian faiths. Judges have declared that these faiths are not “religions.” The project will explore these recent restrictions on the freedom to practice Afro-Brazilian religions. The research involves reading and reviewing court cases, laws, reports, newspaper articles, and other records about these faiths.

Minimum Qualifications:
Student must be able to read Portuguese.
Project Name: Interannual variation in fruit availability for white-handed gibbons (*Hylobates lar*) living in suboptimal habitat in western Thailand

Mentor Name: Lydia E. O. Light

Mentor Department: Anthropology

Abstract:
Fruit abundance is known to vary from year to year, creating considerable limitations in short-term ecological studies of animals that are highly dependent on fruit resources. One such species is the white-handed gibbon (*Hylobates lar*), a small arboreal ape that consumes a diet high in fruit. Most studies of white-handed gibbons have focused on populations living in habitats with a fairly consistent supply of fruit. However, in Huai Kha Khaeng Wildlife Sanctuary in western Thailand, white-handed gibbons are found living in a mosaic savannah environment in which groups inhabit fixed territories, some in areas that experience significantly lower amounts of fruit availability than other areas. My previous work at this site documented an unexpected period of low fruit availability during the wet season, a time during which other sites experience an increase in fruit abundance. Yet despite a low availability of ripe fruit, gibbons maintained a high proportion of fruit in the diet (>75%) by eating more readily available unripe fruit and liana fruit. Due to the one-year duration of that study, it is unclear whether this period of fruit scarcity was typical for this site or a stochastic event. Field site staff familiar with the site speculated that the unusually high rainfall the year before had altered fruiting patterns, causing fruit crops to fail and forcing gibbons to shift to unripe fruit. This study aims to determine if the previously reported wet season fruit availability results are consistent with wet season fruiting several years later or if they more likely represent stochastic changes in fruit availability resulting from unusual weather patterns. I will work together with the undergraduate researcher to collect fruit availability data and gibbon feeding data from two gibbon social groups during July 2018. Comparing wet season fruit availability and gibbon feeding behavior between two separate years will allow for a broader understanding of the importance of interannual variation in food resources and gibbons’ capacity for altering foraging behavior to respond to such changes, information that is of growing importance in the face of increasing global climate changes and continuing threats to primate survival.

Minimum Qualifications:
Students must be willing to work in difficult and remote conditions. Students must have previous experience with primate field research and must have completed ANTH 2142 and ANTH 4140 by the end of the Spring 2018 semester.
Project Name: Understanding changing communities in Charlotte

Mentor Name: Nicole Peterson

Mentor Department: Anthropology

Abstract:

Many areas of Charlotte are experiencing changes due to development of the light rail, shifting demands for housing, and emerging projects like Camp North End and the Smart District. While the technical and financial issues of these projects are well conceptualized and modeled, very little is known about how these projects will affect long-standing communities and their residents. How will residents understand the changes and how they may affect safety, transit, and economic development near their homes? How are residents responding to potential and existing changes? Are there resources that they need to adapt successfully to some of these changes? These questions are underexplored with respect to city planning, particularly when it comes to Smart Communities research.

Over the past year, we have worked with a community organization in the Lockwood neighborhood in Charlotte to collect interviews with community members about their experiences and concerns. While gentrification and related topics are important themes in these interviews, there are other concerns and issues that have emerged from the project, including community engagement through food and events, beautification and tranquility, outdoor activities and public space, safety, homelessness, and race.

For this project, a student will examine how residents are thinking about the development of the area as a smart district – what does this mean for how they understand safety, housing, community, and other topics. They will review the literature on community perception of smart districts and their changes in the social sciences and planning literatures, analyze completed interviews for these themes, and complete additional interviews as needed. The product for the summer will be a draft of a research paper about this topic to submit to an academic journal.

Minimum Qualifications:

None
Project Name: Genetic analysis of mosquito vectors in Ethiopia

Mentor Name: Daniel Janies

Mentor Department: Bioinformatics and Genomics

Abstract:

Our research focuses on malaria in Ethiopia and examining the genetic diversity of malaria parasite (Plasmodium), mosquito vector (Anopheles), and human host populations. We are particularly interested in how host and vector movement impact the genetic diversity of malaria parasite populations. Over the past few years, malaria has become a growing public health threat in multiple zones and districts of eastern Ethiopia. There is evidence to suggest that human movement for agricultural purposes is playing an important role in the increase in malaria cases. However, not much is known about the mosquito vectors and its contribution to malaria prevalence in eastern Ethiopia. Our group recently identified an Anopheles species in Ethiopia that was previously found mainly in the Middle East and Asia. We are interested in the origin and timing of this species in Ethiopia and the potential impact on the malaria population. More questions remain related to the general mosquito species composition in eastern Ethiopia, frequency of insecticide resistance genetic mutations, and feeding preferences. Genetic analysis of mosquitoes collected during field surveys can provide important information about the mosquito population’s potential to spread malaria. The student will have the opportunity to answer some of these important questions. General lab experiences include processing mosquito specimen, DNA extractions, polymerase chain reaction (PCR), gel electrophoresis, and sequence analysis. The data produced from this study will contribute to our understanding of vector composition and pathogen transmission potential in a region in Ethiopia where malaria and other vector-borne diseases are a growing concern.

Minimum Qualifications:
Student must have taken General Biology and accompanying lab courses. Previous lab experience is required.
Project Name: Visual Analytics of Pathogens

Mentor Name: Daniel Janies

Mentor Department: Bioinformatics

Abstract:
The global spread of multi-drug resistant (MDR) bacterial pathogens is a pressing problem that can lead to the loss of many aspects of health care. With the recent ease of access and decreased cost of DNA sequencing the several US and international regulatory agencies have formed a network of sequencing labs that collect genetic data on bacteria in the food supply. The resulting bacterial sequence datasets are rapidly scanned for the presence or genes that confer antibiotic resistance but are not fully annotated or analyzed.

By combining genetic data with bacterial host, location and time metadata in a graph database, our work provides graph mining analytics and graph network visualizations that enable risk analytics around the spread of MDR bacteria.

Minimum Qualifications:
Ability to work in a agile programming team with Javascript, R-Shiny, R, HTML and D3. Some subset of these capabilities may be acceptable. Understanding the scientific literature surrounding MDR pathogens a plus.
Project Name: Bioinformatics approaches to improving the fruit quality of East African banana

Mentor Name: Robert Reid

Mentor Department: Bioinformatics and Genomics

Abstract:
Dr. Reid works with the International Institute of Tropical Agriculture (IITA), which is a non-profit organization that generates agricultural innovations to meet Africa’s most pressing challenges of hunger, malnutrition and poverty.

Improving crops in sub-Saharan Africa is one of IITA’s top priorities. In sub-Saharan Africa, where millions depend on agriculture not only for food but also for their livelihoods, IITA’s research provides solutions to hunger, poverty and natural resource degradation. Using sophisticated genetic engineering or selective breeding, IITA develops a wide range of staple crop varieties for different situations and purposes.

Banana and plantain crop improvement is crucial to IITA’s research mandate. Their work to fight major banana and plantain pests and diseases is producing impressive results and securing one of the continent's primary food sources. IITA scientists have introduced high-yielding, disease and pest resistant varieties with durable fruit quality. The final objective is to create high-yielding banana hybrids by 2019 that can be multiplied for large-scale distribution.

Uganda and Tanzania consume as much as 50% of all bananas in Africa, but only yield 9% due to disease and pests. IITA’s genetic research aims to improve resistance and boost banana yields by 30%. Such tools and strategies enhance the capacity of smallholders throughout sub-Saharan Africa to produce enough banana and plantain to meet demand.

Focusing mainly on genomics, Rob has been involved sequence assembly projects include the assembly and analysis of the oat and blueberry genomes, the transcriptome assemblies of various plants, assay development for genotyping and marker mapping, genome annotating, gene expression studies and characterizing plant pathways using a variety of bioinformatics approaches.

For this project, Dr. Reid will be sequencing selected varieties of the East African highland banana for the purpose of developing an Illumina SNP microarray, specific for banana genotyping. Further research will compare and contrast the sequencing results to the current banana reference genome to identify single nucleotide polymorphisms (SNPs), which will be used in collaboration with Illumina to facilitate construction of a banana SNP chip.

This project would benefit from including a highly motivated undergrad with a biology background that is willing to learn some of the computational tools needed for this project.

Minimum Qualifications:
Seeking a biology student who wishes to learn more about the bioinformatics tools used in genomics. They will need a strong biological background (rising Senior) and a desire to learn programming.
Project Name: Creating web application for data visualization of bacterial mutation topology

Mentor Name: Way Sung

Mentor Department: Department of Bioinformatics and Genomics

Abstract:

Mutations are a critical evolutionary force, providing the raw fuel for natural selection. Recent mutation-accumulation experiments have generated an in-depth view of the genome-wide rate and spectrum of mutations in a broad range of bacterial species (Sung et al., PNAS, 2012 109 (45)). This large-scale multi-species data set contains many patterns that can help us further understand the evolution of bacterial genome architecture, pathogenicity, and virulence. In this project, we will create a web application for data visualization of mutations across multiple bacterial species that we can use to identify key regions of the genome where the mutation process varies. For instance, certain regions of the genome appear to be highly enriched in mutations, and an overlay of different bacterial genomes can assist in identifying these regions (Sung et al., MBE, 2015 32(7)). In addition, visualization of large-scale and small-scale segmental mutations in bacteria can provide insight on the evolutionary forces driving gene duplication, gene functionalization, and horizontal gene transfer. The funding from Charlotte Research Scholars will allow the student to create a web application to visualize and contrast the topology of mutations across multiple species.

Minimum Qualifications:

Strong computer science background, basic biology knowledge.
Project Name: Identifying cancer drug targets using a novel Yeast small compound screen.

Mentor Name: Richard J. Chi

Mentor Department: Department of Biological Sciences

Abstract: Currently, there are billions of theoretical combinations of small molecules. Many of these small molecules have been shown to possess potent medicinal properties such as stimulating neuronal growth or combating cancer. However, understanding the underlying biological targets of these compounds continuously hampers their pharmaceutical development. Studies in mammalian cells have proven too complex and unreliable to elucidate these pathways. To aid in drug development, we have focused our work to use a simpler model system, *Saccharomyces cerevisiae*. Yeast, have 4 times fewer genes than humans and many of the pathways are conserved, making it an ideal model organism for drug discovery. Our lab has established a novel drug screen that utilizes a drug sensitive yeast strain that when presented with a toxic compound, the compound accumulates within the strain, resulting in reduced fitness causing eventual cell death. This summer, we will survey a library of small compounds that have anti-cancer properties with unknown targets and catalogue their sensitivity to this query strain. If we identify a fitness reducing compound, we will introduce a library of overexpression plasmids spanning the entire yeast genome and identify genes that rescue growth in the presence of the compound. Then, we will cluster common genes into biological pathways in hopes of identifying the drug’s target.

Minimum Qualifications: None
Project Name: Inflammation and breast cancer progression

Mentor Name: Didier Dréau

Mentor Department: Biological Sciences

Abstract:
Currently, about 1 in 8 women in the United States will be diagnosed breast cancer in their lifetime. Indeed, recent progress including early diagnosis, the use of combinations of surgery, chemotherapy and radiotherapy are associated with improved survival. However, much remains unclear regarding the metastatic progression of breast cancer observed in a significant number of patients and associated with a much dimer prognosis. In particular the role of the microenvironment of primary tumor cells including the matrix proteins and stroma cells i.e., immune cells, vascular cells and fibroblasts are gaining interest in the progression toward metastasis. The research overarching focus of this project is on the inflammation related effects on tumor growth and tumor cell migration, both key early steps in the generation of metastases. Specifically, the Charlotte Research Scholars will be involved in research that centers on the stromal cells and the roles of inflammasomes proteins in promoting breast cancer progression.

Minimum Qualifications:
Student should have an excellent work habits, a background in Biology is required including having successfully completed a Cell Biology course. Prior experience in cellular and molecular research will be viewed positively.
Project Name: Testing novel recombinant oncolytic viruses against pancreatic cancer cells

Mentor Name: Valery Grdzlishvili

Mentor Department: Biological Sciences

Abstract:
Pancreatic cancers, about 95% of which are pancreatic ductal adenocarcinomas (PDAC), have the worst prognosis of all cancers and will soon be the second leading cause of cancer-related deaths in the United States. Current treatment regimens clearly fail to benefit patient survival. Oncolytic virotherapy is a relatively new anticancer approach that utilizes replication-competent viruses to specifically infect and kill tumor cells. Our studies focus on vesicular stomatitis virus (VSV) as a treatment for PDAC. VSV is a promising OV, and a phase I clinical trial using VSV against hepatocellular carcinoma is in progress (Clinicaltrials.gov, 2012, Trial ID: NCT01628640). Our recent studies demonstrated that VSV is effective against the majority of clinically relevant PDAC cell lines tested, both in vitro and in vivo; however, some PDAC cell lines were resistant to virus-mediated oncolysis. These results suggest a need for better “armed” OVs to enhance OV efficacy. Our preliminary studies generated several novel recombinant VSVs expressing human genes, which have anti-tumor and pro-apoptotic properties. The proposed experiments will test these novel viruses against a panel of human PDAC cells in vitro. The student will use several cell biology, molecular biology and virology assays to examine abilities of viruses to infect, replicate in, express foreign, and kill cancer cells. We hypothesize that these new viruses will have a significantly increased anticancer efficacies compared to the parental VSV strain.

Minimum Qualifications:
General knowledge of cell biology and molecular biology techniques, equipment and terminology. Basic knowledge of Virology and previous lab experience working with viruses is strongly preferred.
2018 Charlotte Research Scholars
Research Project Submission

Project Name: Combined Roles for Behavior and Gene Expression in Animal Ecology

Mentor Name: Adam Reitzel

Mentor Department: Department of Biological Sciences

Abstract:
Abiotic factors like temperature, salinity, and UV light are key environmental variables that affect physiology, survival and distribution of most organisms, particularly species in shallow aquatic habitats. Estuaries are among the most dynamic coastal environments and are “hot spots” to study the effects of climate change. Estuarine species like the starlet sea anemone, *Nematostella vectensis*, experience large fluctuations in temperature and salinity, requiring wide physiological tolerances, and at the same time, have a natural distribution along a pronounced thermal cline, which may promote the evolution of different temperature optima and tolerances in populations. This summer research project would use behavior experiments with field collected anemones as well as utilize molecular methods to study how this species responds to temperature and salinity stress and how different populations may have different degrees of tolerance. The student researcher will learn and apply a suite of techniques, including measurements of behavior, physiology, and gene expression. If interested, the selected student would have the opportunity to conduct field collections along the coast of North and South Carolina. The selected student will also have the opportunity to work with multiple graduate students and other undergraduate students during the summer to learn additional approaches targeting different research questions.

Minimum Qualifications:
A curiosity about the mechanisms of organismal biology and interest in animal ecology. Previous research experience is a plus but not expected.
Project Name: Understanding HDJ2 function in breast cancer using high-throughput chemical genetic screens

Mentor Name: Andrew W. Truman

Mentor Department: Department of Biological Sciences

Abstract:
Hsp70 is a universally conserved molecular chaperone that performs a wide variety of functions in the cell including protein folding, transport and disaggregation. Helper "co-chaperone" proteins control the activity and specificity of chaperones. Cancer cells express mutated oncoproteins that are intrinsically unstable and require high levels of Hsp70 to maintain activity. Consequently, cancer cells are “addicted” to chaperone function and are very sensitive to small molecule inhibitors of Hsp70. An understanding of co-chaperone function should lead to novel anticancer therapeutics. In this project, students will undertake a large-scale chemical genetic screen analyzing the sensitivity of cancer cells lacking the HDJ2 co-chaperone to 3000 NIH-curated compounds.

Minimum Qualifications:
General knowledge of cell biology and molecular biology techniques, equipment and terminology.
Project Name: Using CRISPR/Cas9 to edit Hsp70 in breast cancer

Mentor Name: Andrew W. Truman

Mentor Department: Department of Biological Sciences

Abstract:
Hsp70 is a universally conserved molecular chaperone that performs a wide variety of functions in the cell including protein folding, transport and disaggregation. Cancer cells express mutated oncoproteins that are intrinsically unstable and require high levels of Hsp70 to maintain activity. Consequently, cancer cells are “addicted” to chaperone function and are very sensitive to small molecule inhibitors of Hsp70. Although transcriptional regulation of Hsp70 has been highly studied, little is known about phosphorylation of Hsp70 (known as the “Chaperone Code”) and their effects on in vivo function. We are currently using advanced technologies such as CRISPR-Cas9 editing to block phosphorylation sites on Hsp70 in the genome of breast cancer cells. We measure the effects of these mutations by analyzing the changes in global Hsp70 protein interactions using high-resolution mass spectrometry. By understanding the role of phosphorylation on Hsp70 function, we hope to develop novel anticancer treatments that modulate the Hsp70 chaperone code.

Minimum Qualifications:
General knowledge of cell biology and molecular biology techniques, equipment and terminology.
Project Name: Mechanistic studies of genome stability and cancer etiology

Mentor Name: Shan Yan

Mentor Department: Biological Sciences

Abstract:
Cells of all organisms are challenged constantly by environmental agents or spontaneous DNA decay during normal metabolism. The reactive oxygen species (ROS)-induced oxidative stress is one of the most frequent sources of DNA damage, generating approximately 10,000 oxidative DNA damage per cell per day. If left unrepaired in a timely fashion, oxidative DNA damage may compromise DNA replication and transcription programs or may be converted into potentially lethal DNA double-strand breaks (DSBs), therefore representing a serious challenge to genomic integrity. In response to oxidative DNA damage, the base excision repair (BER) pathway is activated to repair the damage, thereby maintaining genome stability (Yan, et al., 2014, Cell Mol Life Sci, 71 (20): 3951-3967, 2014). However, it remains less understood how the oxidative DNA damage is sensed and signaled for checkpoint response. AP Endonucleases including APE1 and APE2 are critical enzymes implicated in the BER pathway. Recently, graduate student Jeremy Willis and undergraduate honors students Yogin Patel and Barry Lentz from the Yan laboratory have demonstrated that APE2 is required for the ATR-Chk1 checkpoint signaling (Willis, et al., 2013, PNAS, 110:10592-10597, 2013). We further demonstrated that APE2 Zf-GRF domain associates with ssDNA to promote the 3’-5’ end resection of oxidative DNA damage for checkpoint signaling (Wallace et al., 2017, PNAS, 114 (2): 304-309). With the ongoing project, we plan to further investigate the molecular mechanisms of how DNA damage response is regulated in oxidative stress. We will also investigate how oxidative stress-induced genome stability leads to cancer development. The anticipated findings from this research project will help to provide new avenues for novel therapeutic strategies. Undergraduate students working in the Yan lab won the prestigious Barry Goldwater Scholarship and ANSwer Scholarship in 2017. More information can be found from the lab website @ https://clas-pages.uncc.edu/shan-yan/

Minimum Qualifications:
Biol 2130 (or equivalent course) C or above.
Project Name: Real Estate Investment Research – Residential and Commercial

Mentor Name: Sara Spencer

Mentor Department: Belk College of Business, Finance Department

Abstract:
Students will be given a budget to invest in real estate. The investment must include both residential and commercial properties (individual properties and REIT stocks), subject to allocation rules and return requirements for various property types. The goal will be to select properties that are actively listed on the market for investment. Each investment will need approval from the investment committee and require an investment memorandum with financial analysis. Once the funds are spent, the student must track the REIT stock performance and compile a summary (written and presentation) of the investment choices and overall portfolio allocation.

Minimum Qualifications:
At least 1 undergrad finance and/or real estate course completed. The student should be an interest in real estate, finance or general business.
2018 Charlotte Research Scholars
Research Project Submission

Project Name: Computing with RNA and DNA nanoparticles
Mentor Name: Kirill Afonin
Mentor Department: Chemistry

Abstract:
Reconfigurable and dynamic nucleic acid (RNA and DNA) nanomaterials hold much promise for the future of cancer diagnostics and therapy because their designs can be easily customized and their physicochemical properties can be easily fine-tuned. With a naturally occurring toolset of five ubiquitous nucleotide building blocks, nucleic acid-based nanoparticles can be programmed to carry out multitude functions and only activate them when specific triggers, characteristic for the deceased state of the cell, are present. Recently, our lab introduced several alternative techniques that allow for conditional activation of different functionalities in cancer cells. During 2018 Charlotte Research Scholars project, we will attempt to create a computational algorithm that will aim at finding the optimal sequences to conditionally induce the apoptosis in cancer cells. This will result in establishing the designing principles for nucleic acid-based logic gates able to either activate or deactivate various cellular processes, and have logic gate output be colored or tagged for ease of recognition.

Minimum Qualifications:
The successful candidate should have a strong background in common laboratory techniques: PCR, transcription, gel electrophoresis, cell culture, transfections, flow cytometry, etc, and should preferably have some experience in working with nucleic acids-based assemblies. Additionally, knowing some programming will extremely benefit the applicant.
Project Name: Crystalline Covalent Polymers from Nanoscale Clusters

Mentor Name: Christopher Bejger

Mentor Department: Chemistry

Abstract:

New synthetic approaches to polymers are crucial to realizing next-generation materials and solving modern problems in energy storage and catalysis. Over the last decade, metal-organic frameworks (MOFs) and covalent organic frameworks (COFs) have emerged as important hybrid polymers that offer robust stability, crystalline structures, and highly tailorable electronic properties. Our lab is currently developing a methodology for a new class of framework polymers, which we call molecular cluster organic frameworks (MCCFs). Specifically, we are synthesizing preformed, discrete, molecular clusters that are appropriately functionalized to form covalent bonds using the same organic linkers employed in the synthesis of COFs. Our approach borrows from the conceptual basis of MOF and COF chemistry while offering access to new materials that cannot be imagined using traditional framework methods. We have recently designed and synthesized several key metal-sulfide molecular cluster monomers with various geometries and functions. Connecting these metal sulfide clusters through strong covalent bonds is expected to increase the stability of the ensuing polymer as well as enhance electronic coupling between individual cluster units. We aim to study the polymerization reactions of these molecular cluster building blocks and to fully characterize all new materials. Specifically, we will investigate the electronic, magnetic, and catalytic properties of all new MCCF polymers. This work will provide synthetic guidelines for the preparation of future polymers with programmable properties and structures.

Minimum Qualifications:
Qualified applicants will have successfully completed General Chemistry (1251 and 1252) and Organic Chemistry (CH 2131 and CH 2132) with corresponding laboratory courses.
Project Name: Synthesis of fluorinated building blocks and functional organic materials

Mentor Name: Markus Etzkorn

Mentor Department: Chemistry

Abstract:
Organic synthesis is a powerful tool to obtain complex molecular frameworks with tailored properties for applications in medicinal chemistry, material science and may other areas. The CRS project will provide an opportunity to apply classic and standard synthetic techniques to furnish small fluorinated molecules and explore their potential as building blocks toward structurally more complex architectures. Fluorine, as one of the most unique property-altering substituent in organic chemistry, is employed to tailor structural and electronic properties of conjugated targets, such as dendralenes or other cross-conjugated pi-scaffolds. The project involves the synthesis, purification and characterization of known and novel compounds, as well as an introduction to the theoretical background of the targeted scaffolds.

Minimum Qualifications:
Students should have passed CHEM 2131 and CHEM 2131L with a grade B or better
Project Name: Determination of Crystal and Molecular Structures by X-ray Methods

Mentor Name: Daniel S. Jones

Mentor Department: Department of Chemistry

Abstract:

The technique of single-crystal X-ray crystallography is used to determine the detailed molecular structure of chemical compounds. Because this is a completely general method, it can be applied to almost any compound of chemical interest which can be crystallized, and is thus an important tool in many different areas of research. The determination of a substance’s structure by X-ray methods involves several steps, including 1) preparation of suitable crystals for study, 2) preliminary X-ray investigation for the determination of crystal quality and lattice type, 3) collection of high accuracy intensity data on an automated X-ray diffractometer, and 4) reduction and analysis of the data utilizing high-speed computers.

The Research Scholar will be involved in all of these aspects of structure determination.

Structure determinations are carried out on compounds of interest in a variety of research endeavors; the particular compounds studied depend on the immediate research interests of faculty colleagues within our department and at other universities. Structures recently determined include a porphyrin important for photoluminescence studies, molecules relevant in the preparation of new antibiotics, and molecules used as fluorescent sensors.

Minimum Qualifications:

An introductory chemistry course; one semester of calculus; one semester of physics – all with a grade of “B” or better.
Project Name: Structural characterization of RNA nanoparticles

Mentor Name: Joanna Krueger

Mentor Department: Chemistry

Abstract:
Small-angle X-ray scattering (SAXS) is a fundamental characterization tool for investigating the nano-scale structural features of macromolecules. It can be used to characterize the size, shape, degree of self-association, polydispersity, and intermolecular interactions for a multitude of molecules including proteins, lipids, nucleic acids, nanoparticles in solution, as well as semi-crystalline solids, thin films, and other systems of interest to the biological and nanomaterials communities. These detailed molecular characterizations are essential to understanding and/or designing specific functionality. For example, revealing the molecular, nanoscale structures of biological molecules that function as “nano-machines” and the intramolecular forces that support them will afford essential insights into the intelligent designs found in nature, thereby enabling the design and improvement of useful synthetic nanomaterials for use in the energy and biological/health sectors. This project will involve a collaboration with Dr. Afonin’s research group in the emerging field of RNA nanotechnology. RNA-based nanoparticles (RNA NPs) are currently a focus of pharmacological and biological studies because RNA can be designed and manipulated to produce a variety of nanostructures. The resultant structures require detailed structural and functional characterization. We will use SAXS for structural characterization and optimization of RNA NP systems. RNA NPs can be functionalized for therapeutic use with short interfering RNAs (siRNA), ribozymes, or therapeutic aptamers, as well as proteins, and small molecules via fusion with individual RNA strands, which form the scaffold of RNA NPs. The resulting functionalized NPs will guarantee precise control over the composition and stoichiometry of therapeutic modules for simultaneous delivery into diseased cells. The direct visualization of RNA NP multi-stranded assemblies can be achieved with atomic force microscopy (AFM) and cryogenic electron microscopy (cryo-EM). However, the resolution of these techniques is often limited by the size, shape and composition of the NPs. Therefore, to gain the most complete picture of the structure of the NPs and thereby gain insight into their structure to function relationship, several techniques (including SAXS) will be employed.

Minimum Qualifications:
Chemical or Biological Sciences Major, experience with the RNA preparation techniques (PCR, transcription, native-PAGE, etc)
Ability to travel to Duke University and/or Brookhaven National Lab to collect SAXS data
Project Name: Synthesis of Bioconjugation Reagents and their Bioconjugates

Mentor Name: Craig Ogle

Mentor Department: Chemistry

Abstract:

With increasing amounts of biomolecules being introduced into the modern pharmacopeia there becomes increasing interest and importance in drug targeting. The way to do this is by connecting a targeting molecule to the drug of interest. This connection is termed bioconjugation when one of the connected molecules is a biomolecule. We are developing bioconjugation reagents, reagents to connect molecules of interest to biomolecules. This new adduct with the connected molecule is called a bioconjugate.

Projects will involve making bioconjugation reagents and characterizing them. Subsequently the bioconjugation reagent will be used to link a molecule of interest to a biomolecule followed by characterization and evaluation.

Minimum Qualifications:

Organic chemistry CHEM 2131 & 2132
Abstract:
We have recently synthesized several coordination complexes of copper(I) and gold(I) supported by sterically-demanding N-heterocyclic thione (NHT) and selone (NHSe) ligands. More specifically, complexes of general formulas (IArE)MX, (SIArE)MX, and (SpymArE)MX (Ar = Xy, Mes, Dipp; E = S, Se; M = Cu, Au; X = Cl, Br, I) have been isolated and fully characterized using a combination of analytical and spectroscopic techniques. The key difference between these three families of compounds is the nature of the sulfur- or selenium-donor groups since the IArE ligands feature unsaturated five-membered rings, SIArE have saturated five-membered rings, and SpymArE consist of saturated six-membered ring derivatives. We have also prepared silver(I) complexes with the IArE and SpymArE ligands, and these compounds are likely to have antibacterial or anticancer properties based on literature precedent. In order to complete a systematic study of these types of compounds, we would like to prepare and completely characterize the SIArE series of silver compounds. The proposed work involves a combination of organic and inorganic syntheses and first-hand experience with the common methods used to handle air- or moisture-sensitive compounds, including glovebox and vacuum line techniques. In addition, the purity of the new compounds will be verified using elemental analysis, multinuclear nuclear magnetic resonance (NMR) spectroscopy and, whenever possible, single-crystal X-ray diffraction, thereby providing the CRS participant with a valuable learning experience.

Minimum Qualifications:
Two semesters of General Chemistry (CHEM 1251/1252), including their laboratories, are required; one semester of Organic Chemistry (CHEM 2131) and its laboratory is desirable.
Project Name: Development and investigation of RNA nanoparticles designed to target human cancer genes.

Mentor Name: Caryn D. Striplin

Mentor Department: Chemistry

Abstract:
As medicine and life span have increased so has the frequency of cancer diagnosis. Treatment of disease has become more personalized through advancements in molecular biology; but innovative combinatorial approaches are still critically needed to target specific tissues or cells when cancers evolve. The development of nanotechnology has introduced the application of multifunctional RNA and DNA nanoparticles that may be useful as regulators of biochemical pathways. Capability of intracellular tracking and designable target specificity have been accomplished using unique nanoparticles with attached functional groups (e.g., fluorophores and siRNAs).

Nanoparticles designed to specifically target genes involved in breast cancer will be investigated during this summer project. RNA nanoparticles composed of rationally designed nucleic acid sequences to a target anti-apoptotic genes (e.g., BCL-2 and PLK-1) will be used. Conditional activation of the nanoparticles will be explored using a strand displacement approach. The primary focus of the project will be the development of specific nanoparticles to regulate targeted cancer genes and optimization of these protocols. Time permitting the project will move into cell cultures.

Minimum Qualifications:
PCR, in vitro transcription, electrophoresis (agarose and PAGE), RNA purification and quantification, nucleic acid assembly, and cell culture. This work will be done in collaboration with the Afonin Lab.
Project Name: Complex glycan biosynthesis in bacterial pathogens

Mentor Name: Jerry Troutman

Mentor Department: Chemistry

Abstract:

Bacterial surface polysaccharides play central roles in a wide range of biology, and could serve as targets for novel anti-microbial agents, pathogen sensors, vaccine antigens or other important therapeutics. All of these applications require robust methods to produce these materials that can be easily adapted from one type of polysaccharide to another. One important way to go about doing this is to exploit the natural pathways that are associated with the formation of these materials to build them either enzymatically or engineer a living system to do it. Both of these options require more effective tools for the analysis of bacterial polysaccharide biosynthesis and a better understanding of these natural pathways than is currently available. The Troutman research group focuses on the development of new methods and tools for the production and analysis of complex polysaccharide biosynthesis in vitro and in cells. In the long-term the tools generated will provide new platforms for the development of both glycan-based and glycan-targeting therapeutics designed to combat the emerging threat of antibiotic resistant microorganisms.

Minimum Qualifications:
CHEM 1251/1252
CHEM 2131/2132
Abstract:
Gene therapy currently represents a significant portion of new pharmaceuticals to alleviate a wide variety of diseases, including viral infections, cancer and autoimmune disorders. However, the gene therapeutic potential is frequently hampered by various biological barriers. In order to take full advantage of this potential, it is necessary to develop effective and safe delivery systems to carry the DNA or siRNA biomolecules. The main goal of this project is to develop novel silica-based nanoparticles (SNs) as an efficient platform for gene delivery. The participation of the undergraduate student on this project will be focused on the synthesis, functionalization and characterization of silica-based nanoparticles that will be used to deliver DNA/siRNA. A Ph.D. student in my group has developed and optimized and efficient method to synthesize SNs. The undergraduate student will learn the synthesis of silica-based materials and the structural characterization of nanoparticles using a wide variety of methods such as dynamic light scattering, thermogravimetric analysis and scanning electron microscopy. In addition, the student will carry out organic reactions to functionalize the exterior surface of SNs with different functional groups. A variety of analytical techniques will be use to characterize the organic groups such as NMR and FT-IR. Finally, the student will be involved in testing the loading and delivery of DNA/siRNA material both in solution and in vitro settings.

Minimum Qualifications:
The undergraduate student working in this project needs to have completed CHEM 2131 with a grade of B or above.
Project Name: Solution Processable Porphyrin Light-Harvesting Systems

Mentor Name: Michael G. Walter

Mentor Department: Chemistry

Abstract:
Porphyrin compounds represent a class of highly light-absorbing materials whose optoelectronic properties may be tuned by changing peripheral substituents using various synthetic transformations. In addition, their film forming properties (useful for integration into solar energy conversion technologies) can be adjusted by extending various solubilizing groups around the porphyrin macrocycle. Porphyrin compounds that have long alkyl chains exhibit liquid crystalline properties that allow for organization/reorganization and self-assembly, which is highly advantageous for thin-film organic solar cell development. This project will examine a series of new liquid crystalline and/or highly soluble porphyrin derivatives with the intention of examining their potential application as the light-harvesting / donor material in an organic solar cell. Students working on this project will be exposed to some synthetic chemical transformations, small molecule characterization techniques, and solar cell device engineering/testing.

Minimum Qualifications:
1 yr. general chemistry, 1 yr organic chemistry
Project Name: Time-Resolved Photoluminescence Properties of Thiazolothiazoles (TTz)
Mentor Name: Michael G. Walter
Mentor Department: Chemistry

Abstract:
This project is directed towards examining the photophysical properties (absorption and fluorescence emission/excitation spectra) of several newly synthesized thiazolothiazole (TTz) dyad systems. In addition, students working on this project will model structures using a computational software package (Spartan). This project will initially focus on optimizing the geometry of the thiazolothiazole dyads using molecular mechanics followed by higher-level density functional theory calculations. The student working on this project will prepare solutions of both individual TTz molecules and that of the dyad molecules and examine their steady-state absorption / fluorescence spectra to elucidate the charge transfer states of the dyad. The donor-acceptor properties of the charge-separated states will be determined using pump-probe picosecond time scale transient absorption spectroscopy. Lastly, the student will begin to look at the film forming properties of spin-cast films of the dyad for various optoelectronic applications.

Minimum Qualifications:
1 yr. general chemistry
Project Name: Solar Water Splitting with Organic Molecules
Mentor Name: Michael G. Walter
Mentor Department: Chemistry

Abstract:
The "Holy Grail" of solar energy conversion and storage is the harvesting of light and the efficient conversion of this energy into a fuel, which can be stored and used upon demand. New materials that are developed for this purpose must be able to absorb light well and transmit that energy to a catalyst site, which can store the energy in a chemical bond. One such method, solar water splitting, aims to split water into hydrogen and oxygen using sunlight and water as the only inputs. The hydrogen can then be stored and used later as a fuel. This project will examine a new series of light-harvesting polymers and compounds used in organic photovoltaics that can potentially serve as the light-harvesting component of a solar water splitting device. The project will examine how organic photovoltaics can be successfully coupled to earth-abundant catalysts for efficient conversion of light energy into chemical energy.

Minimum Qualifications:
1 yr. general chemistry, 1 yr physics
Project Name: Bio-concrete: Using bacteria to make self-healing sustainable concrete

Mentor Name: Mariya Munir

Mentor Department: Civil and Environmental Engineering

Abstract:
Concrete is a common construction material, the properties of which may be predetermined by design, selection of constituent materials, and quality control. Concrete has cracking problems which are caused by stress from carrying loads. Cracking may lead to leakage problems which over the time can cause deterioration of the concrete. There are existing methods that are employed like synthetic mixtures to reduce the concrete cracking problems but they are not environmental friendly and might be a potential human health hazards. Bio-concrete might be solution to this issue. Bio-concrete is a unique concrete mixture that include bacteria as one of the ingredient along with other organic nutrient. The purpose of bio-concrete is to increase the durability and lifespan of a concrete structure through the self-healing action of the concrete caused by some particular specialized bacteria. This research project will focus on understanding the use of bacteria for this specialized property and determining parameters and conditions for formation of better and more sustainable bio-concrete. Another aim of this project is to find ways to reduce the cost for production of bio-concrete to make it easily accessible and applicable in real world. This project will provide a learning experience for student to gain more knowledge on this topics of civil and microbiology along with a chance to meet professionals in the related industry. This will be a great opportunity to expand on the environmental microbiology and engineering background focusing on sustainability.

Minimum Qualifications:
CEGR 3225, CEGR 3155 (preferred), CEGR 3141 (preferred)
Project Name: BioChar: Using sustainable ways for water/wastewater treatment

Mentor Name: Mariya Munir

Mentor Department: Civil and Environmental Engineering

Abstract:
Biochar represents an alternative low cost and sustainable solution in providing safe drinking water for low income communities without access to treated water. Biochar is charcoal made from biomass (organic matter used for energy). A process called pyrolysis, in which biomass is heated to high temperature in the absence of oxygen, produces biochar along with combustible gases (syngas) and oils (bio-oils). Sources of biomass include algae, corn stover, grass, rice husks and straw, manure, municipal solid waste, and wood waste products, among others. Biochar usage for water treatment has several potential merits compared to existing low-cost methods (i.e., sand filtration, boiling, solar disinfection, chlorination). 1. Biochar is a low-cost and renewable adsorbent made using readily available biomaterials and skills, making it appropriate for low-income communities. It can easily remove chemical, biological and physical contaminants. This study intend to investigate the effectiveness of Biochar in removing microorganisms in water treatment processes, and its advantages and disadvantages as a sustainable water treatment technology. This project will provide a learning experience for student to gain more knowledge on water/wastewater treatment processes along with a chance to meet professionals in the related industry. This will be a great opportunity to expand on the environmental microbiology and engineering background focusing on sustainability.

Minimum Qualifications:
CEGR 3155, CEGR 3141
Abstract:
Brine Encapsulation technologies are now being earnestly considered and evaluated by many utilities to manage flue gas desulfurization (FGD) wastewater and other forms of wastewater streams from electric generating units (EGUs). Paste, the most promising of these technologies, based on recent results from laboratory investigations, has performed well in sequestering some trace elements and cations, however because of the high solubility and elevated concentrations of some anions in reduced volume of treated wastewater and its rejects, has not been very efficient in immobilizing halides. To improve halide sequestration in paste, this research is investigating processes to substitute halides, sulfate, and carbonate in cementitious hydrates to form AFm (aluminate ferrite monosubstituent) and AFt (aluminate ferrite trisubstituent) stable phases. For this research project, selected student will participate in developing a process for the formation of AFm (aluminate ferrite monosubstituent) and AFt (aluminate ferrite trisubstituent) in paste mixes. AFm and AFt are solid phases that form in hydrated cement systems when alumina combines with water, calcium, and substituents including hydroxide, carbonate, sulfate, and halides. The well-known AFm family of phases includes: hydroxy-AFm, monosulfoaluminate, monocarboaluminate, hemicarboaluminate, strätlingite, Friedel’s salt, and Kuzel’s salt. The AFt family of phases includes ettringite with carbonate, sulfate, and chloride as substituents. Halide binding in cement systems may occur when any of that anion-type such as chloride interacts with hydrated cement or cementitious materials to form chloroaluminate phases including Friedel’s salt, Kuzel’s salt, and ettringite or halide-containing AFm phases. The scope of this study is to investigate processes to form and synthesize AFm (aluminate ferrite monosubstituent) and AFt (aluminate ferrite trisubstituent) in the laboratory using chemical grade reagents, to verify and identify the phase minerals, and to measure the solubility of the solid products. A key aspect of this project involves investigation of the different factors influencing the formation and stability of the AFm and AFt factoring in the FGD brine chemistry and electric generating units (EGUs) operating environments.

Minimum Qualifications:
Civil & Environmental Engineering and Mechanical Engineering (rising senior), Chemistry (Rising Junior), and earth science (rising senior)
Project Name: A Qualitative Study of Social Media Activism

Mentor Name: Tiffany Gallicano

Mentor Department: Department of Communication Studies

Abstract:
The selected scholar would work on one of two projects, depending the student’s interest. One project is an observational study that is focused on police shootings of African-Americans. The student would use the constant comparison method to identify the characteristics that differentiate the cases that attracted significant news coverage and Twitter discussion from the cases that did not. The analysis will include characteristics of each case and how the cases were communicated.

The resulting characteristics that are found to amplify public attention will be a meaningful contribution to the agenda setting literature, which currently has general categories about drivers of news coverage and online sharing, such as human interest and conflict (e.g. Trilling, Tolochko, & Burscher, 2017). Practical implications will also be addressed for advocacy organizations and police departments.

The second opportunity involves recruiting and interviewing people who are politically active on Twitter to contribute to conflict management theory with regard to how people respond to political content with which they disagree. Particular attention will be given the decision about whether to post to hashtags that conflict with a user’s beliefs, the use of quoted tweets to express disagreement, the decision about whether to reply to content that conflicts with a user’s beliefs, and the choice of how to respond if a user decides to tweet a response. The scholar will also focus on the interviewee’s reaction to various types of tweets that convey disagreement with the user’s political position. If there is additional time after saturation has been reached with the interviews, a survey will be designed and possibly implemented (just depending on time) to test the generalizability of the insights from the interviews.

Minimum Qualifications:
Major in communication studies, political science, psychology, sociology, or anthropology. Familiarity with Twitter and experience with conducting interviews and performing content analysis are desirable but not mandatory.
Project Name: Gamification and Algorithms
Mentor Name: Dewan Tanvir Ahmed
Mentor Department: Computer Science, CCI

Abstract:

Our goal is to build an interesting, effective, and interactive tool to teach CS algorithms. This project will focus on sorting techniques and/or shortest path finding algorithm in the form gamification.

Minimum Qualifications:

- Interest in computer games
- CS student
Project Name: Gamification and Data Structures  
Mentor Name: Dewan Tanvir Ahmed  
Mentor Department: Computer Science, CCI

Abstract:

Learning computing concepts, particularly for students who have had little to no experience prior, can be very difficult. The workload is heavy and often very tedious, which leads to a corresponding lack of motivation to learn. Beyond the initial difficulties, students must take a numbers of courses centered mostly on complex, conceptual topics. Courses that teach data structures and algorithms are required in most schools early on in a Computer Science program, and much like the introduction courses, these can be difficult to grasp.

Our goal is to provide an interesting, effective, and interactive tool to teach CS concepts. This project will focus on undergraduate data structures mainly binary search tree (BST), and/or binary heap in the form gamification.

Minimum Qualifications:
- Interest in computer games
- CS student
Project Name: Coordinating Robot Swarms
Mentor Name: Srinivas Akella
Mentor Department: Computer Science

Abstract:
We are looking for undergraduate students who can investigate and implement algorithms to coordinate the motions of robot swarms. The students will be introduced to several state of the art algorithms that make motion planning of large numbers of drones feasible (for example, the drone show at Super Bowl 2017). Once the coordination strategies are validated in simulation, the students will have an opportunity to test them on small teams of mobile robots or drones.

Minimum Qualifications:
Strong programming skills, and good background in math (linear algebra, calculus).
Project Name: Algorithms for Mapping Streets Using Robotic Drones

Mentor Name: Srinivas Akella

Mentor Department: Computer Science

Abstract:
We are looking for undergraduate students interested in developing graph algorithms for robotic drones. The student would master and use existing libraries for graph algorithms to solve robotic applications, such as generating flight paths for drones. Building on algorithms for a class of problems called arc routing problems, the project would involve creating a graphical interface for obtaining road networks from map servers available on the web, running the developed graph algorithms, and displaying the obtained results.

Minimum Qualifications:
Strong programming skills and understanding of graph algorithms.
Project Name: Discovering Valuable Information about the World Events using Unclassified Open Data and Data Analytics

Mentor Name: Mohsen Dorodchi

Mentor Department: Computer Science

Abstract:
Data Analytics of massive data of events, reactions, news, opinions, etc. is an interesting subject to discover new knowledge about such events. For this purpose, having access to such massive data source is very critical. GDELT stands for Global Database of Events, Language and Tone and is known as an index of the world's "events, emotions and narratives" that collects information in real time by monitoring broadcast, print and online news media. The sources are coming across dozens of languages including the events, counts, quotes, people, organizations, locations, about 4,500 emotions and themes, imagery, video and social posts. The purpose of this project is to perform data analytics to analyze different types of events in the past and extract different knowledge from them such as ontology of events or possible prediction. The undergraduate researcher would be able to start from fundamental techniques in data analysis and move toward more advanced and machine-learning based analytics. Since the site itself provides some knowledge, the replication of the extracted knowledge on the site would be a very useful learning tool.

Minimum Qualifications:
Junior in Computer Science as of Fall 2018
Project Name: Reinforcement Learning
Mentor Name: Minwoo "Jake" Lee
Mentor Department: Computer Science

Abstract:
Reinforcement Learning is a way that we train an intelligent agent by giving rewards in a similar way that we train a dog. The goal of this project will build a general learning platform that enables various reinforcement learning experiments. From the learning framework, we also search for the most important events from an agent's experience.

Minimum Qualifications:
Solid programming skills and computer science background, statistics, and linear algebra. Some background or knowledge of machine learning will be a plus.
Abstract:
Brain-Computer Interfaces (BCIs) are hardware/software systems that enable communication between human brain and an external device. Through electroencephalogram (EEG) signals from electrodes placed on the scalp, this project extract brain signals and find patterns that indicate the mental activities and recognition of mistakes or errors.

Minimum Qualifications:
Solid programming skills and computer science background. Some background or knowledge of machine learning will be a plus.
Project Name: Augmented Reality for Immersive Analysis

Mentor Name: Aidong Lu

Mentor Department: Computer Science

Abstract:

During the past years, newly developed technologies, including big data, cloud, mobile and social, have significantly changed our everyday lives. Among the next big things, mixed reality is especially interesting, as it may create many new perception and interaction channels to expand the cognition capabilities of people. Specifically, mixed reality (MR) mixes holograms with the environment around you and allows you to interact with holograms and everyday objects together through sensory experiences, which may include sight, hearing, touch and gesture. Represented by innovative devices such as Microsoft HoloLens and Oculus Rift, MR is the ongoing evolution in computing, as it creates new perception and cognition channels that fundamentally affect how people see and interact with our world.

This project will focus on investigating innovative data analytics techniques in augmented reality, which may benefit people from everyday life to scientific discoveries. Toward this goal, we plan to reconsider the design of visualization and interaction techniques that can fully take advantages of new capabilities brought by augmented reality. The visualization in mixed reality is not only a problem of blending holograms with real world, but also new dimensions for people to perceive, understand, and analyze information. There are great potentials of creating innovative visualization methods that may push the perception and cognition of human beings to a new limit and promoting effective visual reasoning in the mixed reality.

In this project, students will work with a team of faculty and graduate students on the exciting topic of mixed reality. You will have the chance to obtain the first hand experience with the latest MR technologies and work on MR equipment including Microsoft HoloLens and Oculus Rift. It will be both challenging and rewarding.

Qualifications: Experiences with Unity and 3D graphics are preferred.
Project Name: Computational models for analysis and interpretation of cancer genomic data

Mentor Name: M. Taghi Mostafavi

Mentor Department: Computer Science

Abstract:
Our lab focuses on novel computational models for analysis of cancer genomic data in order to interpret relationship among different genes of interest for potential identification of disease and/or early detection of possible ones. We have studied and innovated algorithmic models for genomic inference through utilization of annotated biological database. We desire to confirm our models through proper implementation using a data-driven framework for harnessing available genomic and biological data.

For summer 2018, we are looking for research interns in developing our algorithmic models into a simplistic framework, valuable for biologist and biomedical researchers. Summer interns may participate in different parts of our ongoing projects including:

1) developing user-friendly services for biological scientist: Creating web-based software where the users input a list of genomic experiment results in order to find high-level biological interpretation. The web-service will receive different formats of text input and will output text lists as well as graph visualization of biological pathways related to the input.

2) Tailoring the in-house computational models for general genomic applications: Identifying and deploying into the in-house models of different libraries of biological annotations (such as KEGG, Reactome) and genomic array technologies (Illumina, Affymetrix, etc.)

3) Developing methods for analysis of biological networks: Applying graph theory (such as centrality models or network design modeling) and statistical approaches for detecting the dysfunction of biological pathways based on genomic data.

The selected candidate will have background in software engineering, having knowledge at the introductory level of statistic (normal for CS undergraduate students), and being interested in web-development for data visualization. The selected will be approaching their final year of study and exhibit interest in working on data analysis platforms for serving cancer research community.

While not absolutely required, an ideal candidate may have:

1) Proficiency with web-development related technologies including HTML, Java Script, etc.
2) Data analysis proficiency such as SAS, R, or Python. Having experience in querying biological databases such as KEGG, NCBI-GEO, and TCGA is a plus.

Minimum Qualifications:

A Computer Science late junior or early senior undergraduate students; already completed a software engineering course.
Abstract:
According to a recent report by Grand View Research, the global chatbot market is expected to reach $1.23 billion by 2025. A chatbot is an intelligent computer program that can communicate with humans through text or speech input and can achieve certain goals. This research project will include hands-on experience in the design, development and evaluation of social bots. A preliminary case study is to design a social bot with the goal of reducing stress and anxiety for its users through conversation. For example, how do humans regulate their emotions and how can bots be deployed to instigate and propagate emotion regulation strategies in social networks to influence their dynamics. The use of bots to promote political agendas and motivate political behavior is a rapidly developing technology with potentially staggering consequences for society.

Scholars selected to work on this project will have the opportunity to work on cutting-edge, interdisciplinary research that bridges computer science and psychology.

Minimum Qualifications:
Research interests in computational social science, affective computing or natural language processing. Prior coursework or practical experience in machine learning and solid background in mathematics/statistics is preferred.
Project Name: Bringing power of IoT to everyone
Mentor Name: Min C. Shin
Mentor Department: Computer Science

Abstract:
Smart “things” are appearing everywhere around us. These range from thermostats that program themselves to save energy, lights that respond to your voice or presence, and washers and dryers that you can control from anywhere. These devices have often helped many of us. However, I would like to argue that the people who could use these devices the most have not been served. How can a person who cannot speak use Amazon Alexa’s voice commands to control a Nest thermostat? What about controlling lights through apps on a smartphone if you are quadriplegic? However, these are the exact people who could use the power of IoT and AI the most. In this project, I would love to work with you to build amazing systems that brings the power of IoT to EVERYONE to empower them to independence and productivity.

Minimum Qualifications:
If applicable (200 characters maximum)
Project Name: Data Structures and Algorithms Unplugged: Interactive Visualization of Data Structures Using Real-World Data

Mentor Name: Kalpathi Subramanian, Erik Saule

Mentor Department: Computer Science

Abstract:
This project will contribute to an ongoing NSF funded project on improving the engagement and retention of Computer Science majors by bringing in real-world datasets and interactive visualization as part of routine course projects, targeting data structures and algorithms courses. Part of the project will involve developing compelling visualizations for data sets that involving spatial and temporal dimensions, as well as generating/testing engaging assignments for use in the classroom. The visualizations will be performed using web based tools, making them available for easy publication/dissemination by the students.

Minimum Qualifications:
Strong computer science and programming background, especially in data structures and algorithms. D3 toolkit will be used for visualization. Knowledge of javascript will be a plus. Student will be working as part of the project team.
Project Name: Interactive Textbook Learning Modules for Foundational Concepts in Basic Algorithms and Data Structures

Mentor Name: Kalpathi Subramanian, Erik Saule

Mentor Department: Computer Science

Abstract:
The goal of this project is to replace or augment typical textbook reading to reinforce course lecture material using highly engaging and interactive learning modules. The CRS student will work with a project team and infrastructure (OpenDSA) to continue building new modules and add to a repository that will be usable by data structures and algorithms course instructors across the nation. The goal is to build interactive homework modules that are highly appealing and visual, so as to enable the student to master foundational concepts. It will also involve automatically communicating the results to the instructor in a timely manner for adjustments to the subsequent lectures. Student will work as part of a project team.

Minimum Qualifications:

Strong computer science and programming background, especially in data structures and algorithms. D3 toolkit will be used for visualization. Knowledge of javascript will be a plus.
Project Name: Mobile Crowd Sensing, Communication, and Computing

Mentor Name: Yu Wang

Mentor Department: Department of Computer Science

Abstract:
With the wide spread of smartphones, wearable devices, and other mobile devices, human-centered mobile crowd sensing (MCS) has been emerged as a new sensing solution for collecting large-scale sensing data in many applications. Optimization in mobile crowd sensing systems has attracted many attentions from researchers recently, however there still exist many open problems. This project studies resource optimization in mobile crowd sensing system, with aims to design resource allocation algorithms which improves the overall efficiency of resources while accomplish all sensing and computing tasks. The key idea is mining temporal-spacial and social characteristics of mobile users and using them in the optimization. Specifically, this project could study one of the following problems: (1) participation selection and task assignment problems under different models of MCS; (2) hybrid communication method by leveraging mobile social networks and opportunistic routing; (3) distributed computing solution for MCS system, where computation tasks can be outsourced to mobile. Evaluations of proposed algorithms and systems will be conducted via simulations, experiments, and theoretical studies.

Minimum Qualifications:
- CS, SIS, ECE, Math or relevant major
- Skilled in C or Java programming
- Knowledge of Data Structures and Algorithms
Project Name: Mobile Edge Networking and Computing

Mentor Name: Yu Wang

Mentor Department: Department of Computer Science

Abstract:

In most of the current mobile computing system, the data is usually sent to the cloud for analysis and storage. However, with the new types of multimedia sensing (videos, audios, high resolution images, real time streaming, etc.) and increasing number of sensing and internet of things (IoT) devices (smart phones, smart watches, smart glasses, smart meters, smart vehicles, RFIDs, etc.), the amount of mobile data grows to a scale that existing networking and cloud infrastructure cannot support. Especially, cloud computing is not always efficient for data processing when the data is produced at the edge of the network. With the push from the cloud services and pull from the blooming IoT and smart sensing, edge computing is emerging as a novel computing architecture, where computation and data analysis can be performed at the edge of the network. In this project, we will consider networking, computing and sensing under mobile edge infrastructure, where edge units are possible places to performing computing/data aggregating/data analytics/data transmission. By doing so, we aim to optimize the end-to-end performance, protect the user and data privacy, provide greater flexibility and efficiency, and enable optimization at the edge. Obviously, the massive and likely noisy sensed data, the diverse and dynamic tasks, and the heterogeneous devices, access networks and computing resources impose new challenges for this edge networking and computing.

Minimum Qualifications:

- CS, SIS, ECE, Math or relevant major
- Skilled in C or Java programming
- Knowledge of Data Structures and Algorithms
Project Name: The applicability of the serial murder literature to the case of Theodore Robert Bundy. and/or The applicability of the serial murder literature to the case of Jeffrey A Dahmer.

Mentor Name: Charisse T.M. Coston

Mentor Department: Criminal Justice and Criminology

Abstract:

Multiple homicide is one of the most fascinating phenomena of modern day crime. It is also one of the most sensationalized areas of research. This project focuses on understanding the real facts of a case of serial murder by debunking the myths and applying the most current research from stringent, reputable researchers to a case of serial sex murder. Therefore, the student will examine the research literature (victim, crime scene and perpetrator) on serial murder and apply these findings to a case study of a serial murderer: Jeffrey Dahmer and Theodore Bundy.

Minimum Qualifications:
Rising Senior or Senior
Project Name: Understanding White Power Music

Mentor Name: Shannon Reid

Mentor Department: Criminal Justice and Criminology

Abstract:
This project will qualitatively code both rap and white power music for a range of themes, including violence, misogyny, criminal activity and race. The goal of this project is to examine how these themes are portrayed across these two genres. This project will require listening to both rap and white power music with adult content that may not be suitable for everyone, so please consider this when applying.

Minimum Qualifications:
Senior or rising senior
Project Name: An exploration of the genetic moderation of peer effects on adolescent substance use.

Mentor Name: John Stogner

Mentor Department: Criminal Justice

Abstract:
Given the plethora of research on genetic moderation of strains’ effects on adolescent substance initiation, use, and dependence, it seems reasonable that the connection between other risk factors and such use is conditioned by genotype. The proposed research will explore this potential phenomenon in the context of Akers’ social learning theory through secondary data analysis.

Minimum Qualifications:
Criminal Justice student preferred. Having completed the criminological theory course prior to the program is also preferred.
Abstract:
Professor Williams is investigating Ring Shout dance traditions created by enslaved African Americans in the United States. This year, she is specifically focusing on re-imagining Ring Shout traditions during the late 1700s and early 1800s.

The Ring Shout is a religious dance brought to the Sea Islands (Carolinas and Georgia) from the Angola (or Gullah) people of Africa. Enslaved people used this spiritual dance and music form to uphold traditions brought to the new world from Africa. During the first two hundred years of slavery, there was a strong connection between Ring Shout movements and circle dances practiced in parts of West Africa. The movement patterns, rhythms, gestures, songs and atmosphere have lineages that trace back to the Yoruba, Akan, Ibo, Angola peoples as well as others. The summer research will call for an examination of the West African dances performed in circles during special rites of passages. The main focus will be the dances that are performed during times of death and funerals. The Ring Shout tradition honors the ancestors in the dances; therefore, there is a strong connection to honoring the deceased.

The Ring Shout dances documented in the early 1900s have overwhelming influences of Christianity, and oftentimes do not incorporate the movement patterns that represent honoring of ancestors or spiritual transcendence as the original form entailed. Examination of the West African dance forms that pay homage to the ancestors is essential to understand the foundation of Ring Shout.

Minimum Qualifications:
Prior studies in African Diaspora dance forms.
Project Name: The Price is Wrong: Pricing Residential Solar PV to Provide Proper Incentives to Purchase and Produce Solar Energy

Mentor Name: Peter M. Schwarz

Mentor Department: Economics

Abstract:
Net metering allows residential customers who have installed solar systems to sell any excess of production over consumption to electric utilities, typically at the retail rate. In many states, third parties can also lease systems to residential customers, in which case they get paid for solar production that is sold to utilities. However, electric utilities and regulators are challenging net metering for numerous reasons, including declining revenues to utilities and higher costs to non-solar customers. Most fundamentally, net metering does not carefully match the cost of serving residential solar PV customers with the price.

In order to determine the correct prices, it is necessary to categorize the benefits and costs of residential production of solar electricity. I am currently working with CAPER, a joint project of NC State and UNC Charlotte that is gathering data from all fifty states on their categorization of costs and benefits of solar integration on electric utility costs. Categories include: integrating solar into the utility grid, administrative cost, avoided energy, avoided generating capacity, avoided transmission lines, avoided distribution lines, system line losses, ancillary services, price volatility and hedging, effect on electricity market prices, and environmental benefits.

I will investigate the use of a financial framework such as the one used in Satchwell, et al. (Energy Policy, 2015) used to determine utility rates, but with more detailed linking of utility costs affected by solar energy penetration. I will also consider a greater range of rate structures than most studies. Residential rates typically contain fixed charges as well as energy charges. Commercial and industrial rates also contain demand charges, and I will consider demand charges as part of the residential rate for solar PV customers.

The Minimum Qualifications:
Economics or engineering student with an interest in electric utility pricing of residential solar photovoltaic (PV) systems.
Abstract: (1894 characters)
Roughly 80 percent of the children’s book world—authors and illustrators, editors, execs, marketers, and reviewers—is White. In 2016, the Cooperative Children’s Book Center (CCBC) published its annual report that stated only 14 percent of books had Black, Latino, Asian, or Native American main characters. Black, Latino, and Native authors combined wrote just 6% of those new children’s books. Oftentimes the author is not the same race as the characters in their books, which can be dangerous if they have a deficit orientation. They are writing about someone without having authentic knowledge about that racial/ethnic group (Erlich, 2017). Unfortunately, this representation aligns to issues we also see in schools across the country. The majority of children in public schools are children of color, but the teacher force is 80% White, middle class, monolingual women who do not have diverse experiences to develop their cultural competence and anti-racist epistemology.

There is not as much of an issue with White authors writing books with people of color as the main characters as there is with main characters being the only form of diversity that is being addressed in the book. The context of a story must not perpetuate stereotypes, or have a deficit orientation. There is a need to increase authors and illustrators of color. Families of color purchase more books than their national population (Lee & Low, 2017). Families of color specifically are looking for books that promote equity, diversity, or social justice. I want to investigate what is the context of many children’s books that include diverse characters.

This proposal has multiple projects:
  1. Discovering Multicultural Children’s Books
     a. Examining Multicultural (racial/ethnic) children’s books from any publishing outlet to see what has been published. (Ex. grade level, reading level, racial/ethnic representation).
  2. Multicultural Rubric Validity
     a. Validate a rubric that assesses multicultural books’ level of equity, diversity or social justice
  3. Content Analysis
     a. Examine Multicultural books to investigate what topics are being discussed? Although the book may include diverse characters, do the books discuss equity and social justice?

Minimum Qualifications:
• Computer processing (typing) skills
• Library search skills
• Critical thinking skills
• Self-reflective skills
Project Name: Addressing Dynamic Environments in SLAM Algorithms

Mentor Name: James Conrad

Mentor Department: Electrical and Computer Engineering

Abstract:
Simultaneous localization and mapping (SLAM) algorithms are used to determine the location of a device or robot while simultaneously constructing a map of its environment without any prior information about it. One of the problems that arises in SLAM algorithms is the inability to function within dynamic environments. In this research, we seek to explore multiple SLAM algorithms and how well they perform within environments which are constantly changing. After observing the performance, the student will develop methods and modifications to these algorithms make them more robust in non-static environments.

Minimum Qualifications:
Programming course, Statistics course, Signal Processing course, experience with Linux operating systems.

Helpful: ECGR3101 & ECGR3183.
Project Name: Fundamental understanding of solar cell contacts through Electroluminescence Analyses

Mentor Name: Aba Ebong

Mentor Department: Electrical and Computer Engineering

Abstract:
A solar cell is a device which converts sunlight to electricity without any polluting by product. It consists the absorber, the two surfaces and metal contacts. The metal contacts can be formed by planar process (lithography), which is expensive and not manufacturable but gives high efficiency close to the limit of the semiconductor material. The manufacturable contacting technology – screen-printing is short of giving the highest efficiency because of the high contact resistance, which decreases the maximum power. Electroluminescence technique can be used to study the spreading resistance of the solar cell after fabrication and quantify the total series resistance. The total series resistance consist of six components, namely: emitter, gridline, busbar, contact, bulk and rear contact. These components can then be investigated to properly understand to decrease the overall series resistance. This will lead to improved fill factor, which is the measure of squareness of the current-voltage curve, and hence high efficiency at lower cost.

The Electroluminescence tool is under construction in the PVRL for student to adapt to qualitatively and quantitatively assess the series resistance of a commercial screen-printed solar cell. The work involves, the use of LabVIEW or MatLab to communicate between power supply and infrared camera to capture the image of a finished solar cell and in conjunction with a code of the fundamental semiconductor contacts equations to analyze and quantify the series resistance.

Minimum Qualifications: Willingness to be challenged and learn
Project Name: Spectroscopy imaging of microscopic scale structures in semiconductor devices

Mentor Name: Yong Zhang

Mentor Department: Electrical and Computer Engineering

Abstract:
Develop a spectroscopy imaging system with diffraction limit spatial resolution for semiconductor material and device characterization. This project includes modification of a commercial Raman microscope, testing new experimental methods, and data processing and analyses.

Minimum Qualifications:
Basic knowledge of optics, capable of performing simple mechanic work, familiar with data processing software, such as Matlab, Mathematica, etc., good math skill.
Project Name: Peer to Peer Microgrid Energy Trading Using Hardware-In-The-Loop System and Wireless Communication Protocols

Mentor Name: Umit Cali

Mentor Department: Engineering Technology and Construction Management

Abstract:

The research project titled above aims to create a real world microgrid infrastructure that allows the transfer of stored energy amongst peers. Allowing prosumers to trade stored/generated renewable energy to neighbors within a microgrid without first selling to the grid will increase energy efficiency and save consumer money. A digital neighborhood microgrid system will be designed using MATLAB, Simulink, and RT Lab to be tested for theoretical analysis. Implementation of hardware-in-the-loop (HIL) with embedded systems will be used to simulate and test the designed system for effectiveness and validity against realistic virtual stimuli. A physical photovoltaic system with battery and additional electrical loads will then be constructed and tested based on the researched digital design. The physical systems will behave like a household with solar PV installation. This system will include all required parts to act as a stand-alone energy and storage source for testing. The physical components of the system will communicate to other nodes using a private wireless communication network. The proposed cyber physical system (CPS) will be extended for other scenarios such as community disaster relief system after completing the first version of the test bed. The testbed is planned to be used as a leverage for external project submission (NSF and DoE).

Minimum Qualifications:

Mentee is currently enrolled in electrical or mechanical engineering, or electrical or mechanical engineering technology at UNC Charlotte. Mentee shall have some programming background (ideally Python and Matlab).
Project Name: Quality Control Tools to Support Performance Engineered Concrete Mixtures

Mentor Name: Tara Cavalline

Mentor Department: Engineering Technology and Construction Management

Abstract:
Performance-engineered concrete mixtures include optimized mixture designs (materials selection, gradation, cement content, etc.) which, paired with advanced quality assurance methods, provide substantially improved durability, economy and sustainability. Over the past several decades, research has led to new understanding of deterioration mechanisms, advancements in concrete mixture design, and better field and laboratory tests to aid in QA/QC. With this new knowledge, a Federal Highway Administration (FHWA) initiative to move to performance-engineered concrete mixtures is underway. Development and implementation of performance-related specifications is an extensive undertaking, and the shift will impact all stakeholders in the construction process. As part of this project, the student will work to develop guidance for owner agencies (DOTs) to specify and use contractor QC programs, QC plans, and test data. Guidance developed by the student will include technology transfer material to support implementation of new test methods included in AASHTO PP84-17, including proper use of analysis and test results.

Minimum Qualifications:
Currently enrolled as a Civil Engineering Technology or Construction Management student in the Department of Engineering Technology and Construction Management
The ultimate goal of this work is to aid in the development of potential tools for therapeutic treatment of cancer and cardiovascular disease. Cancer and cardiovascular disease are two of the leading non-infectious diseases with the highest mortality rates in the United States and worldwide. Magnetic drug targeting (MDT) has received much attention in using nanoscale superparamagnetic iron oxide particles (SPIONS) as carrier vehicles for transporting therapeutic agents to targeted treatment sites in the arteries. However, despite ongoing research of cardiovascular flows and magnetophoresis as a potential candidate for drug delivery, the fluid dynamics and coupled magnetophoresis is poorly misunderstood. Treating localized diseases such as cancer and cardiovascular disease cases are challenged by determining methods to deliver therapeutic agents to targeted treatment sites. Treatment sites are linked to vessels that are curved, branching, and elastic which undergo lateral dynamic motions under oscillating pressure waves. The flow of blood is governed by these complex fluid-structure interactions (FSI). In addition to the behavior of blood and FSI, the efforts of successfully targeting SPIONS in such flows are governed by the ability to achieve a sufficiently high attraction/movement against cardiovascular flow. The objectives of this work will be to successfully model physiological flow with a clear mock arterial model flow loop. The objectives will be to obtain information about the flow field in varying sections along the mock arterial model. This data will be used to predict the magnitude of magnetic field strength needed to overcome local and global flow disturbances for successful targeting. In addition to modelling physiological flow experimentally, a targeting system will be developed to successfully target particles in the flow field. Optical techniques will also be used to observe the behavior of particles under the influence of a magnetic field.

Minimum Qualifications:

If applicable (200 characters maximum)

- Junior or Senior level status
- Must have completed Fluid Mechanics
- Must have experience with statistical analysis
- Must have experience with Matlab, Fortran, or C++
- Must have experience with Solidworks or other CAD software modelling
Abstract:
The structure and home destruction problem related to wildfires has been increasing globally recently. Case studies found that most destroyed homes ignited directly from firebrands. Firebrands (or fire embers) are a primary sources of ignition because they can either directly ignite components of vulnerable structures or can ignite nearby vegetation and other combustibles, which can subsequently ignite the structure via radiant heating or direct flame contact. The firebrand phenomenon (i.e., spotting by airborne burning firebrands) can be understood in three major processes: firebrand generation, firebrand transport, and firebrand ignition of recipient fuel. Firebrand generation is the first step of the firebrand phenomena and is the basis for understanding the subsequent transport and ignition processes. Firebrand production is affected by many factors, such as the fuel material type, condition of the fuel (e.g., live or dead fuels and moisture content levels), the thermal degradation characteristics (or pyrolysis properties) of the fuel, the combustion properties of the fuel, and environmental conditions the fuel is subjected to (such as wind, relative humidity, temperature, and external heating condition). These factors will affect the firebrand production process, such as the possibility of firebrand formation, firebrand production rate, the physical characteristics of firebrands (e.g., firebrand size and shape, and mass) and the combustion characteristics of firebrands (e.g., burning duration and intensity, potential heat energy, temperature and heat flux). Particularly, there is a need for specific information relating basic pyrolysis and combustion properties of the fuel with the firebrand production process and the associated physical and combustion characteristics of the produced firebrands.

The goal of this project is to measure the pyrolysis and combustion properties of selected vegetative fuels as a function of fuel MC levels under various external heating conditions (e.g., various heating rates and heat flux levels). To achieve the goal, the following research objectives need to be achieved: (1) Measure the pyrolysis properties of the selected fuels using the Thermogravimetric Analysis (TGA) technique at different fuel MC levels and various heating rates; and (2) Measure the combustion properties of the selected fuels using the Cone Calorimeter at different fuel MC levels and various heat flux levels. In order to accomplish the above objectives, the following tasks are planned: (a) To select two appropriate and representative vegetative fuels that are abundant in the southeast Appalachian mountain regions as specimens for this study; (b) To perform laboratory studies to measure and control the MC levels of the selected fuels at two designed MC levels (fresh and dry conditions); (c) To carry out TGA experiments to obtain pyrolysis kinetics parameters of the selected materials at the three MC levels and three heating rate (HR) levels; and (d) To conduct cone calorimeter experiments to obtain combustion properties of the selected materials at the three MC levels and three heat flux (HF) levels.

Minimum Qualifications:
- UNC Charlotte undergraduates that will return in Fall 2018 with at least a Junior standing and a minimum GPA of 2.8.
- Course work and lab experience in thermal and combustion testing and data analysis.
Project Name: The Child in Southern Literature and Film

Mentor Name: Sarah Minslow & Mark West

Mentor Department: English

Abstract:
The Child in Southern Literature and Film is a project funded by the North Carolina Humanities Council. The project aims to increase awareness in our community of the diversity of children’s lives in the South throughout history and today; reflect on how child characters function in subverting dominant ideologies, particularly those related to racism in the South; and support the future of Humanities scholarship by facilitating workshops for educators and providing research and internship opportunities for college students who will be the next generation of Humanities scholars. In Summer 2018, Dr. Minslow and Dr. West will facilitate a youth book club/camp based on southern childhood. The CRS will assist with preparation, facilitation, and evaluation of the camp. The student will conduct research on resources to include in the camp, develop project management and event planning skills, and conduct a formal evaluation of the camp by designing, administering, and analyzing surveys to the camp participants.

Minimum Qualifications:
Most applicable to students studying English, Education, American Studies, or Children’s Literature and Childhood Studies.
Project Name: Science in the Kitchen: 17th Century English Women’s Manuscript Recipes

Mentor Name: Jennifer Munroe

Mentor Department: English

Abstract:
I propose to have a CRS work on a project that interrogates the place and importance of women’s domestic medicine and cookery in the literary history of science. To do so, a CRS student will be trained to transcribe 17th century italic handwriting, which s/he will use to complete a substantial transcription of a manuscript recipe book from the period. The transcriptions will serve as the student’s primary text for a longer research project that considers how the body of knowledge represented in the book fits into a larger understanding of women’s place in the history of science.

In addition to experience with research and writing in this area, the student will also gain valuable experience working on a digital humanities project. For the transcriptions, the student will use a platform (Dromio) developed by the Folger Shakespeare Library; All transcriptions produced during the course of this project will join others that have been collected over the past 5 years under the auspices of EMROC (Early Modern Recipes Online Collective), an international group of scholars (of which Dr. Munroe is a founding and Steering Committee member) that is working to create a public-access database of searchable transcriptions of these books. These transcriptions are currently held in the Folger’s EMMO (Early Modern Manuscripts Online) database. The CRS student who works on this project will received named attribution for his/her work.

Minimum Qualifications:
The CRS student need not have any experience with transcription. Student can come from any major, though this project is more ideal for a student in English or a related major.
Project Name: Race, Identity, and Culture in Contemporary Black Poetry

Mentor Name: Malin Pereira

Mentor Department: Honors College/English

Abstract:
African American Poetry is leading American poetry today, with black poets winning major awards and a proliferation of book publications and slam/spoken word events. How does black poetry relate to questions of identity, race, and aesthetics? This professor is working on a book project on several contemporary black poets, including Elizabeth Alexander, Rita Dove, Yusef Komunyakaa, Natasha Trethewey, Cornelius Eady, Thylias Moss, and Wanda Coleman, among others. Read the poetry, locate and read articles and books about the poetry, and talk with the professor about it all. The student will be expected to write a research paper on one or more of the poets (of their choosing), and will be encouraged (although not required) to submit proposals to conferences and journals for publication.

Minimum Qualifications:
3.2 GPA, Major or minor in English or Africana Studies, or strong interest in those fields.
Project Name: The Victorians and the Natural World

Mentor Name: Alan Rauch

Mentor Department: Department of English

Abstract:

We can all acknowledge that human understanding of the natural world was dramatically changed by Charles Darwin. But what was the context that helped nurture this brilliant, shy, and persistent individual? In this project, I want to explore Victorian science, literature, and culture through the lens of the living world as it was “imagined” by the Victorians. By way of preparing, we will review well known works, such as Gilbert White’s Natural History of Selborne, William Paley’s Natural Theology, Thomas Malthus’s On Population, and Erasmus Darwin’s Zoonomia. Other literary and scientific to keep in mind include the work of Henry Bates and Alfred Tennyson, and John Ruskin, as well as Alfred Russel Wallace, Charles Kingsley, and Thomas Henry Huxley.

The big question for this research project, however, is what did the typical Victorian reader know about nature and the environment, and how did they understand it in relationship to themselves, to the English countryside, to the idea of industrialism, and, of course to “empire”? Needless to say, these are big questions and potentially more ambitious than can be covered in the time allotted. Nevertheless, this is an area that is surprisingly poorly understood. This research project will delve into archival material (both in digital and print formats), to tease out an argument about how the Victorians actually thought about the concepts of “œcology” (a word invented in the late 19th century) and “environment” (first used in the 1830s). The questions posed here are, of course, critical for an understanding of the history of environmental science, but are equally important for an appreciation of cultural attitude that help shape ethics and the creation of social policy.

Minimum Qualifications:

This is a project that might appeal to a variety of students potentially interest in the history of science, biology & ecology, and literary culture. Needless to say, the project involves a good deal of reading, particularly of older materials. But the reading will always play into science (in the most general sense) and so an appreciation of and enthusiasm for the natural world is desirable. Archival work requires good organizational skills as well.
Project Name: Hydrological and Water Quality Analysis of a Developing Piedmont Watershed

Mentor Name: Dr. Craig Allan

Mentor Department: Geography and Earth Sciences

Abstract:

The Department of Geography and Earth Sciences is participating in a multi-year study in partnership with Charlotte Mecklenburg Stormwater Services and the US Geological Service in examining the impacts of suburbanization of Piedmont watersheds. The ongoing project in the McDowell Creek watershed near Huntersville NC, involves quantifying changes to the hydrologic and material fluxes through the development cycle of the watershed. Researchers are collecting a variety of hydrologic data, Precipitation, Evapotranspiration rates, Soil Moisture levels, Groundwater levels and water quality data to develop hydrologic, chemical and sediment fluxes for this developing system. This summer research project will involve both the collection of field data, the processing and analysis of water samples in the laboratory, database management and analysis of collected data. Exact duties will depend on the background and interest of the student.

Minimum Qualifications:
Driving License
Project Name: Mapping hydropower-caused deforestation with satellite remote sensing data

Mentor Name: Gang Chen

Mentor Department: Geography and Earth Sciences

Abstract:
Forests play a pivotal role in regulating the energy and mass exchange between terrestrial ecosystems and the atmosphere. However, anthropogenic disturbances, such as megaprojects of hydropower, have been observed to substantially impact the biodiversity, structure, and functioning of forest ecosystem. Remote detection of deforestation caused by hydropower has proven to be a timely and accurate approach to scale up sample measurements from the field to landscape scales, allowing forest managers and stakeholders to take prompt and informed actions in sustainable forest management. This project aims to map hydropower-caused deforestation in the Brazilian Amazon Basin. To do this, the student is expected to develop a remote sensing model integrating satellite data with field measurements.

Minimum Qualifications:
Image processing or geography/biology.
Project Name: Role of stream restoration in improving water quality
Mentor Name: Sandra M. Clinton and David Vinson
Mentor Department: Department of Geography and Earth Sciences

Abstract:

Water quality is an important parameter that describes stream health and is impacted by land use change such as urbanization. Restoration is one method used to enhance impacted streams; however, it is not always clear that current methods result in water quality improvements. In this project the Charlotte Research Scholar (CRS) would work with an interdisciplinary team of graduate and undergraduate students in hydrology and stream ecology to investigate the role of restoration on urban stream water quality. The study is currently taking place in the Reedy Creek Watershed at Reedy Creek County Park (near UNCC) where we have monitored the stream for multiple years and are currently monitoring particulate and dissolved nutrients as the headwaters are being restored. This project will require the CRS to work in both the laboratory and the field. The CRS will gain an appreciation of the issues impacting urban streams and learn how to properly sample stream systems and how to analyze water samples for basic nutrients (nitrogen, phosphorus, and carbon).

Minimum Qualifications:
Interest in stream chemistry and major in a related field; one semester of college chemistry; ability to work outdoors in all weather conditions; able to use a spreadsheet program
2018 Charlotte Research Scholars
Research Project Submission

Project Name:  Mapping the space-time distribution of vector-borne diseases in Colombia

Mentor Name:  Eric Delmelle

Mentor Department:  Geography and Earth Sciences

Abstract:

Vector-borne diseases (VBDs) infect over one billion people and are responsible for over one million deaths each year, globally. Chikungunya (CHIKV), Dengue Fever (DENF) and Zika (ZIKV) are emerging VBDs due to overpopulation, increases in urbanization, climate change, and other factors. Colombia (South America) has recently experienced severe outbreaks of each of the two aforementioned mosquito-borne diseases. These three viruses are transmitted by the Aedes mosquitoes and are preventable with a variety of surveillance and vector control measures (e.g. insecticides, reduction of open containers, etc.). Spatiotemporal statistics can facilitate the surveillance of VBD outbreaks by informing public health officials where to allocate resources to mitigate future outbreaks.

For this research, I am looking for a highly motivated student to help mapping the spatial, temporal and space-time distribution of CHIKV, DENF and ZIKV in Colombia during the outbreaks occurring in 2015 and 2016. Specifically, I anticipate that the student will help prepare weekly and monthly maps showing the variation of rates. I am particularly interested to examine (1) the size and (2) duration of the clusters and (3) co-occurrences (cluster overlapping) of DENF, CHIKV and ZIKV in space and time, which is critical to identify regions that may have experienced the greatest burden of VBDs.

In addition to the opportunity to participate in research as an undergraduate student, the successful applicant will be participating in a project that is truly transdisciplinary. I am seeking to increase knowledge at the intersection of research and application across the domains of medical geography, geographic information systems and public health. If you’re interested in joining this vibrant project that will look great on your resume, please apply!

Minimum Qualifications:

Good working skills in Geographic Information Systems and/or Geovisualization. Knowledge or interest of epidemiology a plus.
Project Name: Ancient Soils of the Piedmont

Mentor Name: Martha Eppes

Mentor Department: Geography & Earth Sciences

Abstract:
We have discovered a rare deposit of ancient sediment and soil in the Piedmont of South Carolina. In order to determine its age, we are examining the amount of iron accumulated in the soil since its deposition. Student would perform detailed laboratory analyses on soil samples and learn to use an Atomic Adsorption Machine. Results would then be compared with deposits of known age in the Piedmont.

Minimum Qualifications:
Ability to work carefully on detailed laboratory work.
Project Name: Mecklenburg County biodiversity data management

Mentor Name: Sara Gagné

Mentor Department: Geography and Earth Sciences

Abstract:

Biodiversity data at a variety of spatial and temporal scales are increasingly available. These data are crucial to informing our understanding of ecosystems and their management. Local jurisdictions play an important role in these endeavors by collecting a substantial amount of data on the occurrences of animal and plant species and associated abiotic conditions. However, these jurisdictions often lack the critical resources of time and expertise for efficient data management. Without data management, highly valuable data that could be used to address important natural resource issues are often overlooked.

I am seeking a highly-motivated, detail-oriented, and creative student to work with the Mecklenburg County Department of Nature Preserves and Natural Resources (DNPNR) to organize their biodiversity data archive. The successful applicant will work closely with Dr. Gagné, a landscape ecologist, as well as DNPNR staff to identify DNPNR data sources and develop a metadata database that describes data characteristics, such as sample size and spatial and temporal resolution. Along the way, the selected student will have the opportunity to identify research questions in collaboration with DNPNR staff that could be addressed using available data. If time allows, Dr. Gagné will work with the student to develop hypotheses and design a study to address a research question of particular relevance and importance, which could form the basis of a future research experience in Dr. Gagné's lab.

This is an excellent opportunity for an undergraduate student to learn foundational research skills that can be applied at later stages of their academic career. The successful student will also benefit from the opportunity to participate in research of importance to our local community.

If you’re interested in gaining valuable research experience and helping to conserve Mecklenburg County's amazing biodiversity, please apply!

Minimum Qualifications:

None.
Project Name: Predicting Charlotte’s Future: Exploring Recent Changes in the Urban Growth Process

Mentor Name: William Graves

Mentor Department: Geography and Earth Sciences

Abstract:
The traditional technique to forecast population growth is to assume that people will move to follow jobs (this is the expectation of economic equilibrium). However, recent evidence shows that this relationship is breaking down, particularly in high-growth areas like Charlotte. It has been speculated that growing disconnect between population growth and job growth is a product of changes in the nature of employment, the growing importance on entrepreneurship and the growth of non-traditional forms employment such as Uber or Airbnb. In short, American’s are increasingly making migration decisions based on factors other than the availability of employment. This trend has been confirmed by recent pilot studies.

This project will involve collecting data on metropolitan population and employment from 1969 to present in order to investigate; 1) changes in the relationship between job and population growth; 2) the causes of this variation (e.g. why do some cities grow more rapidly than others?); 3) identify the demographic components of these changes (e.g. how to specific age-cohorts drive population growth). These findings will yield new insights into urban planning, policy-making, real estate development and business location decision-making.

Minimum Qualifications:

Familiarity with Microsoft Excel
Project Name: Understanding poverty in Charlotte

Mentor Name: Colleen Hammelman

Mentor Department: Geography & Earth Sciences

Abstract:
Text only (2,000 characters maximum)

The Equality of Opportunity study released by Chetty and colleagues in 2013 indicated that social mobility is a significant challenge in Charlotte. In ranking Charlotte-Mecklenburg 50th out of 50 cities for upward mobility in the US, it demonstrated that Charlotte is experienced by many as two cities segregated by race and income. Within this context, and a rising cost of living in the region, it is increasingly difficult for families to make ends meet and lift themselves out of poverty in an otherwise prospering city. This project can investigate these trends through the lens of food security, affordable housing, and/or another relevant metric (identified in collaboration with the mentor and research scholar). In particular, this research offers an opportunity to explore how everyday needs such as food and housing come together spatially in Charlotte to produce and maintain poverty for many families. This research can be accomplished via: 1) conducting a spatial analysis of housing prices, food costs, and demographics across the city; 2) interviewing service providers in organizations or government agencies; and/or 3) systematically reviewing academic, government, non-profit, and media materials on the topic. The specific research methods can be designed to suit the skills and interests of the student in seeking a better understanding of the everyday experiences of poverty in Charlotte.

Minimum Qualifications:
If applicable (200 characters maximum)

If seeking to do a spatial analysis, familiarity with GIS is necessary. If seeking to do interviews or utilize another qualitative research method, experience volunteering, interning, or otherwise engaging with Charlotte social service agencies is a plus.
Abstract:
Atmospheric sciences is one lens through which scientists study the physics and chemistry of the Earth system. I have a number of different projects that may be interesting for the right student, and I encourage students to take a look at my UNC Charlotte webpage for more information about what my group works on. Some project ideas, all of which focus on improving technical programming skills with Matlab, R, or Python, are listed below. The CRS student could 1. Use computational programming to explore air quality in the region, state, or city using available archived data, and test how variability in air quality is related to weather and climate variability at the same spatial scale. 2. Take available climate data and study what the data conveys about the degree of climate change as a function of location in the USA. 3. Study lightning variability in key vulnerable ecosystems using current and/or past satellite data. 4. Study fire variability over the past 2 decades using satellite data. 5. If already an advanced programmer, run a weather model to test the forecast skill using a hindcast method for cases from the recent past, such as the fire smoke that originated in the eastern Appalachian foothills of NC and impacted Mecklenburg county in November 2016 or the extreme cold of January 2018. Other projects related to atmospheric and climate sciences are possible as well.

Minimum Qualifications:
Strong familiarity with Microsoft Excel is required, and programming (Matlab, Python, C, C++, Fortran, and/or scripting) is preferred.
Project Name: Understanding Precipitation Projections in Computer Simulations of Climate Change

Mentor Name: Jack Scheff

Mentor Department: Geography & Earth Sciences, Meteorology Program

Abstract:
Different computer models of future climate change profoundly disagree with each other on where the climate will get wetter vs. where the climate will get drier. This project will involve applying some new ideas and theories to the climate model results to help understand the physical reasons for these disagreements, such as different treatments of clouds and different evolution of wind patterns. Down the road, this work will contribute to a better understanding of which climate models to trust for precipitation predictions, and which ones not to.

Minimum Qualifications:
Strong interest in learning to use Matlab, or prior experience using Matlab, Python, R, or a similar data-analysis environment.
Interest in climate change.
Project Name: Surface water and groundwater hydrology along the urbanization gradient

Mentor Name: David Vinson & Sandra Clinton

Mentor Department: Department of Geography & Earth Sciences

Abstract:
This project will provide an immersive field and lab experience in the hydrology of streams and groundwater and how they interact. The CRS student will gain appreciation for urban water availability, water quality, and stream restoration. The CRS student will work with an interdisciplinary team in the area of hydrology, water quality, and stream ecology. The CRS project will focus on physical hydrology and its connections to water quality at the Reedy Creek Restoration Project, a 6 km² urban forest watershed near UNC Charlotte currently undergoing whole-watershed restoration. Critical to evaluating the hydrologic effects of incised Piedmont streams on water quality is the interaction between surface water and groundwater. The CRS student will monitor water levels and water quality in a network of instrumented wells and streams, process data, and assess groundwater surface-water interactions. There will be opportunities for the CRS student to cross-train in geochemistry/water quality analysis. We anticipate there may also be opportunities for the CRS student to participate in a new research site being instrumented in 2018, the Redlair Watershed Observatory in Gaston County, NC. Through this experience, the CRS student will gain an understanding of site design for long-term hydrologic research.

Minimum Qualifications:
Interest in hydrology and major in a related field; one semester of college chemistry; able to work outdoors; able to use a spreadsheet program.

Mentor Name: John Cox

Mentor Department: Global Studies

Abstract:
We signed a contract for this book last fall (in October 2017).
Adam Jones is one of the world’s leading genocide experts and scholars, and I direct UNCC’s genocide & human rights center and recently published a book on modern genocide.
We could benefit from assistance in researching the lengthy Introductions that Adam and I will write for the book, and for each individual section; for contacting and corresponding with our contributing authors (and we have more than 30 authors) and editing their submissions; for searching for images and securing permissions where needed; among other things.
I have excerpted our book proposal and included our list of chapters:

The field of genocide studies has experienced extraordinary growth during the past two decades. It must surely stand today as one of the most diverse and interdisciplinary in the social sciences and humanities. From an original set of contributions drawn predominantly from history, psychology, political science/international relations, and law, the conceptual range has expanded to include scholars from philosophy, anthropology, religious studies gender/queer studies, criminology, cultural studies, area studies, and the natural sciences. Likewise, the field’s anchoring case-studies have proliferated, from an initial focus on the Jewish Holocaust and the Armenian genocide, to a genuinely global framework that incorporates case of genocide on every populated continent. In tandem with the growth of scholarship in the field, a host of academic institutions in Europe, North America, and beyond now offer courses and degree programs in comparative genocide studies.
It seems an opportune moment to prepare a handbook that will do justice to the expansion and diversity of genocide studies. Our proposed book would be more expansive than existing volumes, and would comprise original rather than reprinted or excerpted materials. The target market and expected readership will be similarly wide-ranging. A volume of its scale and scope should be an automatic purchase for many libraries and research institutions. It will appeal to undergraduate and graduate students who are new to the field, and to researchers and professionals in numerous fields who seek an encompassing understanding of genocide studies.

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Part 2: Disciplinary Perspectives
Part 3: Genocide through History
Part 4: The Twentieth Century: Genocide Before the Convention
Part 5: Genocide Since 1948
Part 6: Interventions and Aftermaths
Part 7: Cultural Legacies

Minimum Qualifications:
Junior or Senior; majoring in INTL, HIST, or POLS; GPA of at least 3.3.
And: should have taken my “Comparative Genocide” and/or “Introduction to HGHR Studies” course, and earned an “A” in one or both classes.
Abstract:
What explains attitudes toward immigrants? Why do some individuals welcome immigrants into their society and recognize the economic and social contributions they offer, while others view immigrants as a threat to their jobs or culture and want to send them all back home? Those who evaluate immigration in more objective, utilitarian terms focus on whether immigrants are going to take their jobs or whether immigrants will do the jobs that no one else wants. Alternatively, a more symbolic, value-based evaluation of immigration will see immigrants as either a cultural threat or a source of cultural enrichment. Whether one views immigration objectively or symbolically, those who judge it negatively see it as a threat of some kind, while those with a more positive assessment view it as a benefit.

Previous research has developed this distinction by clustering the sources of anti-immigration attitudes as either material and economic interest or values and cultural identity. The former argues that individuals whose economic interests, based on their skills or sector of employment, are threatened by immigration are most likely to hold anti-immigrant sentiments. The latter approach argues that a myriad of noneconomic factors, such as the strength of one’s national identity, openness to people from other groups, and social and cultural tolerance, play a greater role in explaining these sentiments.

The interests-values distinction has been useful, but when we think about the causal sequence, one factor has a direct impact on both one’s interests and values. Education is undoubtedly a significant determinant of one’s occupational skills. Fishers and farmers rarely have the same educational background as scientists or managers. Education can also influence our values. By providing knowledge of a larger world and encouraging us to consider how we fit within that space, education, particularly higher education, can lead to a broader worldview. Therefore, a properly specified understanding of anti-immigration attitudes should have education prior to and influencing both interests and values.

While the causal linkages from education to skill/occupation to anti-immigrant attitudes is well-specified by existing theories, the linkages from education to values/identity to anti-immigrant attitudes needs more development. How and under what circumstances does one’s education impact one’s feelings of national attachment/identity, cultural homogeneity, and cosmopolitanism? Reviewing the theories and previous studies that inform this question, and designing a model to partially test the linkages is where I would expect the selected scholar and I would focus our efforts over the summer.

Minimum Qualifications:
GPA > 3.5 in the major; strong writing skills.
Project Name: Slavery in 18th Century North Carolina

Mentor Name: Christopher Cameron

Mentor Department: History

Abstract:
Over the past two decades, historians have explored numerous facets of slavery in colonial America, including religion, culture, gender, and resistance. While the scholarship on slavery has become incredibly widespread, historians have tended to focus on the antebellum era or on regions with more numerous slave populations such as Virginia or South Carolina. This project will contribute to our understanding of slavery in colonial and revolutionary North Carolina. Through an exploration of primary sources at the Charlotte Museum of History and local archives such as the special collections in Atkins Library, this study seeks to illuminate the everyday lives of slaves on plantations such as that owned by Charlottean Hezekiah Alexander.

Minimum Qualifications:
N/A
Project Name: Jefferson Davis in Confederate Memory

Mentor Name: Karen L. Cox

Mentor Department: History

Abstract:
This project will engage the student in doing historical research about the various ways that white southerners commemorated the life of Confederate President Jefferson Davis. In the immediate aftermath of the Civil War, Davis was vilified, but over the course of the next few decades his reputation was restored, such that he became the martyr of the Lost Cause. The scholar assigned to this project will research Davis’s funerals (yes, there were two) along with the various ways in which he was commemorated in the years following his death in 1889. This will include identifying monuments and markers, researching how Davis was remembered at the 1895 Cotton States Exposition in Atlanta, and examining literature about Davis in the Confederate Veteran magazine (Atkins has the magazine since 1900, but the scholar should locate articles on Davis between 1893-1900). He or she will be engaged in questions of memory, commemoration, and Victorian rituals related to the death of a loved one.

Minimum Qualifications:
It would be useful if the student had some basic understanding of southern history of Civil War history. I’d also hope to work with a History or English major who has conducted primary research and is interested in bizarre history. Sense of humor a plus.
Project Name: The Free Womb Act: Gradual Abolition throughout the Americas 1780-1830

Mentor Name: Erika Edwards

Mentor Department: History

Abstract:

During the Age of Revolution, 1776-1830, British and Spanish American colonies became several republics. To win the wars of independence, these colonies depended on their black populations both slaves and free to aid in battle. In turn, black soldiers proved to be more than equip and quite courageous in the wars of independence. During the struggle for independence, the issue of slavery came to the forefront with a simple question: "How can we fight to free ourselves [from tyrannical governments], but keep others enslaved?" This common question throughout the Americas gave birth to a similar answer, the Free Womb Act. In British America, it began in Pennsylvania in 1780. In Spanish America, it began in Chile in 1811. This law granted freedom to all children born to enslaved mothers. Former transferences of slavery, wombs became a place where freedom was literally conceived. My project provides an overview of the law and its implementation in the following cities: Philadelphia, New York City, Buenos Aires, and Santiago. It examines how gender and race became conveyors of freedom, by focusing on slave mothers who produced a new generation of liberated people.

Minimum Qualifications:

I seek a student that will accomplish two goals. First is gather articles and books about the Free Womb Act and second, read primary documents. The student should be able to fluently read Spanish and knowlegable about the Age of Revolution.
Abstract:

On June 8, 1917, 18 German men were delivered to Hot Springs, NC where they were interned as "enemy aliens" of the United States. Five days later, another 58 of their compatriots joined them. By late summer, the small resort town and home of the Mountain Park Hotel and Spa had become the home of 2200 German POWs—German citizens who had been caught by surprise while travelling or working in the United States when America declared war on their country.

I am looking for a Research Scholar to help me with this book project called, *Appalachia in the Trenches*, and which reconstructs the story of the German Civilian Internee Camp located in Hot Springs, NC from June 1917 through August 1918. This assistant would help me in collecting and analyzing research materials related to this project. Although the intern will read through some books and articles to collect background information, the majority of the 8-week research time will be spent using the Atkins Library Historic Newspaper Collection to collect articles from both state and national newspapers that document the discussions and attitudes about the camp. The student will also use the online Fold3.com records of NARA’s collection of FBI records from WWI to collect information about the 2200 prisoners and the government’s data about them. Although students do not need expertise with these particular research tools, they do need to have research experience and the ability to concentrate on reading printed text both online and on paper.

Minimum Qualifications:

Experience using online library databases
Experience with Research Methods (such as grade A or B in HIST 2600)
Reliable, prompt communication via email and in person
Abstract:
Roughly 40 years after Martin Luther’s 95 Theses sent shockwaves through Europe in 1517, the Reformed faith based on the teachings of John Calvin superseded Lutheranism and transformed the religious and political landscape of Europe. This research project seeks to highlight women’s contributions to the spread of this monumentally influential faith across Europe. *Dissenting Daughters: Reformed Women’s Religious and Political Activism in Europe* will contest the assumption that women had little impact on religious change because they were officially barred from preaching and church office. Rather than limiting women to domestic acts of religious devotion, they played public religious and political roles within both local and international networks. Many Reformed women, such as Anna Maria van Schurman (1607-1678), Cornelia Teellinck (1553-1576), and many others inspired revolt against authorities opposed to their faith, organized church services, participated in international debate, and supported their fellow Calvinists abroad.

For this Summer 2018 CRS Project, I am seeking an undergraduate research assistant to help me collect and analyze research materials related to this project. During the 8-week research period, the intern will gather primary and secondary sources and outline international networks in which women played important religious and political roles. This experience will teach the student valuable research and organizational skills, as well as deepen her/his knowledge of the history of early modern Europe.

Minimum Qualifications:
History major interested in early modern history with good research and writing skills.
Project Name: The regulation of skeletal muscle myogenesis by micro-RNAs

Mentor Name: Joseph S. Marino

Mentor Department: Kinesiology

Abstract:
This project will further our understanding of how micro-RNAs contribute to the regulation of skeletal muscle health. Micro-RNAs are non-coding RNA molecules that interfere with the processing of messenger RNA (mRNA) and therefore the translation of the mRNA to a functional protein. Micro RNAs play a role in regulating many aspects of skeletal muscle health, including the myogenic program and insulin responsiveness.

The myogenic program is the proliferation of and fusion of muscle cells into multinucleated immature muscle fibers, called myotubes. This process is often studied in cell culture to elucidate the mechanisms that regulate it. In vivo, this process is important for skeletal muscle regeneration after injury and skeletal muscle growth. Importantly, the chronic consumption of a high fat diet, as seen in cases of diabetes and obesity, impairs the cell signaling that regulates the myogenic program, leading to poor recovery from muscle injury. We hypothesize that micro-RNA 23a in skeletal muscle, is sensitive to fatty acid overload, which impairs the myogenic program.

The CRS student will test the hypothesis that overexpression of micro-RNA 23a protects myogenic signaling in the presence of saturated fatty acid. This will be accomplished by overexpressing micro-RNA 23a in C2C12 mouse muscle cells with and without exposure to palmitic acid. After 4 days of myotube formation, cells will be stained for myosin heavy chain and a fusion index will be determined. We will also extract messenger RNA and protein to determine how overexpression in the presence or absence of palmitic acid, altered the expression of key muscle regulatory factors.

These data may highlight novel signaling pathways that regulate skeletal muscle health, particularly associated with obesity and diabetes. This work will serve as preliminary data for external funding and provide the opportunity for the CRS student to present research at a national meeting in addition to the CRS conference.

Minimum Qualifications:
Comfortable with basic wet lab techniques including: mixing solutions, pipetting, dilutions, and weighing chemicals. It would be helpful if the student were previously exposed to cell culture.
**Project Name:** Examination of dynamic predictability of excess returns  
**Mentor Name:** Dr. Jiancheng Jiang  
**Mentor Department:** Department of Mathematics and Statistics

**Abstract:** As an important research topic in economics and finance, the predictability of stock returns has been studied in decades. In many financial applications, for example, the mutual fund performance, the conditional capital asset pricing, and the optimal asset allocations, the predictability problem is routinely examined. Tremendous empirical studies demonstrate the predictability of stock returns using various lagged financial variables, such as the book-to-market ratio, the dividend yield, the dividend-price (D-P) ratio, the earning-price (E-P) ratio, the interest rates, and the term spread and default premia, among others. An essential question is often asked about whether the returns are predictable in a specific financial application. Because many of the predictive financial variables are highly persistent and even nonstationary, it is challenging to answer this question. A long-term goal of the mentor is to use time-varying coefficient models to examine dynamically predictive ability of state variables on excess returns. It involves in statistical modeling, rigorous reasoning, numerical simulation, and real data analysis.

The mentor and his student discovered that the long-short yield spread \( s_t \) and the log E-P ratio \( x_t \) are cointegrated and have joint predictive power for the excess return \( r_t \) of monthly NYSE/AMEX value-weighted index data (1926-2002) from the Center for Research in Security Price, based on the following model

\[
r_t = \beta_1 x_{t-1} + \beta_2 s_{t-1} + \theta(\hat{e}_t) + v_t, \tag{1}
\]

where \( \theta(\cdot) \) is a nonlinear error correction term, reflecting a cointegrating relationship between \( x_t \) and \( s_t \) and \( \hat{e}_t \) is the residual from the ordinary least squares regression model,

\[
x_t = a + b s_t + e_t.
\]

However, the economic conditions change over time. It is more reasonable to predict the excess return dynamically. Therefore, model (1) can be extended using time-varying coefficients \( \beta_1(t) \) and \( \beta_2(t) \). Such a model can adapt the change of economic conditions. Problems that will be investigated in this project will include estimation of coefficient functions and misspecification test of model (1). Another task is to check the predictability of other excess returns using corresponding state variables.

In this project, because the estimation algorithm is known, it remains to implement them on computer via simulation and real data examples. The appeal of this project to students is two-fold: it is a direct application of statistics to real economic problems with a lot of potential, and the statistical model involved is well formulated. After completing this project, students will understand how to run nonparametric smoothing, how to construct nonparametric tests, and especially how to apply for cutting-edge statistical techniques to solve real problems and to discover some important state variables with predicting power.

**Minimum Qualifications:** (i) Being familiar with linear regression models; (ii) being familiar with some statistical software, for example, R or SAS; and (iii) being able to communicate via internet and to write a scientific report.
Project Name: Queuing Strategy in the Supermarket with Randomized Loading for Periodic Customer Spikes

Mentor Name: Xingjie Helen Li

Mentor Department: Department of Mathematics and Statistics

Abstract:

The main goal of this project is to study and compare the most effective use of two specific loading algorithms under various circumstances, which are the standard randomized loading algorithm introduced by Vocking and the randomized loading scheme including memory introduced by Shah and Prabhakar. Meanwhile, the student will learn the basic knowledge of random processes, numerical generators of random variables, and statistics tools of data analysis. The result of this project will be novel and expected to be published in an undergraduate research journal.

These loading algorithms ideally seek to distribute incoming jobs into different queues to be serviced in the most time-efficient way possible, which can be imagined as customers and checkout stands in a large grocery store. Several experiments will be run and compared by using various values of system parameters to find the most efficient use of each algorithm. In particular, we will focus on the short-time (transient) and the long-time (asymptotical) performance and properties of each scheme when the arrival rate of jobs changes periodically or statically with fixed mean throughout one simulation cycle. Such environments can be found in a real world setting, such as at an airport with many waiting lines, or in a digital setting, such as an online service seeking to connect many customers to servers quickly. Most systems such as these see a natural varying arrival rate, due to the fact that they would see more traffic during the daytime hours than the nighttime hours. In systems such as these, it is generally easy to quantify the average arrival rate of jobs at various times, the variance of service time, and how quickly jobs are being serviced on average. The ultimate goal of this project is to design a new algorithm based on existing ones that best fits the system when these parameters are learnt from simulation data.

Minimum Qualifications:

The student must have taken calculus I, II, linear algebra, and must have taken at least one programming course such as python or MATLAB. The student must have a minimum GPA of 3.2 in these courses.
Name: Formulation Design of Dissolving Microneedles

Mentor Name: Gloria Elliott

Mentor Department: Department of Mechanical Engineering and Engineering Science

Abstract:

Dissolving Microneedles (DMs) can provide a new way to deliver drugs painlessly and directly without the drawbacks of hypodermic needles, such as the creation of sharps waste and pain at the injection site. DMs are made from a carrier substance and the desired drug, which then dissolves to release the drug when exposed to water in the body. DMs are typically made from sugars and polymers, but there remains considerable formulation design space to improve the manufacturability, mechanical strength, drug stability, and release characteristics. To determine the usefulness of new compositions, dissolving microneedle plates will be fabricated from a range of sugar and organic salt compositions using a micro-mold process and then tested and analyzed for desirability. Testing parameters that can be explored include mechanical strength (insertion force, insertion depth, and fracture force), dissolution time, and percent dosage delivery.

Minimum Qualifications: Basic chemistry, materials science.
Project Name: Analyzing the benefits of a Haptic Shared Control Framework for remotely controlling an Unmanned Ground Vehicle
Mentor Name: Amirhossein Ghasemi
Mentor Department: Mechanical Engineering

**Project Overview:**
Unmanned ground vehicles (UGVs) hold promise for increasing mission performance and guaranteeing personnel safety, but the ability for a human operator to control a UGV from a remote ground station is compromised by communication bandwidth limits and latency. Automation can be added onboard where it is not subject to long-range communication, but UGVs are often used in complex environments, where full automation is not possible. Among many schemes for sharing control between human operator and automation system, haptic shared control is a promising means for combining manual control with automatic control to keep the human in the loop while promoting cooperation and avoiding automation pitfalls.

**Project Requirements**
This project is aimed to design an experimental platform in the form of a mini-vehicle. Specifically, we equip the vehicle with a motorized steering wheel which will be controlled by a ground station featuring a second motorized steering wheel. A radio link can be used to couple the two wheels to a common “virtual steering shaft”. While the virtual shaft is somewhat compliant, it should be sufficient to support driving the vehicle from the ground station and the transmission of steering torques applied by a driver on board to be felt by the driver at the ground station. We will use this test-bed to explore how providing haptic feedback to the human driver can support effective negotiation of control authority and improve driver/automation/vehicle system performance.

**Expected Deliverables/Results:**
- Experimental Set up in the form of Golf-Cart
- A fixed-based Experimental support for remote control of the Golf Cart
- Characterization of the radio-communication
- Identification of the system parameters
- Documented Report

List here any specific skills, requirements, knowledge needed or suggested:
Electronics, Arduino programming, radio communication, CAD, Matlab Programming
Project Name: Design, analysis, and control of biologically inspired robots

Mentor Name: Scott David Kelly

Mentor Department: Mechanical Engineering & Engineering Science

Abstract:
Current research in Dr. Kelly's lab concerns a variety of topics related to the mechanics, dynamics, and control of robotic systems that mimic phenomena observed in the natural world. Of particular interest are problems related to the locomotion of mobile robots that mimic fish, snakes, or other animals to achieve agility or energy efficiency. Opportunities are available for multiple students to assist with research in this area by developing computer simulations, designing and constructing mechanical prototypes, collecting and analyzing data from physical experiments, or developing control strategies using tools like machine learning. The details of individual projects can be tailored to match participating students' interests and qualifications.

Minimum Qualifications:
Project details to be negotiated between Dr. Kelly and the CRS student will dictate minimum qualifications. Academic training in engineering, physics, mathematics, or computer science is expected.
2018 Charlotte Research Scholars
Research Project Submission

Project Name: Precision Engineering / Metrology Research Activities
Mentor Name: Jimmie Miller
Mentor Department: Center for Precision Metrology

Abstract:
Precision Engineering is an interdisciplinary field involving the controlled optimization of programmed, optical, electrical and mechanical systems (POEMS). Students from any of these disciplines are encouraged to become involved. The research will be tailored to the successful applicant’s background and interests. The emphasis will be on the success of the student rather than the ultimate completion of any specific project. Possible projects could involve, but are not limited to, the following:

1. Systems/Computer advancement: Write programs that support quality information technologies that will allow accessible data files to be produced by one program, combined by another program and possibly analyzed by a third independent program and displayed possibly by information browsers. The programming languages are not pre-specified but may involve Labview, Java, C++ etc.

2. Optical: Use interferometry and reversal type techniques to characterize mirrored surfaces that can be used as references to do parametric metrology of machine tools.

3. Electrical: Interface encoder electronic boxes and other analog signals to LabView to obtain simultaneous data for the measurement of optical free-form parts.

4. Mechanical, Design and build fixtures for holding metrology artifacts in a machine tool environment to do dynamic evaluation of machine capabilities.

5. Build and measure a large straightness artifact using geometric principles and metrology instruments such as extensible ball-bars.

Prospects are welcome to come by and discuss possibilities before the selection. Contact via jamiller@uncc.edu

Minimum Qualifications:

1. EE ME, CE, SEEM, Physics, computer science or Math student acceptable with sufficient background.
2. Willing to do hands-on practical work.
3. Inquisitive
4. Desire to broaden your horizons,
Abstract:

The Wheeling Suspension Bridge is one of the most significant American engineering accomplishments from the antebellum period. This bridge was designed by Charles Ellet, Jr. (1810-1862) and completed in 1849 to cross the Ohio River at Wheeling, Virginia (now West Virginia). This is still a vital segment of the National Road. Each individual suspension cable was constructed by laying several wires parallel and then periodically wrapping the loose wires tightly to transform the individual wires into a cable. Each finished cable was 7.5 inches in diameter and was constructed of 550 strands of No 10 [nominally 0.13 in (3.3 mm) diameter] wire. A major restoration was made in time to celebrate the 150th anniversary (sesquicentennial) of the bridge in October 21-23, 1999.

The wire used for the cables has undergone investigation using various techniques. Elban and Goodway conducted microstructural studies and reported Vickers (diamond pyramid) microindentation results and Rockwell (B scale) values for three different wrought iron wires from the bridge. Organ, Elban, and Smelser obtained values of yield strength, ultimate tensile strength (UTS), failure stress, strain-to-failure, and Young's (elastic) modulus. One remaining property that would be of interest is the fatigue strength of the wire.

The goal of this project is to continue work begun last summer to determine a protocol for establishing the fatigue strength of the historic wire from the Wheeling Suspension Bridge. This will involve researching techniques for fatigue testing, finding applicable standards, and determining if testing can be completed using existing equipment at UNC Charlotte. The test protocol will be verified by testing steel wires of similar diameter to failure if appropriate equipment can be identified. Time permitting, testing of the wrought iron wire will be conducted. The successful testing of the wrought iron wire will lead to publication of the results.

Minimum Qualifications:

A mechanical engineering, civil engineering, mechanical or civil engineering technology student with some laboratory course experience. Some knowledge of mechanical properties would be desirable.
Project Name: A comprehensive analysis and design of 3D printed medical devices

Mentor Name: Nigel Zheng

Mentor Department: Mechanical Engineering and Engineering Science

Abstract:

3D printing is changing the medical field by providing 3D printing labs in hospitals, low-cost prosthetics, customized medical implants, and customized protective devices and aids. With a 3D printed model, surgeons may look at the model and visualize the surgical procedure prior to surgery, which may lead to less operating time and better clinical outcomes. 3D printing is enabling high-quality, rapid, low-cost production of medical devices that fit better, work better, and offer better protection. The introduction of 3D printing for orthopedics and rehabilitation practice has been extensively discussed because 3D printing technology renders it possible to customize orthoses and increase patient treatment satisfaction. However, a functional 3D printed medical device depends on a good 3D mesh model from a 3D scanner, an excellent design of the device that meets the functional needs of a patient, proper selection of materials that will provide different stiffness, stability and strength of each component to meet the design criteria, and assembling of a 3D printed device from 3D printed and non-printed components. Our on-going research identified issues of 3D mesh models from our 3D body scanner. We have collected about 200 whole body scans from our Cyberware 3D body scanner. The objective of this project is to develop a programmable modeling tool, to address the problems encountered in flaw-tolerant scanning and extra post-production procedure after scanning should be avoided. A well-fit design of 3D printed device will provide better patient satisfaction. For customized medical implants and protective devices, they should meet functional needs for our daily and sports activities. The student will learn basic principles of human motion analysis and biomechanics.

Minimum Qualifications:
Familiar with MatLab
2018 Charlotte Research Scholars  
Research Project Submission

Project Name: New Photonic Technology: Resonance-Selective Optical Sorting of Microspheres

Mentor Name: Vasily Astratov

Mentor Department: Physics and Optical Science

Abstract:
One of the main problems of modern photonics is connected with a lack of technology capable of fabrication microresonators with practically identical resonant frequencies that is required for their optical coupling. Identical microresonators can be viewed as “photonic atoms” which can be used as building blocks for constructing more complicated and functional coupled-cavity structures – “photonic molecules”, waveguides, lasers and sensors. In this project, we develop a novel technology for sorting dielectric microspheres with uniquely identical resonant properties by using optical forces. The project involves building an experimental setup where a powerful laser beam with tunable infrared emission wavelength exerts an optical force on moving dielectric microspheres. It also involves fabrication of the tapered microfibers and measurements of the positions of whispering gallery mode (WGM) resonances in the optically sorted microspheres. The final goal of this project is demonstration of sorting microspheres with better than 0.01% uniformity of their WGM resonances required for reducing optical losses in the corresponding coupled-cavity structures and devices. This project will provide an undergraduate student with a unique experience in the tunable lasers, optical micromanipulation, advanced spectroscopy and microfiber technologies. It will also involve working in a team with an international visiting scholar from France.

Minimum Qualifications:
Some minimal experience with the optical components is required, good team working skills are required
Project Name: Improved fiber optic applicators for MRI-guided laser ablation of brain tumors and epileptic centers

Mentor Name: Nathaniel Fried

Mentor Department: Physics and Optical Science

Abstract:
The National Cancer Institute estimates 23,800 new cases of brain cancer with 16,700 deaths in 2017. There are about 162,000 people living with brain cancer in the U.S. While brain cancer is only the 16th most common type of cancer based on new cases annually, it has a high mortality rate, accounting for the 8th most number of deaths annually.

Magnetic resonance image (MRI) guided laser interstitial thermal therapy (LITT) is a minimally invasive treatment for thermal destruction of brain tumors and epileptic centers, in adults and children resistant to drug and radiation therapy. During this procedure, a fiber optic applicator is inserted into the center of the brain tumor under MRI guidance, and then near-infrared (IR) light is delivered to heat, coagulate, and destroy the tumor or epileptic center. The fiber optic applicators currently used are relatively large, resulting in unnecessary collateral damage to healthy brain tissue during insertion into the brain.

The Biomedical Optics Laboratory at UNC-Charlotte is the world leader in the development of new surgical applications of high power fiber lasers in medicine. Fiber lasers are a new type of laser in which the light originates within the small core of the fiber, providing high intensity or brightness. The fiber laser can deliver higher power into smaller surgical fibers than diode lasers currently used in the clinic, thus enabling miniaturization of both the fiber and applicator for less invasive insertion into the brain.

For this project, the undergraduate student will learn how to handle lasers and fiber optics and conduct basic optical, thermal, and mechanical studies to characterize fiber optic applicators. Basic laboratory equipment such as power meters, oscilloscopes, function generators, etc. will be used.

Minimum Qualifications:
Physics, Electrical Engineering, or Mechanical Engineering major with an interest in learning basic skills in lasers and fiber optics. A willingness to learn and work hard is essential. Previous hands-on laboratory experience a plus.
Project Name: Additive Manufacturing of Birefringent Terahertz Metamaterials

Mentor Name: Tino Hofmann

Mentor Department: Department of Physics & Optical Science

Abstract: Metamaterials are composed of arrays of subwavelength structures which result in collective optical, mechanical, and electrical properties which can differ dramatically from the bulk properties of the constituents. It has been demonstrated, for instance, that metamaterials composed of slanted metal nanowires show anisotropic optical properties [1,2]. This form-induced birefringence offers new pathways to manufacture materials with engineered polarization-optical responses and might lead to multifunctional optical components.

The Charlotte Research Scholar will participate in a research project which is focused on a novel approach to design and fabricate metamaterials. In this project finite-element calculation procedures and CAD methods will be employed in combination with additive manufacturing techniques. In contrast to other existing procedures, this approach allows the manufacturing of optical materials “by design” and opens exciting new avenues for rapid prototyping and the investigation of structure-property relationships.

During the CRS period, the student will (a) use CAD software and state-of-the-art stereolithography 3D printers in order to design and manufacture a range of different terahertz metamaterials; (b) use terahertz ellipsometry techniques to measure the optical response of the designed materials; (c) participate in the data analysis using optical model calculations.

These studies will expose the student to state-of-the-art CAD and 3D printing equipment, optical thin film characterization, numerical analysis techniques, and finite-element calculation procedures. The student will work closely researchers in the group. This interaction with experienced researchers ensures the training for equipment operation and the development of data analysis skills needed to interpret the experimental data obtained during the CRS period. The student will be required to maintain a laboratory notebook and to participate in weekly workgroup meetings. Reporting and publication activities will be coordinated with graduate students in the workgroup.

References:

Minimum Qualifications:
Laser safety training, basic electrodynamics background
Abstract:
The phenomenon of dessication found in nature suggest organs, cells and macromolecules such as proteins can be preserved for biomedical applications in engineered sugar/salt solutions. From empirical studies it is found that solutions with a higher glass transition temperature are better for longer storage times without refrigeration, which greatly lowers costs compared to cryopreservation. The molecular composition of mixtures using different types of sugar, salt with varying water content levels that lead to successful properties for preservation are determined by extensive empirical trial and error testing. Although having an elevated glass transition temperature is desirable, it is observed that a minimum amount of water content is required to facilitate revitalization, but this typically lowers the glass transition temperature. Furthermore, the type and amount of salt in these solutions greatly affects water content. Consequently, complexities arise in making formulations, in part, because of the vast chemical space that can be adjusted in formulating sugar/salt solutions. Unfortunately, the properties of the molecular interactions that result from different mixtures are not possible to directly observe experimentally. There is a gap in knowledge about the mechanisms of action that are critical for successful preservation and revitalization processes. Gaining a better understanding of the spatial and temporal molecular characteristics is a first step toward achieving a means for rational formulation design. This project aims to quantify the molecular properties of certain sugar/salt solutions computationally using molecular dynamics simulations. Systematic trends in comparative studies across different sugar/salt solutions as water content varies will be analyzed in model free terms and in the context of competing microscopic theories.

Minimum Qualifications:
Proficiency in at least one programming language is required. Familiarity with Linux or Unix would be helpful.
Project Name: Probability density estimates for random data exhibiting extreme statistics using quantiles

Mentor Name: Donald Jacobs

Mentor Department: Physics and Optical Science

Abstract:
The task of estimating a probability density function from random data is a well-studied problem in statistics. Often there exist a proposed parametric model for the underlying random process under consideration. In other cases only partial constraints about the data is known, leading to a semi-parametric model, or if no information about the process is known, this leads to a non-parametric model. For parametric models with many parameters, Monte Carlo Markov Chain (MCMC) methods are commonly employed to achieve model selection through a quantitative assessment process. This project will access an alternative method that aims to construct the probability density function, also using a Monte Carlo sampling technique, based on a universal quasi-log-likelihood scoring function that is applied to quantiles. This alternative approach invokes sort ordered statistics, and is based on a strategy that does not require a parametric model, meaning it handles semi-parametric and non-parametric models within the same framework. Another advantage of this alternative method is that it is particularly well suited for situations where there is extreme statistics because it is numerically stable to handle extreme “outliers”. In applications in finance, there is concern about modeling rare events accurately to obtain proper risk evaluation in investments. Similar concerns are found in engineering or in security, where failure of a device or failed detection may be rare, but the consequence of failure could be catastrophic. Estimating a heavy tail power-law exponent that typically characterize extreme statistics requires using as much of the observed data as possible, while data outside of the tails can bias the predictions of the exponent. This project will evaluate a prototype implementation of this alternative method by considering a variety of test cases of known distributions involving extreme statistics. Real financial data will be considered if time permits.

Minimum Qualifications:
Basic knowledge of statistics and probability theory. Familiarity with MATLAB or R would be a helpful.
Project Name: Regulation of actomyosin interaction

Mentor Name: Yuri Nesmelov

Mentor Department: Physics and Optical Sciences

Abstract:

The ultimate goal of the project is to understand how the force is generated in muscle. We study the mechanism of actomyosin interaction with ATP, leading to the force production in muscle. We combine molecular biology, biochemistry, and biophysical spectroscopy in our research. The study is of fundamental importance for understanding the mechanism of muscle function and muscle malfunction on molecular level. Knowledge of this mechanism will allow rational design of muscle malfunction treatment, as well as better understanding of the mechanism of muscle contraction.

Minimum Qualifications:

N/A
Project Name: Structural Studies of the Sleeping Beauty transposon
Mentor Name: Irina Nesmelova
Mentor Department: Physics and Optical Science

Abstract:
DNA transposition is the mechanism that can be used to deliver genetic information to mammalian genome. It has been employed for gene therapy and for functional genomics studies. The *Sleeping Beauty* (SB) transposon system is the most frequently used DNA transposon in functional genomics, and is the first and only DNA transposon that has been adapted for human gene therapy. The SB system consists of the transposase enzyme and of the transposon DNA. From the biophysics point of view, the SB transposition is the sequence of steps during which the transposase interacts with the transposon DNA. Accordingly, we study these steps to create a dynamic picture with atomic-level resolution of how molecular components of the SB transposon system work together.

Our research area is experimental biophysics. By nature, the research is highly interdisciplinary. Students will learn spectroscopic techniques (Nuclear Magnetic Resonance (NMR), circular dichroism (CD), fluorescence), molecular modeling, and gain basic biochemistry skills.

Minimum Qualifications:
Students from Physics, Chemistry, and Biology are welcome to join the project
Project Name: Protein-protein interactions

Mentor Name: Irina Nesmelova

Mentor Department: Physics and Optical Science

Abstract:
Chemokines form a large family of proteins that guide the migration of leukocytes in our body. We need chemokines to fight the infection, but they can also play a negative role by promoting autoimmune and allergic inflammatory reactions, cancer, atherosclerosis, or other inflammatory disorders. Chemokines act individually or interact to form heterooligomers. These interactions alter the biological activity of individual chemokines. We are looking at different chemokines to describe their interactions at atomic level in order to design molecule that will block (or enhance) the interactions, because we believe that it may lead to the development of more targeted, anti-inflammatory pharmacological agents with minimal side effects.

Our research area is experimental biophysics. By nature, the research is highly interdisciplinary. Students will learn spectroscopic techniques (Nuclear Magnetic Resonance (NMR), circular dichroism (CD), fluorescence), molecular modeling, and gain basic biochemistry skills.

Minimum Qualifications:
Students from Chemistry and Biology are welcome to join the project
Project Name: Investigation of implementation errors in thin holograms fabricated using the Nanoscribe Photonic Professional GT.

Mentor Name: Menelaos K. Poutous

Mentor Department: Physics & Optical Science

Abstract:
Holograms reshape light wavefronts through optical phase modulation and diffraction. Micro-holograms are uneven transparent surfaces, on the scale of microns, which project an intensity image in the far-field when illuminated by coherent monochromatic light. Micro-holograms have various applications currently as: security features (reflective holograms in currency and credit cards), pattern projectors for lasers (bar code readers, scanners), high-accuracy metrology (spatial 3D contour identifiers), and entertainment (3D visual projectors and virtual reality), to name a few.

Using a numerical iterative algorithm, various hologram designs will be realized for a variety of test images. The computed intensities, contrast, and ratio of “noise” intensity to target intensity, will be numerically evaluated for each of the projected test images. An optimal image will be chosen and its respective multi-phase hologram will be fabricated with the Nanoscribe tool. The effects of the Nanoscribe tool’s fabrication parameters will be investigated including: a) the phase level accuracy in implementation (induced phase step); b) the optimization of exposure line spacing; c) exposure scan speed, and; d) photoresist exposing laser power levels.

A higher number of phase levels allows for better fidelity during the fabrication of a hologram. Visible ridges in the hologram features, due to exposure line spacing, should be kept at a minimum to avoid extraneous diffraction effects. Slower scan speeds combined with higher laser power should be optimized to result in a better-defined structure with more precise edge definition. The optimized parameters will then be applied in the fabrication of a full size hologram. Following the design steps the Nanoscribe Photonic Professional GT tool will be used to perform direct-write laser lithography to produce sample micro-holograms and explore the relation between fabrication and performance parameters. The performance of the test patterns will be measured using a HeNe laser and a scanning slit detector.

This work is leveraging on last summer’s exploratory activity, which allowed us to determine the maxima and minima of the fabrication parameters, and develop a fabrication process for the micro-holograms using the laser direct-write tool.

Minimum Qualifications:
Basic knowledge of optics. The ability (and desire) to be trained to use some of the various metrology and optical fabrication instrumentation in the Grieg Clean room facility, such as: Olympus confocal UV microscope, Nanoscribe Laser writing tool. The desire to contribute in the continuing research on direct-write techniques for micro-holograms. The ability to adhere to Laboratory safety rules and regulations is required. The Optical Micro-Structured Interfaces Lab is a safe and respectful environment for all student and staff members, and as such, the participant is required to adhere to the Lab’s and University’s rules and regulations.
Abstract:
Conventional optical systems are typically based on rotationally symmetric lens surfaces for imaging. Recent advances in fabrication technologies have enabled the fabrication of freeform surfaces (which may have limited or no symmetry) that can enable entirely new optical functions and capabilities. Example applications spaces include head mounted displays for virtual/augmented reality, high power laser beam shaping/combination, to dynamic surface metrology and compact, high performance telescope systems, among others. These new optical forms and application spaces introduce additional challenges in the simulation, optimization, manufacture, and measurement of optical components and systems. To this end, the objective of this project is to research and apply new modeling and design approaches for freeform optics application examples. Specific component functions from the application spaces presented above will drive and guide the research project. The research will require application of both custom models (Matlab™) and commercial optical software packages (e.g., Zemax OpticStudio™ and VirtualLab Fusion™), as well as consideration of ultraprecision manufacturing and metrology requirements for freeform optical surfaces.

Minimum Qualifications:
Junior or Senior standing in Physics, Engineering, or Mathematics
Project Name: An Intraoperative Hyperspectral Imaging System based on a Single-Pixel Camera Design for Surgical Guidance and Disease Diagnosis

Mentor Name: Susan Trammell

Mentor Department: Physics and Optical Science

Abstract:
Surgery remains the foundation of cancer treatment. However, a remaining significant challenge for cancer surgery is ensuring that no residual malignant tissue is left behind after surgery, as recurrent tumors lead to high mortality rates. The goal of this project is to develop a new hyperspectral imaging modality that can be used during surgery for cancer detection and resection margin delineation. HSI is a hybrid imaging modality that combines imaging and spectroscopy and provides a 2D image that contains spectral information in each pixel. During the summer CRS project, students will work with the PI and her graduate students to improve the design of a prototype single pixel HSI system and refine data acquisition and analysis algorithms. In addition, they will test image acquisition through a coherent fiber bundle to assess the potential of using single pixel HSI during minimally invasive procedures.

Minimum Qualifications:
Must have completed PHYS 2101 and 2102 + labs. Completion of PHYS 3141 is preferred, but not required.
Project Name: School Choice and School Segregation
Mentor Name: Jason Giersch
Mentor Department: Political Science and Public Administration

Abstract:
One of the consequences of allowing families to choose schools is that they tend to choose schools with students who resemble their own children in terms of race and social class. Using student demographic data on school enrollments, this study tracks the re-segregation of schools when choices become more available. Preliminary results suggest that charter schools increase segregation both directly, by being more segregated themselves, and indirectly, by leading school districts to become more segregated.

Minimum Qualifications:
Must be skilled at locating, collecting, and managing data from online sources.
Must be skilled at using spreadsheets in Excel, Stata, or SPSS to merge and analyze data.
Project Name: Campaign Money and Corruption in American Politics

Mentor Name: Eric Heberlig

Mentor Department: Political Science and Public Administration

Abstract:
I have two projects related to money and politics and a student could work on either. One project analyzes the relationship between interest group money and legislative effectiveness. “Access-oriented” interest groups (especially corporations) have traditionally concentrated their campaign contributions on legislators with specific characteristics: members of the majority party, members serving on committees with jurisdiction over their agendas, and legislators who are more centrist ideologically. The political environment has changed substantially over the past decade, with Congress polarizing ideologically and great power being concentrated into the hands of party leaders. These changes undermine the viability of corporate Political Action Committees’ strategies. I seek to analyze how and why their contribution strategies have adapted to the new environment. I hypothesize that contributions are increasingly oriented towards Republicans (ideologically aligned with corporations and the majority party), elected party leaders, and legislatively effective Democrats. This project involves using a data base I have developed that combines data on campaign donations from the Federal Election Commission, legislative effectiveness scores, voting records, and institutional positions of members of the House from 1996 through 2012.

The second approach is to understand how citizens evaluate the role of money in politics. Surveys show that citizens believe that campaign donations corrupt politicians but they do not consistently remove incumbents from office when they are accused of corruption. In fact, they seem to evaluate legal uses of money as negatively as illegal uses of money. If citizens believe that “everybody does it,” it hampers their ability to punish politicians who are actually engaged in corrupt activities. I have run a series of experiments that evaluate the role of partisanship, the “credibility of the accuser,” and the type of corruption accusation to analyze the conditions under which citizens hold officials accountable for accusations of corruption.

Minimum Qualifications:
Completed POLS 2220 (or equivalent) with a B or higher. Familiarity with data management and analysis programs such as Excel and SPSS.
Project Name: Emotion and Emotion Regulation in Interpersonal and Social Media Communication about Politics

Mentor Name: Dr. Cherie Maestas

Mentor Department: Political Science and Public Administration

Abstract:
The Charlotte Research Scholar would assist on projects related to a National Science Foundation funded grant to study how people regulate their emotions in response to political events, and how their emotion regulation strategies influence their political activism and political communications. The Research Scholar will have an opportunity to analyze national survey data on emotions and communications about politics, collaborate on research papers or presentations related to this project, and participate in designing new experiments to test theories to explore how emotions about politics transmit themselves from person to person. The Research Scholar will participate in regular interdisciplinary team meetings with faculty and students from Psychology, Political Science, Psychology, Communications, and Computer Science.

Minimum Qualifications:
Introductory social science research methods or social science statistics course. Familiarity with using a statistics program such as SPSS, Stata, SAS, or R.
Abstract:
In the 2012 election, the amount spent per voter in North Carolina ranged from $3.64 in Forsyth county to $17.67 in Warren county. What explains a nearly five fold difference in spending on election administration? This project helps answer this question and contribute to research that looks at how outcomes may be influenced by spending on election administration.

Researchers started significantly looking at election administration after the hanging chad debacle in 20000. Voting equipment and the quality of the election administrators were the first topics, but research has begun to look at the influence of spending on election administration as a determinant of outcomes. The first election administration spending paper in the US was published recently in 2012.

Election administration spending data is hard to find. The main reasons that most states do not have this information easily available is that election administration is a small expenditure and the accounting standards vary significantly both within and between states. We have collected spending data from a grant that we got from MIT.

One of the projects that we would like to look at with this data is whether the actual spending differs from the budgeted spending. Research from the United Kingdom shows that the amount budgeted and the amount actually spent on election administration differs significantly, particularly during recessionary years. While this question has been looked at in the UK, the question has never been addressed in the US.

The research question for this project is whether budgeted amounts for election administration are different from actual spending for election administration? As such, we will compare the actual spending that we have already collected with the budget data that we will collect. Our research expectations are that there will not be a difference during regular fiscal years, but during recessionary periods we expect there to be a significant difference. If this research project shows that there are only minor differences between the budgets and the actual spending, we could conceivably expand the financial data on election administration to all of the states and address new and understudied research questions. If there are significant differences, this research will likely be published in an election politics or budgeting journal.

Minimum Qualifications:
Must be proficient in Excel; statistical packages such as SPSS or STATA preferred
Project Name: Accessibility of Social Capital: Mapping Charlotte’s Nonprofit Sector

Mentor Name: Sarah Pettijohn

Mentor Department: Political Science and Public Administration

Abstract:
This project delves more deeply into Charlotte’s economic mobility problem by examining the role local nonprofits play in hindering or supporting upward mobility. Community-wide efforts are underway to understand and address why children born into poverty in Charlotte are least likely to achieve economic prosperity (compared to the 50 largest commuting zones in the U.S.). A report released by the Opportunity Task Force (OTF) identified social capital, relationships that “enable people to acquire resources” to leverage for action, as an essential component to moving individuals out of poverty.

Social capital is often thought to be an equalizer in upward mobility. Critical to this assumption is that social capital is equally accessible and available to all children in a community. However, what happens when key intermediary institutions - nonprofit organizations - do no locate in resource poor neighborhoods? Research on other large U.S. cities finds nonprofits are not locating in poor neighborhoods, and preliminary analysis in Charlotte shows that the city’s poorest zip code is home to only 3% of nonprofits, while the area surrounding UNC Charlotte boosts nearly 25% of the city’s nonprofit population. To examine this question further, the project will merge data from the National Center for Charitable Statistics, NC Secretary of State, U.S. Census Bureau, and Charlotte Area Transit System to examine the spatial distribution of nonprofits and churches in Charlotte, their accessibility to opportunity poor residents, and their proximity to public transportation to assess whether the very solution to Charlotte’s economic mobility issue is actually part of the problem.

Minimum Qualifications:
None
Project Name: Human Trafficking of Minors: A scourge of modern slavery. A study of current trends in the human trafficking network from areas of South and Central America to South and Central America and to the United States

Mentor Name: Dr. Gabriela Tarazona-Sevillano

Mentor Department: Department of Political Science and Public Administration

Abstract:
Modern trends of human trafficking have been centered on the trafficking of women and children, but mostly minor women, females under the age of 18. They are minors and specially protected in international law. Nonetheless, these young women have been abducted and “sold” to clients who would exploit them in the sex business. States seem to turn a blind eye into their plight.

Globalization has facilitated the enterprise of transnational criminals. Human trafficking and smuggling have been the fastest growing transnational crimes in recent years because world conditions have created increased demand and supply. The migration of people has also hidden this illicit activity. From the large cities of South America to the illicit mining camps in the Andes, from the rural communities of Central America to the United States, human trafficking is a policy issue and a human rights issue that should concern us.

Minimum Qualifications:

Major: Political Science, International Studies, or Holocaust and Human Rights Minor.
Grade Point Average: 3.0 or higher

Mentor Name: Dr. Gabriela Tarazona-Sevillano

Mentor Department: Political Science and Public Administration

Abstract:

This study addresses accountability for human rights violations and the evolution of international human rights law in protecting the individual. It will focus on international cases in European Courts. Two key concepts are crucial in achieving accountability: (1) Universal Jurisdiction, as Spain and Belgium asserted to try in Spanish and Belgian courts Argentineans for crimes committed in Argentina, against Argentineans; and (2) The validity of civilian courts in judging military defendants for violation of human rights.

Minimum Qualifications:

Pre-law/ Political Science/ International Studies major 3.0 GPA or higher.
Project Name: Political competition and immigration attitudes

Mentor Name: Beth Elise Whitaker

Mentor Department: Political Science and Public Administration

Abstract:
Hostility toward immigrants appears to be on the rise in many parts of the world. Scholars seeking to explain attitudes toward immigration have tended to focus on economic conditions, changing demographic patterns, and cultural factors. Relatively less attention has been given to the role of political competition in fueling anti-immigrant attitudes and generating exclusive policies. In this research, I examine the rise of anti-immigrant attitudes and policies in comparative context. One project involves a comparative case analysis of six countries in Africa, three of which have seen a dramatic increase in exclusionary attitudes and policies in recent years while the others have continued to be more inclusive. Another project is a quantitative analysis of immigration attitudes in 42 countries around the world using data from existing surveys. I would like to work with a Charlotte Research Scholar in summer 2018 on various aspects of these related projects. The scholar’s tasks could include creating a longitudinal dataset of “safe seats” and “competitive seats” in the parliaments of selected African countries, collecting more recent literature and data for both projects, and assisting with data analysis. The scholar will gain experience with different types of research methods and learn more about existing research on immigration attitudes, both of which could be useful for a student who is working toward doing an honors thesis.

Minimum Qualifications:
Political science major, preferably an honors student; must have taken POLS 2220 or a statistics course
Project Name: Emotion Firestorms on Social Media: Psychological constructs supporting contagion of emotion within the self and between individuals in social media settings

Mentor Name: Sara Levens

Mentor Department: Psychological Science

Abstract:
Emotion Firestorms on social media has been shown to catalyze/influence large scale social and political movements. This research project will provide interdisciplinary training in the psychological constructs that support the proliferation of emotion on social media—from the contagion of emotion to the self, to the spread of emotion across individuals to give rise to larger social movements. For example, how does emotion regulation influence the spread of emotion? What cognitive and social mechanisms influence an individual's processing of and response to posted social media content? What types of emotional content are most contagious on social media and why?

Scholars selected to work on this project will explore potential answers to these questions and have the opportunity to work on cutting-edge, interdisciplinary research that bridges psychology, communication and computer science.

Minimum Qualifications:
Research interest in emotion. Coursework experience in the fields of Psychology and Linguistics or Communication. Previous research experience and/or practical experience with social media platforms such as Twitter is desirable.
Project Name: Arousal and Immune Response (AIR)

Mentor Name: Tierney Lorenz

Mentor Department: Psychological Sciences

Abstract:
The AIR-HC study will examine immune function in healthy non-pregnant adult women before and after genital arousal, and compare these effects in women who are and are not taking hormonal contraceptives (HCs). We have previously found differences in sexually active vs. abstinent women across immune markers. We hypothesize that sexual arousal will be associated with increased immunity in vaginal fluid, but lower immunity in saliva.

By Summer 2018, we will have collected saliva and vaginal fluid samples, as well as markers of physical arousal response, from 100 healthy women. We also are also collecting surveys of psychosocial data including information on participants’ sexual history, stress, mood, sleeping and eating patterns, physical activity, physical symptoms, and more. The Scholar will complete a set of assays that quantify functional immunity by exposing saliva and vaginal fluid samples to a known bacterial load. Finally, they will create a research question of their choosing, linking psychosocial variables to the functional immune data they helped collect (e.g., does poor sleep amplify the effect of stress on immune function?).

The project would be ideal for a student interested in health psychology, biomedical research, or women’s health. I (Dr. Lorenz) will be the primary mentor and will supervise the student in the Women, Immunity and Sexual Health lab (with secondary mentorship from my two grad students and 5 undergrad RAs). The Scholar will gain exposure to the following: biological lab skills, biological safety procedures, ethical standards for human subjects research, designing a research question using archival data, basic statistical analyses, searching for relevant scientific literature to answer a research question, and preparing and presenting a scientific poster. I’ve previously completed similar projects in a 10-week summer session with undergrad research assistants who had little to no prior wet lab experience, and know how to trouble-shoot common issues in training on an accelerated schedule. For example, I’ve created a “hypothesis-mapping” activity to help students quickly translate their vague interests into research questions.

Minimum Qualifications:
- Comfort with and interest in women’s sexual health research
- GPA at least 3.0 (standard for all students in WISH lab)
- Preferred (not required): At least one lab-based course in biology or chemistry with min. grade of B (or equivalent research experience in a physiology-focused lab)
- Preferred (not required): ability to stay on in WISH lab in following year as a research assistant to continue to gain experience
Project Name: Technology, Health, and Risk Behavior Among Young Adults

Mentor Name: Erika Montanaro

Mentor Department: Psychological Science

Abstract:

Young adulthood is a unique developmental period, in that individuals are asked to begin taking responsibility for their decisions and behavior in the context of more adult activities (i.e., sexual behavior). Social media platforms and/or text messaging may be one form of communication young adults use to explore their new adult identities allowing them to express their interests, establish intimacy, or negotiate positive health behaviors among their peers. However, there may be negative consequences of social media and text message communication as well, such as risky sexual behavior or substance abuse.

Smartphone use has permeated young people’s lives, and their use has rapidly changed the way young people communicate, flirt, date, and even participate in risk behavior (e.g., substance use, sexual activity). Remarkably little is known about the risks and benefits associated with this new form of communication via social media and text messages. Innovative methods are needed to measure how young people use social media and text messages in their interactions around risk behavior, psychological mechanisms associated with risky health behavior, and correlates of risky health behavior to other health behaviors.

Many risky health behavior studies rely on self-report assessments that are prone to reporting biases instead of using objective behavioral measures. This has resulted in inconclusive evidence regarding the relationship between social media use, text messages, and risky health behavior. An exploration of the actual content of social media posts and text messages can inform health interventions targeted within vulnerable populations. This study would identify the conditions under which risky health behavior posts on social media and text messages are associated with risks or benefits, ultimately allowing young people to make more informed choices.

Minimum Qualifications:

- Completion of Research Methods in Psychology with a B or better
- Experience using SPSS
- Overall GPA of 3.5 or better
Project Name: Improving Community Health and Wellness via Organizational Capacity Building
Mentor Name: Victoria C. Scott
Mentor Department: Psychological Science

Abstract:
Individual wellness is linked to the well-being of our society, including the environments in which we live, work, and play. In our community lab, we are committed to social improvement. Our work involves collaborating with students, researchers, and community members to cultivate a more equitable, healthy and compassionate society that promotes justice. Using an ecological perspective nested in the fields of implementation and improvement science, we study the relationship between individuals and their environments to understand the complexity and determinants of individual and organizational improvement. Our work is highly applied and action-oriented. This Charlotte Research Scholar track presents a motivated, rising scholar with the opportunity to gain hands-on research experience while contributing to the well-being of residents in the Charlotte area. The Scholar will work with Dr. Scott and her research team on either (or both) of the following active projects:

1) **Building Uplifted Families (BUF)** -- this initiative aims to improve the well-being of residents living in the 28208 zip code, an urban area within Charlotte where residents experience intergenerational poverty, substandard educational opportunities, and poor access to healthcare. Using a collaborative approach that is resident-informed, the initiative leverages local partnerships in an effort to re-think and re-design existing community services. In summer 2018, the BUF project team will enter Phase I of implementation. Dr. Scott’s research team will lead the data and evaluation effort.

2) **The Carolinas Healthcare Employees Study (CHEBS)** – this study aims to examine and improve breastfeeding attitudes, experiences, and outcomes among Carolinas Healthcare System (CHS) employees, and perceptions and awareness of workplace breastfeeding policies. Entering Phase II of our research, in Summer 2018, the CHEBS research team will be working closely with CHS leadership to implement policies and procedures for improving workplace breastfeeding support.

Through both of these action-research projects, the Charlotte Research Scholar will obtain research experience through an array of research activities including:

- **Assist with basic research:** help recruit and retain participants, run participants through study protocol from informed consent to debriefing, enter and analyze data, prepare presentations and manuscripts, attend regular research team meetings;
- **Complete database research:** conduct literature searches, prepare literature syntheses, and present summaries to research team members and community partners;
- **Learn how to conduct responsible research:** complete standardized online training through CITI and develop good research practices;
- **Other:** the Scholar has the option of adding other skills s/he wishes to learn that are within the scope of broader lab interests and timeline

In addition to receiving one-on-one mentoring from Dr. Scott, the Scholar will also have the opportunity to develop strong relationships with other undergraduate and graduate students with shared interests and overlapping career aspirations. These relationships can provide the Scholar with a network of resources for discussing topics pertaining more broadly to career development (e.g., preparing an academic resume, applying to graduate school, preparing for a job interview). To learn more about Dr. Scott’s research lab and active projects, please visit: [www.collectivewellnesslab.com](http://www.collectivewellnesslab.com)

**Minimum Qualifications:**
The following are required qualifications:
1) UNC Charlotte undergraduate that will return in Fall 2018;
2) At least a Junior standing;
3) Minimum GPA of 2.8;

The following are preferred but not required qualifications:
1) experience in healthcare and community settings;
2) experience with SPSS, Zotero, TurksPrime, and other research software;
3) coursework in Statistics and Research Methods with grades of B or better;
4) Overall GPA of 3.5 or better
Abstract:
Decades of research have accumulated implicating the negative impact of media images and messages on the experience of body image and embodiment among young women. These images often convey a narrow depiction of the thin or thin/athletic ideal that are frequently digitally modified to represent unrealistic standards of beauty, health, and fitness. The social justice-inspired body positive movement has emerged in recent years as an alternative aiming to transform and revolutionize current standards of relating to and living in one’s body. The philosophy underlying this movement advocates a strong inclusion of all body sizes and shapes and inclusion of a broader sense of beauty that transcends one’s physical form or ability. *Embrace* (2017) is a 90-minute documentary spearheaded by photographer and body positive activist Taryn Brumfitt. The film draws upon these contemporary themes of body positivity and inclusion of physical appearance diversity. The specific aim of this study would be to assess the immediate and short-term impact of viewing this film on measures of body image and embodiment in a sample of UNC Charlotte undergraduate women. A brief focus group will be conducted with participants after viewing the film to take the opportunity to provide a more in-depth exploration of their experiences. An email link to follow-up questionnaires would be sent to interested participants to complete 1 month after viewing the film to evaluate the sustainability of any effects observed.

Minimum Qualifications:
Psychology Major or Minor
Overall GPA of at least 3.0
2018 Charlotte Research Scholars
Research Project Submission

Project Name: Health of gender and sexual minority individuals
Mentor Name: Jessamyn Bowling
Mentor Department: Public Health Sciences

Abstract:
There are two projects on which the Charlotte Research Scholar would work. Both projects address the health of sexual and gender minority individuals (including lesbian, gay, bisexual, trans, and gender non-conforming, among others). Project 1: Perceived resilience of gender diverse individuals in Mecklenburg County, NC. This project incorporates in-depth qualitative interviews (n=18) and participant photographs to examine how individuals perceive their own strength and resilience. Project 2: Sexual health of sexual and gender minority individuals in urban India. This project incorporates interviews (n=25) and focus group discussions (n=4) in 3 cities in India to address definitions of sex, and prevention of unintended pregnancy and sexually transmitted infections. For both of these projects, we will be in data synthesis and manuscript preparation phases.

Minimum Qualifications:
Previous experience with reading peer-reviewed/academic journal articles
Strong writing skills
Safe Zone trained by May 2018
Abstract:

**Background:** Young adults (ages 18-21) residing on a university campus are transitioning from a home environment that often offers structure and support to a more independent living environment. Once on the university campus, young adults make 100% of their eating and physical activity decisions within the university and local community environment. The habits developed during this time may influence their eating and physical activity behavior post university.

**Project Description:** Residential university students study, live, eat, and play within a university system; the majority of student activities are documented digitally. These university systems (i.e. grading, admissions, housing, parking, meal plan, recreational use, financial status, health care use) tend to operate in isolation but all identify the student by their UNC Charlotte ID number. Our research team sees these data sources as a unique opportunity to study the predictors of student food purchasing choice and recreational facility use. We have worked with a number of departments on campus to get the necessary approvals to acquire and link data systems. The dataset allows us study things like the impact of policy change on food purchasing and recreational use, how food purchasing and recreational facility use behavior differs by subgroups of students, trends in fast food purchasing, etc.

**Methods:** Students from Fall 2013 through present, living on a university campus and participating in the university dining plan, are the sample population. Approximately 6 university data systems used to manage and facilitate the operation of a large urban university in the US were merged. Specifically, systems that contained information on student food purchases, recreational facility use, student organization participation, academic schedule, academic achievement, residential facility use, and demographic characteristics were merged using the university student identification number. Eleven nutrients (such as calories, fiber, carbohydrates) were linked to the food purchase data. A healthy food score was constructed.

Minimum Qualifications:
Coursework in one or more of the following: computer science, nutrition, statistics, data analysis, epidemiology,
Project Name: Bridging the Digital Divide via Intergenerational Mentor-Up.

Mentor Name: Othelia E. Lee

Mentor Department: School of Social Work

Abstract:

A decline of resiliency among transition-aged youth has been problematic, since many more college students than in the past come to campus already on medication for mental health challenges. They need good role models who have gone through many life challenges. The Intergenerational Mentor-Up (IMU) program offers valuable opportunities for at-risk college students to help and learn from low-income older adults via panel discussions and student-led tutorials on using Health Information Technology and social networking services.

A student learning outcomes evaluation is implemented to determine the activities’ impact on students’ engagement in learning. The 25-item Resilience Scale measures the degree of individual resilience through five components: equanimity, perseverance, self-reliance, meaningfulness, and existential aloneness (Wagnild & Young, 1993). Our preliminary findings revealed that as a result of IMU, students were able to combined ideas and that levels of active and collaborative learning were enriched by engagement with people representing different economic backgrounds, political views, and religious beliefs (Lee & Kim, 2017). Major themes emerged in students’ narrative data revealed their learning outcomes in the areas of self-awareness, empathy, empowerment, and new perspectives about aging and social connections.

Minimum Qualifications:
A student in the College of Health and Human Survives or related area who has interest in developing Behavioral Health Interventions
Abstract:
Current research on urban school mental health response is broad and often intervention specific. Research currently demonstrates that the response to student mental health may include interventions such as utilization of Key Opinion Leaders to implement School Based Mental Health services (Atkins et al., 2008), partnerships with mental health providers for teacher consulting and coaching (Cappella, Jackson, Bilal, Hamre, & Soule, 2011), using student service learning projects (Wilczenski & Cook, 2009), and consulting with after school programs to address mental health needs of students (Frazier, Cappella, & Atkins, 2007). There is limited research addressing a coordinated response system model for urban schools.

School response to student mental health is a major public health concern in urban schools due to the increased risks associated in urban environments such as trauma, violence, and mental health symptoms. This research project will focus on analyzing collected data from local urban schools regarding implementation of strategies for responding to student mental health issues. The research seeks to understand the current mental health response model being implemented within secondary schools. This study will further the research by identifying patterns and trends among urban schools for response models for student mental health issues. Potential recommendations will be provided based on the results.

Minimum Qualifications:
Undergraduate student pursuing a degree in Social Work
Social Work Honor’s Student
Project Name: Why are there so many immigrants in STEM Degrees and Occupations?

Mentor Name: Martha Cecilia Bottia

Mentor Department: Sociology

Abstract: Increasingly a college degree in Science, Technology, Engineering and Mathematics (STEM) will be necessary for entrance into the most rewarding, high status jobs in the economy. Underserved minority youth, women, and, low income youth are less likely to enter STEM majors. At the same time, immigrant and children of immigrant students are more likely to enter STEM majors. Race, gender and socioeconomic stratification in educational processes and outcomes have been identified as social forces that underlie differences in STEM participation. While there is abundant research that aims to explain why women and underserved minorities are not participating in significant rates in STEM majors and occupations, less research focuses on understanding why immigrant and children of immigrants are more likely to participate in STEM majors and occupations. Prior research reports that immigrant students tend to perform better academically due to their “immigrant optimism” referring to parents of children of immigrants’ higher value of academic achievement and higher expectations for their children. In this research, we aim to understand why immigrants and children of immigrants participate more in STEM. Is their higher participation due to family and/or cultural characteristics, to their levels of academic preparation, to differences in attitudes and self-concept related to STEM? Specifically, we want to identify factors that are related to immigrant student’s higher likelihood of going into STEM. By identifying some of these factors we should be able to provide policy recommendations that help increase the participation of all students (immigrants and non-immigrants) in the STEM fields.

Minimum Qualifications: Ideally some knowledge of quantitative analysis.
Project Name: Cultural mismatch and regional inequality in UNESCO’s World Heritage List

Mentor Name: Vaughn Schmutz

Mentor Department: Sociology

Abstract:
In 1972, UNESCO adopted the Convention concerning the Protection of the World Cultural and Natural Heritage, also called the World Heritage Convention. Among other things, this Convention created a World Heritage List that aims to identify and protect sites of “outstanding universal value” to humanity. Beginning with 12 sites in 1978, the List has rapidly expanded to over a thousand sites of cultural or natural wonder from around the world. To date, 193 countries have agreed to the Convention, making it the most widely ratified UNESCO convention. In previous work on this topic, I have focused on:
1. tracing the institutional foundations of the Convention from 19th century to present
2. linking the Convention to fundamental globalization processes
3. the increasing reliance on scientific criteria to assess cultural heritage sites (e.g. buildings, monuments, art)

This project will build on previous research by focusing on the nomination process for the World Heritage List, which is overseen by an intergovernmental World Heritage Committee and two independent, nongovernmental advisory bodies – the International Union for the Conservation of Nature and Natural Resources (IUCN) and the International Council on Monuments and Sites (ICOMOS). In addition, other intergovernmental organizations (e.g. World Tourism Organization, World Bank) and international non-governmental organizations (INGOs) have shaped the development of world heritage. To understand these changes, this project will focus on the evaluations of the official advisory organizations (IUCN, ICOMOS) as well as the nomination files submitted by nominating countries. It will also help shed light on the unequal global distribution of world heritage sites.

Work on the project involves:
1. Collecting country-level data (international tourism, GDP, etc.)
2. Analyzing site evaluations and nomination files
3. Collecting data on various organizations (INGOs)
4. Collecting data on world heritage sites

Minimum Qualifications:
None, but familiarity with Excel is useful and attention to detail is essential.
Abstract:
Scholars who study reputation in creative industries (e.g. music, literature, film, television) often focus on three types of cultural legitimacy – popular appeal, professional recognition, and critical acclaim. In popular music, sociological research has demonstrated that characteristics of performers (e.g., race, gender, age) shape the types of cultural legitimacy they are likely to achieve. In my own work, for instance, I have found that gender affects the long-term reputation of popular musicians and that music critics often draw on different evaluative criteria in their assessments of male and female musicians. Likewise, my research has found differences in the ways that critics classify the music of white and nonwhite musicians. As a result, female and nonwhite musicians generally struggle to achieve critical acclaim even when they are commercially successful. One explanation for the lack of critical acclaim for female and nonwhite musicians focuses on the prevalence of white men among popular music critics. A second explanation focuses on characteristics of music-producing organizations (i.e., record labels), which can influence the reputation of musicians and their work. From this standpoint, the lack of critical acclaim is explained by the underrepresentation of women and nonwhite musicians at the most prestigious record labels. This project aims to empirically evaluate these two different explanations. Drawing on relevant sociological and organizational theories, this project will consider how racial and gender composition among music critics and at recording firms affects the critical acclaim that musicians accrue.

Work on the project will involve collecting and analyzing a wide range of data, including information about:
1. Record labels (e.g., independent vs. major; geographic location)
2. Music critics
3. Reviews of albums in various media outlets
4. Characteristics of musicians and groups

Minimum Qualifications:
Familiarity with Excel is a plus. Attention to detail is a must.
Abstract:
Americans are bombarded by messages to diet – from diet industry meal providers, diet support groups such as Weight Watchers and Taking Off Pounds Sensibly (TOPS), television personalities, and self-help books such as You: On a Diet and Skinny Bitch. Public health officials argue that Americans’ obsession with dieting media, including shows like Celebrity Fit Club and The Biggest Loser, can and should be used by health care professionals to promote change and influence health behaviors.

The Food Network has taken a special interest in anti-obesity efforts. Not only have they developed and aired shows such as Fat Chef and Childhood Obesity: Danger Zone, but they also have incorporated anti-obesity messaging into multiple episodes of popular shows such as Chopped.

This project seeks to explore the public pedagogy of Chopped from a social justice perspective. How does the show “edutain” us with information about health and wellness? What messages does it send? Does it focus on specific health behaviors? What definition of health is used? Is Chopped a good forum for learning about the connections between weight and health, or does it serve up a losing pedagogy?

Student(s) undertaking this project will identify and watch at least six episodes of Chopped that contain explicit mentions of anti-obesity education, transcribe the episodes, and then work with the mentor to code and analyze the data. Our goal for the summer is to prepare preliminary findings and work toward a presentation at a national conference in academic year 2018-2019.

Minimum Qualifications:
Ideal project for a Scholar in a social science or humanities discipline. Qualifications include: strong communication skills (written/oral), good interpersonal skills, and strong computer skills.
Project Name: Cardiovascular Health and Wellness of Hmong Americans in North Carolina

Mentor Name: Heather Brown

Mentor Department: Women + Girls Research Alliance/Metropolitan Studies and Extended Academic Programs

Abstract:

The Hmong American population in North Carolina is the 4th largest Hmong population in the nation. As economic opportunities become available and similar topography between North Carolina to that of Southeast Asia is a nostalgic draw, the Hmong community in North Carolina is increasing; however, there is limited data to assess the health and well-being of this community. What limited data is available on Asian subgroups has shown that there is an increasing obesity rate associated with other chronic health problems such as cardiovascular disease and diabetes among Hmong Americans. The purpose of this project will be to conduct at least 3 focus groups among Hmong Americans as it relates to cardiovascular risks, and to help identify opportunities to design health promotion and intervention programs for Hmong Americans.

Student(s) will be involved in the strategic planning of the focus groups including logistics for holding focus groups, recruitment of participants, assistance in the development of focus group questions, conducting the focus groups, recording focus group participant responses and analyzing the data for future prevention work within the community.

Minimum Qualifications:

Strong communication skills (written/oral), good interpersonal skills, bilingual in Hmong preferred but not necessary. Ideal for a scholar in sociology, psychology and social science discipline. Travel will be involved for focus group locations in the community. Scholar will work closely with Dr. May Ying Ly.