# List of Faculty CRS Projects for 2017

Abstracts listed in alphabetical order starting with Department and then Faculty name.

<table>
<thead>
<tr>
<th>Department</th>
<th>Page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africana Studies</td>
<td>2</td>
</tr>
<tr>
<td>Anthropology</td>
<td>5</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry</td>
<td>17</td>
</tr>
<tr>
<td>Civil and Environmental Engineering</td>
<td>29</td>
</tr>
<tr>
<td>Computer Science</td>
<td>31</td>
</tr>
<tr>
<td>Criminal Justice and Criminology</td>
<td>35</td>
</tr>
<tr>
<td>Dance</td>
<td>36</td>
</tr>
<tr>
<td>Electrical and Computer Engineering</td>
<td>39</td>
</tr>
<tr>
<td>Engineering Technology and Construction Management</td>
<td>41</td>
</tr>
<tr>
<td>English</td>
<td>47</td>
</tr>
<tr>
<td>Geography and Earth Sciences</td>
<td>51</td>
</tr>
<tr>
<td>History</td>
<td>59</td>
</tr>
<tr>
<td>Kinesiology</td>
<td>64</td>
</tr>
<tr>
<td>Library</td>
<td>65</td>
</tr>
<tr>
<td>Mechanical Engineering and Engineering Science</td>
<td>66</td>
</tr>
<tr>
<td>Physics</td>
<td>75</td>
</tr>
<tr>
<td>Political Science</td>
<td>86</td>
</tr>
<tr>
<td>Psychology</td>
<td>93</td>
</tr>
<tr>
<td>Public Health Sciences</td>
<td>98</td>
</tr>
<tr>
<td>Religious Studies</td>
<td>102</td>
</tr>
<tr>
<td>Social Work</td>
<td>103</td>
</tr>
<tr>
<td>Sociology</td>
<td>104</td>
</tr>
<tr>
<td>Special Education</td>
<td>107</td>
</tr>
<tr>
<td>University Writing Program</td>
<td>108</td>
</tr>
</tbody>
</table>
Project Name: Africana Knowledge in U.S. Universities and the Enjoyment of Cultural Rights

Mentor Name: Danielle N. Boaz

Mentor Department: Africana Studies

Abstract:
Several international human rights treaties guarantee the enjoyment of “cultural rights.” They require signatory states to promote respect for diverse cultural expressions, protect cultural practices that are under threat of extinction, and promote education on diverse cultural perspectives. This research project explores the relationship between cultural rights and university education generally, as well as the specific implementation of treaty obligations related to cultural rights in the United States with respect to persons of African descent, who comprise approximately 12 to 13% of the population.

This study explores whether the current structure of the post-secondary educational system in the United States encourages rigorous academic study of African diaspora culture. It examines the curricula at the top universities in the United States to determine whether departments such as Religious Studies, Art, Dance, and Language feature courses on Africana knowledge, and if so, whether those courses are a component of the required curriculum. It investigates whether classes are specific to one region or cover the entire continent of Africa and/or the African diaspora throughout the Americas. It also examines the educational training and research interests of the individuals offering these courses to assess what percentage of classes are taught by specialists in African diaspora culture. Based on this information, this project will analyze whether structural biases exist in university education that might negatively impact the enjoyment of cultural rights for persons of African descent in the United States.

Minimum Qualifications:
Student should have some background in Africana Studies, international studies, human rights, and/or legal studies.
Project Name: Obeah, Witchcraft, and Vagrancy: Spirituality and Colonial Law in the Atlantic World

Mentor Name: Danielle N. Boaz

Mentor Department: Africana Studies

Abstract:
On both sides of the Atlantic, the British attempted to control the practice of religion, spirituality, and medicine by African people and their descendants, through laws and prosecutions of certain rituals. In Britain’s Caribbean colonies, these practices were proscribed as “obeah” and in the African colonies they were banned as “pretended witchcraft.” This research project is the first comparative study of the proscription and prosecution of African spiritual practices in the Caribbean and Africa. It examines prosecutions for violations of obeah laws in Jamaica and witchcraft statutes in South Africa. The study begins in the 1830s and extends through the 1960s.

This project explores how British colonial policies in the Atlantic world, specifically those regarding African spiritual practices, converged and diverged at various historical junctures. Through the examination of statutes and court cases related to obeah and witchcraft, it engages a number of critical questions such as: To what extent did the British experience with African medico-religious rituals in the Caribbean inform their later decisions to proscribe similar practices in their African colonies? Was there a chronological evolution to British colonial laws against “witchcraft” throughout their empire? Did officials establish a clear boundary between “witchcraft” and “religion” in the colonies and if so, did indigenous African beliefs ever fall under the definition of “religion” across the British Empire?

Minimum Qualifications:
Student should have some background in religious studies, history, Africana Studies, or legal studies.
Project Name: The Color of Water: Race, Environment, and Public Health in Savannah (U.S.) and Matanzas (Cuba), 1865-1914

Mentor Name: Oscar de la Torre

Mentor Department: Africana Studies

Abstract:
This project analyzes how public health policies affected race relations in the cities of Savannah and Matanzas from a comparative perspective. Both cities were important ports exporting plantation crops in the late 1800s, and both of them had large populations of freed people in the same period. According to the existing scholarship, in Latin American countries blacks and whites lived and married together much more often than in the U.S. How did public health and urbanization policies alter, reinforce, or dismiss this pattern? In other words, how did those policies segregate or de-segregate black and white populations in both cities?
The student will work with the mentor in introducing public health data in a database measuring some health indicators by racial group, and we will then work mapping the results.

Minimum Qualifications:
Some experience with Access, SPSS, or Power Map is desirable, but not necessary at all.
Project Name: Understanding Charlotte food systems and security

Mentor Name: Nicole Peterson

Mentor Department: Anthropology

Abstract:
The goal of this project is to understand inequities in the Charlotte food system: why some groups or communities suffer frequent food insecurity (are unable to obtain preferred or healthy foods). Food insecurity is a major factor in several health problems, including diabetes, obesity, and heart disease, but despite vast quantities of food for sale in Charlotte, a large percent of its population is still food insecure. The project thus addresses an important and urgent issue for the health and wellbeing of many Charlotte residents. Using methods of interviews, focus groups, and surveys, students will examine ideas and behaviors related to food purchases and consumption, as well as related issues of transportation, planning, and affordability, to identify why some Charlotte residents find it difficult to provide adequate nutrition for their families. There are several potential areas of focus, including African Americans in the Charlotte area and UNCC students. The students will be exposed to research design, data collection, and data analysis, as well as to the ethics, practices, and concerns of applied anthropologists.

Minimum Qualifications:
Experience with qualitative methods
Abstract: The endosomal system is a highly dynamic and interconnected network of organelles that serves as the focal point for the internalization of cargo at the plasma membrane (Elkin, Lakoduk, & Schmid, 2016). It receives proteins and lipids in the form of small vesicles via the endocytic pathway and these vesicles can undergo homotypic fusion to generate the endosome. The endosome matures by gradually acidifying the fluid within the endosomal lumen, which promotes the dissociation of internalized ligands such as nutrients from their receptors, and promotes molecular sorting reactions that either serve to target molecules into the lysosomal degradation pathway, or export proteins from the endosome and deliver them to other organelles for re-use. Defects in receptor-mediated endocytosis and endosome sorting results in loss of cellular homeostasis and can lead to a multitude of human diseases such as Alzheimer’s, Parkinson’s, cardiovascular disease and cancer (Huotari & Helenius, 2011; Schreij, Fon, & McPherson, 2016). Therefore, understanding the basic mechanisms of the endosomal system is vital to the future treatments of many human diseases. Studies in cultured mammalian cells have provided a description of the temporal and morphological features of the endocytic pathway, but studies in budding yeast, Saccharomyces cerevisiae, have led the way for identifying components of the endosomal trafficking machinery and analysis of the mechanisms of their functions (Chi, Harrison, & Burd, 2015). My lab is currently interested in how the endosome coordinates fusion of vesicles to the endosome. We hypothesize that by using fluorescent alpha-factor, an endocytic cargo protein that is internalized by clathrin-mediated endocytosis and targeted for the lysosomal degradation pathway, as a tool in a novel yeast screen, we may identify components of the PM-endosome vesicle fusion machinery.

Minimum Qualifications: BIOL 3111
Project Name: Inflammation and breast cancer progression

Mentor Name: Didier Dréau, PhD

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 proteins of inflammasomes and their roles 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.
Project Name: The Role of Quorum Sensing in Disease Production by *Salmonella*

Mentor Name: James Oliver

Mentor Department: Biological Sciences

Abstract:

The bacterial pathogen *Salmonella enterica* colonizes agricultural plants and animals, and causes disease when transmitted to human hosts via contaminated food. In humans, *Salmonella* infection causes intestinal distress. This is caused by bacterial penetration of the intestinal tissue, which causes robust inflammation and aids the *Salmonella* population in expanding. To combat disease, we aim to prevent *Salmonella* from invading the intestinal tissue.

The invasion of tissue by *Salmonella* is accomplished by a set of genes that occur together in the *Salmonella* genome. The expression of these genes is tightly controlled. This regulation aims to maximize invasion at the proper location in the intestine. Therefore, these genes are repressed in other locations in response to cues provided by the intestinal tissue.

The signaling cascade that relays these cues is unknown. However, a potential mechanism by which *Salmonella* senses its environment is by quorum sensing. Quorum sensing is a system of communication that allows bacteria to coordinate many actions in response to neighboring bacterial populations or environmental conditions. Typically, a small quorum sensing molecule is secreted by bacteria, and when the molecule reaches a threshold concentration, the bacterial community responds in a coordinated fashion. *Salmonella* are capable of sensing such molecules, but do not produce any themselves. Instead, it is likely that the ability to sense these molecules allows *Salmonella* to respond to cues produced by other bacteria in the gut. Such signal molecules are likely to occur in the host intestinal tract, and may provide signals to aid *Salmonella* in timing and coordinating invasion.

In this project, the Research Scholar will construct mutants of *Salmonella* lacking the genes required for quorum sensing. He or she will then determine if these mutants are unable to respond to environmental signals that influence virulence gene expression. This project will involve bacterial genetic manipulation, general microbiology skills, molecular biology, enzymatic assays, and fluorescent reporter analysis. The research scholar will also learn how to design experiments, interpret results, analyze data, and present findings.

Minimum Qualifications:

Candidate must have completed Microbiology lab to be considered.
Project Name: Methods for genetic manipulation of *Vibrio vulnificus* to study the viable but nonculturable dormancy state.

Mentor Name: James D. Oliver

Mentor Department: Department of Biological Sciences

Abstract:

*V. vulnificus* is an estuarine bacterium that naturally occurs in estuaries and coastal waters worldwide and associates with a variety of aquatic organisms including shellfish, such as clams and oysters. Human infections can occur when individuals consume raw or undercooked shellfish, causing potentially fatal foodborne disease in susceptible individuals (50% mortality rate). This pathogen is also responsible for potentially fatal wound infections (ca. 20% mortality rate) in individuals who contract the bacterium through a skin lesion. When environmental conditions are not ideal, this bacterium is thought to exist in a dormancy state referred to as the viable but non-culturable (VBNC) state in which cells transiently cease growth and repress metabolic activities. Once environmental conditions become permissible, VBNC cells can resume normal metabolic functions and growth through a mechanism referred to as resuscitation. This mechanism of dormancy represents an important survival strategy for bacteria, and is thought to be important for *V. vulnificus* persistence in the environment. The VBNC state has been described in a number of prevalent human pathogens, and due to the cessation of growth, these populations fail to grow on routine culture media, thereby escaping detection using traditional cultivation techniques. The inability to detect pathogenic populations in environmental samples presents a significant public health hazard, yet little is known regarding the molecular mechanisms facilitating entry into and resuscitation from this dormancy state.

Our lab recently performed temporal transcriptomics on *V. vulnificus* to identify candidate genes involved in VBNC dynamics. The Oliver Lab is looking for a student to work with Postdoctoral Research Associate, Tiffany C. Williams, who will help develop methods for creating genetic mutants of *Vibrio vulnificus* in order to knockout candidate genes involved in VBNC cell formation and resuscitation. Subsequently, the effect of these mutations on VBNC dynamics will be investigated.

Minimum Qualifications:

A background in Microbiology and/or Molecular Biology is preferred.
Project Name: Urban Microbial Ecology

Mentor Name: Molly Redmond

Mentor Department: Biological Sciences

Abstract:
In collaboration with the Department of Bioinformatics and Genomics, we are studying microbial communities in urban streams and wastewater treatment facilities. A major focus of this project is tracking antibiotic resistance in these environments, but we are also interested in biodegradation of pollutants and microbial community dynamics. Depending on the interests and background of the student, this project can involve environmental sampling, culturing of microorganisms in the lab, DNA sequencing, and analysis of sequence data.

Minimum Qualifications:
Biology or other science major. Having taken a microbiology or bioinformatics course is a plus, but not required.
2017 Charlotte Research Scholars  
Research Project Submission

Project Name: Diversity and Function of Bacteria Associated with Sea Urchins
Mentor Name: Dr. Adam Reitzel
Mentor Department: Department of Biological Sciences

Abstract:
Animals live in a bacterial world and many essential processes in animals (digestion, development, health) are intricately influenced by our prokaryote partners. Sea urchins, bottom-dwelling invertebrates found across the globe, produce swimming larvae that often face extensive periods of starvation. To combat this stress, urchin larvae drastically reconstruct physical attributes that aid in maximizing feeding efficiency. Using *Lytechinus variegatus*, an urchin found off the coast of North Carolina, this project will investigate the role bacteria play in mediating this phenomenon. An interested student would join a graduate student in the Department of Biological Sciences (Tyler Carrier) in fieldwork rearing sea urchin larvae at the Duke Marine Laboratory. These samples will be then be used for extracting DNA and the PCR amplification of a molecular fingerprint, the 16s rRNA gene, to taxonomically identify larval-associated bacteria. Finally, this project will use a series of computer programs to bioinformatically analyze these DNA sequence to identify what bacterial species are associated with these larvae and their potential functions in limiting the effects of starvation in this important economical and ecologic species.

Minimum Qualifications:
The proposed research will involve conducting research on the coast, so a student would need to be available to leave Charlotte for periods of time. Previous experience with molecular biology (PCR) would be a benefit but not a requirement.
Project Name: Formation and Regulation of Symbiosis with Venomous Animals

Mentor Name: Dr. Adam Reitzel

Mentor Department: Department of Biological Sciences

Abstract:
In the world’s oceans, sea anemones have formed dynamic and, in some cases, bizarre symbiotic associations with other animals. These partnerships are unique to just a few lineages in the animal world and are important components of ecosystems. Mechanisms regarding how this symbiotic relationship is established and maintained are poorly understood, especially among the larger sea anemone ectosymbionts (clownfishes, shrimps, and crabs). We are interested in better understanding this dynamic interaction at the molecular level, coupling behavioral observations and life history characteristics with differential gene expression analyses. This symbiotic interaction is truly unique as sea anemones are the only venomous animals that live in close association with symbionts that would otherwise be considered food. As a summer undergraduate researcher through the Charlotte Research Scholars program you will be involved in a project that identifies molecular mechanisms influencing nutrient exchange and the coevolution of venom. Interested students will have the opportunity to work on a multi-institutional collaboration using laboratory techniques at UNC Charlotte along with study animals in aquarium at the Discovery Place Museum, located in downtown Charlotte. Students asking scientific questions about these dynamic interactions and also interested in learning about (or being trained in) aquarium husbandry should apply.

Minimum Qualifications:
The proposed research will involve setting up and running experiments at UNC Charlotte and Discovery Place, which requires reliable transportation to travel between these two locations (although not always in the same day).
Abstract:
Epithelial ovarian cancer (EOC) is responsible for an estimated 21,800 new cases and 14,000 deaths each year. Overall, patients have a five-year survival rate of 30%-40%. The primary option of treatment is often invasive surgery and adjuvant chemotherapy with cisplatin and taxane (Paclitaxel) that lead to multiple systemic side effects and toxicity, limiting the doses physicians can use. Up to 80% of patients will eventually relapse and become platinum-taxane resistant. Recurrence is linked to survival of local tumor stem cells surviving first line of therapy. Development of targeted therapies to selectively deliver chemotherapeutic agents to tumor cells without damaging neighboring unaffected cells would lead to higher effective local doses. Higher effective local doses may increase initial therapy success and reduce relapse. This exploratory proposal will characterize single-stranded DNA aptamers previously identified in a Cell-SELEX screen that we hypothesize will selectively identify, associate with, and internalize into EOC cells but not other cells both in cultured cell lines and in an orthotopic ovarian tumor mouse model. We also hypothesize that these aptamers can be utilized to enhance delivery of chemotherapeutics into EOC cells both in cultured cell lines and in an orthotopic ovarian tumor mouse model. Conjugation of the aptamers to polymer nanoparticles loaded with paclitaxel will be assessed for potential to promote in vivo targeting of platinum-based chemotherapeutics directly to tumor cells. In addition to potential translational outcomes, our studies will increase our understanding of the basic biologic characteristics of individual epithelial ovarian tumor cell membranes, aptamer association and internalization, and cellular response to aptamers and nanoparticles. Overall, this proposal will provide a significant exploratory data to justify future translational studies using these aptamers in EOC diagnostics and treatment.
Project Name: **Morphometric analysis of the threatened Diana fritillary butterfly, Speyeria diana**

Mentor Name: Dr. Carrie Wells

Mentor Department: Department of Biological Sciences

Abstract:

Wings are a key character in butterfly species that largely reflect their behavior and ecological roles. Wing shape also varies within species and can be used as a character to measure individual butterfly and population-level differences in adult forms. I am proposing a Research Scholars study that examines wing morphology in the threatened Diana fritillary butterfly, *Speyeria diana*. Previous students and myself have photographed hundreds of *S. diana* museum specimens from museums in North America and Europe in order to digitize the data in order to compare wing shape and size across space and time. Many of these specimens were simultaneously sampled for DNA through the removal of a single tarsus. The goal of this research project is to digitize these photographs and statistically compare patterns in genotypic and phenotypic variation in this species through space and time. Results from this study will be used to understand and explain the range collapse documented in this species through my PhD Dissertation at Clemson University in 2014. Our results will also be used to inform future conservation planning for this species.

Minimum Qualifications:
The mentee that I am specifically requesting for this project is Ms. Arryn Munn, an advisee and Undergraduate research student of mine who is a senior in the Department of Biological Sciences with a GPA 4.0.
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., 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 in the Department of Biological Sciences have demonstrated that APE2 is required for the ATR-Chk1 checkpoint signaling (Willis, et al., 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., PNAS, 2016). With the ongoing project, we plan to further investigate the molecular mechanisms of how DNA damage response is regulated in oxidative stress. The expected findings from this research project will help to better understand how cancer and neuropsychological disorders develop and open new avenues to therapeutic strategies. 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: Lipid vesicles for efficient delivery of functional RNA nanoparticles designed against metastatic melanoma

Mentor Name: Kirill Afonin

Mentor Department: Chemistry

Abstract:
Melanoma is the deadliest form of skin cancer, with 73,870 new cases and 9,940 deaths from this disease in 2015 in the United States alone, according to the National Cancer Institute. Conventional cancer therapies, including surgical intervention, radiotherapy and chemotherapy, are not consistently effective or efficient in treating melanomas, often allowing the disease to quickly reoccur. Innovative combinatorial approaches are critically needed to treat this aggressive disease. The development of nanotechnology has introduced the application of multifunctional nanoparticles designed to elongate the circulation time and improve the accumulation of drugs in tumor tissues based on surface modification, enhanced permeation, and retention effect. Our project will use biocompatible bolaamphiphile vesicles and RNA nanoparticles for controlled formulation and delivery of therapeutic siRNAs against metastatic melanoma. These novel formulations have never been tested before. The benefit of using RNA nanotechnology for targeted delivery of siRNAs is that the physicochemical properties of nanoparticles, such as size, charge, and hydrophobicity, may be tuned to reduce or eliminate undesirable effects and to improve desirable ones.

Minimum Qualifications:
The candidate should have a strong background in common laboratory techniques: PCR, in vitro transcription, gel electrophoresis, cell culture, transfections, flow cytometry, etc, and should preferably have some experience in working with nucleic acids-based assemblies and with human blood.
2017 Charlotte Research Scholars
Research Project Submission

Project Name: Dual Cluster Frameworks as Potential Hydrodesulfurization (HDS) Catalysts
Mentor Name: Christopher Bejger
Mentor Department: Chemistry

Abstract:

Improving the catalytic hydrodesulfurization (HDS) process remains a significant focus of petroleum research as global regulators seek to limit sulfur content in diesel fuels. Industrial HDS catalysts are made from the transition metal chalcogenide molybdenum disulfide (MoS$_2$). While the exact catalytic mechanism remains unknown, it has been shown that increased surface area of MoS$_2$ edge-sites could lead to more efficient removal of sulfur from crude petroleum feedstocks and fuels. Here, we propose a new class of synthetic porous frameworks comprised of metal chalcogenide molecular clusters (MCMCs). These MCMC building blocks are effectively small, soluble, metal-chalcogenide particles with comparable composition and structure to bulk MoS$_2$. Our strategy is to use functionalized phosphine ligands to incorporate these metal-chalcogenide particles into metal organic frameworks (MOFs). The resulting materials will share features of both conventional bulk MoS$_2$ and porous crystalline MOFs. We will incorporate many different stoichiometric and structural combinations of metal-chalcogenide clusters to create hybrid organic-inorganic frameworks with various geometries and porosities. This will allow us to rationally tune the composition and surface area of our materials to increase exposure of metal-chalcogenide edge site mimics. Results from this study will provide a new class of materials to investigate as potential HDS catalysts.

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: 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: Exploring the Light-Harvesting Potential of Colloidal Quantum Dots

Mentor Name: Marcus Jones

Mentor Department: Chemistry

Abstract:
In less than one hour, enough solar energy is absorbed by Earth’s atmosphere, oceans and land masses to match the total amount of energy consumed by humans in one year. Such a vast energy resource has stimulated a tremendous impetus to develop efficient light harvesting technologies. In recent years, there has been a growing interest in the development of solar cells that are made out of nano-sized semiconductor building blocks called quantum dots. These materials have the remarkable property that their band gap (and hence their color) can be tuned by simply changing particle size and shape. This means that we can easily tune their properties to match desired device characteristics. Furthermore, quantum dots are resistant to degradation by long term solar exposure; their syntheses are straightforward and robust with good size and shape selectivity; and they can support multiexcited electronic states that could potentially revolutionize the efficiency of next generation solar cells.

Of course, we cannot make a solar cell from a single quantum dot! Therefore, we are learning how to assemble macroscopic devices from these nanoscale building blocks while simultaneously controlling interparticle interactions and maximizing device efficiencies. In the Nanoscale Dynamics Group we are interested in the fundamental processes that control the way that quantum dots interact with their surroundings. We use a combination of particle synthesis and optical spectroscopy to unravel the complex ways that energy and charge can be transferred between quantum dots and surrounding molecules. These studies are ultimately driving the development of new quantum dot materials with greatly improved light harvesting characteristics which could ultimately revolutionize the way we generate energy sustainably.

Minimum Qualifications:
Applicants should have passed General Chemistry I and II (CHEM 1251 and CHEM 1252). The only other requirements are passion, enthusiasm and an eagerness to learn about these exciting materials!
Project Name: New Materials for Sustainable Energy Storage

Mentor Name: Jordan Poler

Mentor Department: Chemistry

Abstract:
This project is a fundamental study of supramolecular interactions between spectroelectrochemically active, coordination complexes, and single walled carbon nanotubes (SWCNTs). This research will develop a fundamental understanding of supramolecular-nanoparticle interactions. The intellectual merit of this goal is central to the field of nanoscale science, as highlighted by a recent review of our work in Chem. Soc. Rev. (2010). We are competitively positioned to accomplish our proposed project due to our previous work in this area, expertise on these systems, and recent additions to our experimental facilities. Last year Dylan Brokaw was a CRS Scholar in my group. His work led to our recent publication: Nathan Behm, Dylan Brokaw, Colton Overson, Derek Peloquin, and Jordan C. Poler, “High throughput microwave synthesis and characterization of NiO nanoplates for supercapacitor devices” J. Materials Science, Online First 2012 DOI: 10.1007/s10853-012-6929-6. To make renewable energy technologies truly sustainable we must also incorporate efficient energy storage strategies. This project focuses on methods and materials that can store and transport electrical energy. These materials are safe, lightweight, low cost, and use sustainable earth abundant materials. This project will broadly affect new methods of assembling, processing, and manipulating nanoscale materials such as SWCNTs and metallic NPs. Better control over nanoparticle position, orientation, and topology should lead to optimized performance of new photovoltaic devices, structural materials, and supercapacitor energy storage cells. Our latest publication, J.R. Alston, D.J. Banks, C. X. McNeill, J. B. Mitchell, L. D. Popov, I. N. Shcherbakov, and J. C. Poler* “Adsorption studies of divalent, dinuclear coordination complexes as molecular spacers on SWCNTs” Phys. Chem. Chem. Phys. 2015 17, 29566 – 29573 10.1039/c5cp05419b, featured several UNC Charlotte undergradauate researchers as co-authors.

Minimum Qualifications:
Student must be interested, curious, ethical, and willing to work hard. I can teach them the rest. Background in Chemistry or Physics is preferred.
Project Name: Reactivity of heterocyclic thione and selone complexes of gold

Mentor Name: Daniel Rabinovich

Mentor Department: Chemistry

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 formula (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 next stage in the development of this project entails a survey of the reactivity of these complexes, with the goal of preparing species that may possess interesting catalytic or optoelectronic properties. For example, target molecules include hydroxide, hydride, thiolate, and dithiocarbamate derivatives, all of which would be unprecedented in the context of the thione and selone chemistry of the coinage metals. 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: New fluorescent dyes for OLED applications

Mentor Name: Tom Schmedake

Mentor Department: Chemistry

Abstract:
Organic light emitting diodes (OLEDs) are attractive as efficient, flexible, and low-cost light sources. Traditional OLEDs are limited to a maximum 25% efficiency due to restrictions imposed by quantum mechanics. Luckily, several strategies for increasing the efficiency of OLEDs by harvesting some of the wasted energy (triplet excitons) have been proposed. This summer we will work on synthesizing fluorescent dyes that are expected to recover and emit some of the energy lost to triplet excitons. The CRS student will synthesize new complexes, characterize their solution and solid-state properties, and ultimately incorporate the dyes into a functioning OLED device for testing.

Minimum Qualifications:
CHEM 1252 and 1252L
CHEM 2132 and 2132L
Project Name: Biosynthesis of complex bacterial polysaccharides

Mentor Name: Jerry M Troutman

Mentor Department: Chemistry

Abstract:
Bacterial capsular polysaccharides coat the surface of bacteria and are critical to host immune system evasion. How bacteria build these complex polymers is poorly understood, yet the enzymes responsible for forming these materials are excellent potential antibiotic targets. Our group focuses on reconstructing the biosynthesis of bacterial capsules, to both understand the enzymology behind the production of this important biomaterial and characterize potential antibiotic targets.

Minimum Qualifications:
CHEM 1251 and 1252
CHEM 2131
Project Name: Nanoparticles for Gene Delivery

Mentor Name: Juan Vivero-Escoto

Mentor Department: Chemistry

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 an 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 used 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 at least one semester of hands-on research experience and completed CHEM 2132 with a grade of B or above.
Project Name: Solution Processable Porphyrin Light-Harvesting Systems for Organic Solar Cells

Mentor Name: Dr. 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 Thiazolothiazole Porphyrins

Mentor Name: Dr. 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 porphyrin dyad systems that will be used as the light absorber in an organic solar cell. 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 porphyrin dyads using molecular mechanics followed by higher-level density functional theory calculations. The student working on this project will prepare solutions of both individual porphyrin 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 as it is incorporated into a bulk heterojunction organic solar cell.

Minimum Qualifications:
1 yr. general chemistry
Project Name: Solar Water Splitting with Earth-Abundant Catalysts

Mentor Name: Dr. 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: Response of antibiotic resistant bacteria isolated from wastewater plant towards nanoparticles

Mentor Name: Mariya Munir

Mentor Department: Civil and Environmental Engineering

Abstract:

Antibiotic resistant bacteria and genes have been of the emerging contaminant threatening human health. The overuse of antibiotics, both in human patients and, importantly, in livestock, has led to an explosion of antibiotic-resistant bacteria, both in the U.S. and around the world. New strategies to overcome antibiotic resistance are being attempted and one of these strategies is to use nanoparticles to reduce resistance. Iron oxide nanoparticles have been previously successfully tested to show decreased antibiotic resistance in mycobacteria\(^1\). In this project we will study the response of antibiotic resistant bacteria isolated from wastewater plant towards nanoparticles. This project will (1) collect samples and isolate multidrug resistant bacteria and run molecular tests to identify the resistance genes (2) assess impact of nanoparticles on these resistant bacteria and (3) perform data analysis for possible correlation. The student will learn basic microbiological techniques used to identify emerging contaminants plus an opportunity to learn and implement bioinformatics tools using next generation sequencing techniques.

Reference:

Project Name: Disinfection Byproduct Formation Control and Removal

Mentor Name: Mei Sun

Mentor Department: Civil and Environmental Engineering

Abstract:
Disinfection of drinking water is essential for protecting the public from waterborne diseases. However, carcinogens disinfection byproducts (DBPs) are generated when disinfectants react with halide ions (e.g. bromide) and dissolved organic matter. The goal of this research is to explore solutions to reduce the risk associated with DBPs in drinking water. Two directions are available to achieve the goal for interested students to pick.

DBP formation control in water treatment plants: Bromide can increase the rate and yield of DBP formation, and result in the formation of DBP species with higher toxicity. In 2014-2015, bromide was discharged in Charlotte’s drinking water source from power plants, and elevated levels of DBPs ended up in local drinking water. Similar situations were observed in other parts of NC and across US. Thus, bromide removal is essential to improve drinking water quality. An ion exchange resin is found highly affinitive for bromide and thus can be used for bromide removal. Research objectives are to evaluate factors that control the performance of this resin for bromide removal, and develop resin regeneration strategies for long-term bromide control.

DBP removal at the consumers’ taps: point-of-use water filters capable of degrading DBPs will be explored under this direction. Specifically, activated carbon (AC) will be used to pack such water filters, and metal reductants and catalysts will be doped into AC. The AC adsorbs DBPs and provides DBP-free water for immediate consumption, while the adsorbed DBPs can be degraded by the metals. This project will be a proof of concept study to identify suitable catalysts and reductants for DBP degradation. The undergraduate researcher will prepare and characterize different types of metal-doped AC, and explore the effectiveness of DBP degradation by the metal-doped AC.

This study will lead to innovative approaches to improve drinking water quality and protect public health from been exposed to carcinogenic DBPs. Through this project, the student will become familiar with water treatment technologies and drinking water quality standards. This research will introduce the student to good laboratory practice, environmental chemistry concepts, skills for data analysis and interpretation, as well as documentation and presentation.

Minimum Qualifications:
Have taken the course of Introduction to Environmental Engineering and have a grade of B or higher, or have the basic understand of water and wastewater treatment processes.
Project Name: Cloud Mining
Mentor Name: Mohsen Dorodchi
Mentor Department: Computer Science

Abstract:
Cloud application development requires special platforms and tools. In this research project, a few tools will be used to collect live data from the many different resources of the cloud. The collected data will then be processed further and stored into databases. The data will be visualized in near-real-time reflecting on the research activities. Sample activities will be related to software engineering and development. The research includes machine learning and text/data mining.

Minimum Qualifications:
1. Junior standing in computer science in Fall 2017
Project Name: Automated Multiple Object Tracking in Video

Mentor Name: Min C. Shin

Mentor Department: Computer Science

Abstract:
Cameras are everywhere capturing incredible amount of videos. Videos could provide in-depth understanding in many applications including sports and biological motions. We will develop an automated method for robustly tracking multiple objects.

Minimum Qualifications:
Linear algebra, probability and statistics, solid programming skills
Project Name: Interactive Visualization of Data Structures and Algorithms for Educational Applications.

Mentor Name: Dr. Kalpathi Subramanian, Jamie Payton

Mentor Department: Computer Science

Abstract:
This project will contribute to an ongoing NSF funded project on improving retention of Computer Science majors. The project aims to bring in real-world data into classroom projects in courses relating to data structures and algorithms. A part of this project involves developing compelling visualizations that are the output of typical problems handled in these fundamental courses. The visualizations will be performed using web based tools, making them available for easy publication/dissemination by the students.

Minimum Qualifications:
Strong computer science background, especially in data structures and algorithms. D3 toolkit will be used for visualization. Knowledge of javascript will be a plus.
Project Name: Interactive Textbook for Foundational Concepts in Algorithms and Data Structures

Mentor Name: Dr. Kalpathi Subramanian

Mentor Department: Computer Science

Abstract:
The goal of this project is to replace or augment typical textbook reading to reinforce course lecture material. The goal is to build interactive homework modules that are highly appealing and that target specific learning goals, 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 join other students on similar projects.

Minimum Qualifications:
Strong computer science background, especially in data structures and algorithms. D3 toolkit will be used for visualization. Knowledge of javascript will be a plus.
Project Name: An Application of the Research Literature to a Case of Serial Murder

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.

Minimum Qualifications:
Rising seniors or seniors only.
Project Name: Breaking with Tradition: Critical Approaches to Ballet Pedagogy

Mentor Name: Gretchen Alterowitz

Mentor Department: Dance

Abstract:

Dance lives at the site of the human body. Dance educators and practitioners use our bodies to work through and shape ideas around issues such as identity, representation, relationships, communication, and politics. Attendant body narratives of gender, sexuality, race, ability, etc. are automatically present in any dance-related activity. One cannot teach or take a dance class, or make or watch a dance performance, without being faced with dancing bodies representing and enacting these narratives. How educators teach about, and make room for, a diversity of bodies and ideas about bodies in our classrooms, will affect how our students think about and use their bodies and presences in situations both in and beyond dance.

In spite of this potential, the dance field often remains committed to systems that hinder change. Classical ballet in particular has been evaluated as overly traditional – too entrenched in its structures and philosophies to evolve significantly in relation to the changing world. Critiques have been aimed at ballet’s exclusive and hierarchical values that have: perpetuated heteronormative and male-dominated practices on stage and off, prevented the genre from diversifying in terms of racial and ethnic representation, and normalized pedagogies that maintain the status quo.

Ballet’s defining features are enmeshed with hierarchical and elitist beliefs, and those values are taught intrinsically as the movement technique itself is taught. Ballet educators interested in challenging these philosophies find themselves in a bind – how do we teach ballet technique without reinforcing and advancing these systems? How can our teaching both impart ballet’s theories and movement concepts, and also reflect and engage with current critical discourse that rejects some of ballet’s most essential qualities?

My research focuses on how critical pedagogical practices challenge ballet’s traditional values. The questions mentioned above will structure this research project, as we examine current ballet teaching approaches to determine if and how changes are occurring in the field. We will also study critical teaching methods to learn how to create diverse and inclusive learning environments that value a variety of experiences and ways of being.

Minimum Qualifications:

Knowledge of ballet terminology and class structure; knowledge of educational approaches in dance; interest in critical and feminist theory, interest in women’s and gender studies.
Project Name: Modern dance reconstruction, documentation and archive

Mentor Name: Kim Jones

Mentor Department: Dance

Abstract:

This research project seeks to work on a development of researching, documenting, and archiving and presenting lost modern dances of the twentieth century. As we move into the twenty-first century there is concern among, scholars, critics, dance companies and the public about revitalizing and preserving the “lost’ dances that revolutionized the art-form modern dance. I had the good fortune to meet the only survivor of Cho Seung-hee’s legacy in South Korea. Ms. Kim Yeong-Sun last summer who escaped North Korea 15 years ago. She holds the legacy of "lost" works of Korea's first modern dancer under the occupation of Japan. The objective of this research is to collect, assemble and archive the evidence found to reconstruct and write about Choi’s lost choreographic work last performed in the 1950's

The research will require the undergraduate student to research documents, videos, notation scores, and photographic and audio evidence of Choi’s dance. Locating and contacting any other individuals who had first-hand experience with the choreographer. The student will research the best way to document and archive all found artifacts for my research. My goal is to reconstruct and publish my research from a raw state to a performance-ready work.

Dance reconstructions of a “lost work(s)” will not only develop in my research but also in my course work of dance history, technique, performance practice, research and critical analysis skills.

Minimum Qualifications:

Well organized, independent creative thinker, flexible with ideas, communicative, knowledge of American modern dance, modern terminology, interest in dance reconstruction.
**Project Name:**  *Shouting Echos: Reconstructing and Reevaluating African American Ring Shout Tradition*

**Mentor Name:** Tamara Williams

**Mentor Department:** Dance

**Abstract:**
Systematic investigation and analysis of spiritual dances of the African Diaspora is my current research agenda. The Ring Shout is a religious dance brought to the Sea Islands (Carolinas and Georgia) from the Angola (or Gullah) people of Africa. It was the method used by slaves to continue practicing their religious culture from their motherland. The Ring Shout birthed old spirituals which acted as messages for slaves to survive and try to escape to freedom. It is this aspect of the daily cultural life of the enslaved people that acted as a means of survival and resistance in African American tradition. I am interested in analyzing history, movement patterns, rhythms, gestures, songs, context, environment and the symbology of the Ring Shout dances to create a formulated dance technique that highlights the authentic movement of Ring Shout stemming from the Yoruba, Angola and Akan cultures of West Africa. Research will call for a reconstruction of the earliest recorded dances of the Ring Shout as a means to preserve the original movement and gestures of the tradition. 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 earlier documented materials regarding Ring Shout tradition and early African American culture is essential to Ring Shout investigation.

Ring Shout was one of the first forms of dance for social justice in the United States. Gospel spirituals, songs, and dances emerged from this tradition which allowed enslaved people to persevere through destitute times and even escape. I am interested in comparing the Ring Shout as method of reform and social justice to the current events of black lives and dance as a form of social justice.

**Minimum Qualifications:**
Prior studies in African Diaspora dance forms, Africana Studies, or Civil Rights is recommended.
Project Name: Development of a Humanoid Robot

Mentor Name: James M. Conrad

Mentor Department: Electrical and Computer Engineering

Abstract:
The scholar will work printing humanoid robot parts on a 3D printer and programming Raspberry Pi and Arduino computer boards. The humanoid robot has cameras and uses image processing to recognize people, and has motor control electronics to move its head, arms and hands. The robot currently has one arm and hand operational, so the scholar will build and get the other arm and waist operational.

Minimum Qualifications:
Open to any engineering or computer science student with microcontroller programming experience.

Helpful: 3D printing experience.
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: Evaluation of Air Void System of Concrete Using Image Analysis

Mentor Name: Tara Cavalline

Mentor Department: Engineering Technology and Construction Management

Abstract:
To provide durable and long-life infrastructure, concrete exposed to moisture and cold temperatures should be designed and constructed to have an air void system with characteristics that support relief of stresses caused by freezing and thawing. These characteristics include the appropriate total volume of air as well as adequate spacing of the air voids composing the system. Conventional microscopic means of evaluating the hardened air void system of concrete are time consuming and should be performed by an experienced technician. Recent advances in microscopy and image analysis allow for measurement of the air void system characteristics in a manner that rapid and reliable. For this project, the student will work to finalize and validate an image analysis procedure to evaluate the hardened air void system of concrete. For a variety of concrete mixtures, results will be compared to tests obtained using state-of-the-art concrete fresh property test equipment, as well as by conventional microscopic analysis methods. The findings will help support implementation of new technologies to support construction of more durable concrete infrastructure.

Minimum Qualifications:
Currently enrolled as a Civil Engineering Technology or Construction Management student in the Department of Engineering Technology and Construction Management
Project Name: Contract-Performance Engineering: Integrated Design of Contract Terms and Systems

Mentor Name: Navid Goudarzi

Mentor Department: Engineering Technology and Construction Management

Abstract:
Complex mission, infrastructure and safety-critical systems are shifting away from traditional contract mechanisms of fixed-price followed by the purchase of support. Newer performance-based contracts are growing in popularity for governmental and non-governmental acquisitions of critical systems, such as for energy, defense, transportation and healthcare. These contracts allow the customer to buy the system performance rather than to purchase the product itself, or to buy availability rather than to pay for maintenance. Performance contracts are not warranties, lease agreements, or maintenance contracts, which are all break-fix guarantees; rather, these contracts are highly quantified "satisfaction guaranteed" contracts where "satisfaction" is a combination of outcomes received from the product, usually articulated as a time (e.g., operational availability), usage measure (e.g., miles), or energy-based availability. Performance-based contracts (also called outcome-based contracts) can take different forms where the particular performance that the contract specifies distinguishes the contract mechanism, e.g., performance-based logistics (PBL), public-private partnerships (PPPs), and power purchase agreements (PPAs). Unfortunately, the contract design itself is almost always performed separate from the engineering design process and provided as a requirement to the engineering design process. This project focuses on fundamental research towards the integration of the contract and system design for systems that are subject to performance-based contracts. Such an integrated approach has clear societal benefits since contract failure may mean hundreds of millions of dollars spent by the public for either no outcome or inadequate outcome, or result in the contractor being driven out of business, which can lead to disaster for all parties involved including the public.

This research approaches contract design as a system design problem where the process of designing contractual terms that address performance metrics, the payment model, and performance assessment, represents a multidisciplinary design process that can be integrated into the broader engineering design process. The development of a new methodology will be explored that uses the customer and contractor goals as an input for determining the contractual and engineering design terms using principal-agent and contract theory to factor in incentives and information asymmetry. As a concrete case study, the research team will study PPA contracts for wind farms with multiple design parameters within a stochastic energy-price environment and uncertain wind profile.

Minimum Qualifications:
- UNCC undergraduates that will return in Fall 2017 with Senior standing in Mechanical Engineering, System Engineering, Civil Engineering, Economics, or similar fields,
- Minimum GPA of 3.0,
- Excellent verbal and written communication skills in English,
- Experience in programming language (e.g. MATLAB, Fortran, C/C++)
- Experience in contract design parameters (e.g. inflation rate, WACC, value of money, etc.), and
- Experience in supply chain management, procurement, and life-cycle cost analysis (e.g. related courses in these areas.).
Project Name: Onshore/Offshore Wind Resource Assessment Analysis

Mentor Name: Navid Goudarzi

Mentor Department: Engineering Technology and Construction Management

Abstract:
While regional wind resource maps for residential power generation provide a model derived prediction of annual mean wind speed distribution, the impact of local terrain, vegetation, and related impacts on local atmospheric circulations are not accounted for given its limited spatial and temporal resolution. Further studies of such features are necessary for an accurate wind resource assessment. To help improve knowledge of the spatial and seasonal variability in potential wind power generation across the Metropolitan Baltimore area, Maryland-USA, statistical data of five-year wind speed measurements from 2009 to 2013 at University of Maryland, Baltimore County (UMBC), Padonia, and Essex are used. The Weibull probability distribution function is fitted to monthly measured wind speed data, to obtain the available mean wind power density in this area. Results demonstrate the highest and lowest wind power density for all three sites occurred in February and August, respectively, in line with position of the mid-latitude storm track. Wind speeds, wind power and energy density are highest at UMBC. Despite seasonal and spatial variability in the wind resource, annual mean wind speed for all sites are less than the 3 m/s, suggesting the region is not suitable for large-scale residential power generation. However, it does display a wind power capacity that might allow for non-grid connected and mechanical applications. Hence, a number of wind harnessing technologies that offer a cost-effective solution at an expanded range of operation and structural integration are introduced.
During the CRS summer program, this methodology will be reviewed and a MATLAB code, as a strong toolkit to conduct similar studies in different regions and for different renewable energy sources will be developed and tested.

Minimum Qualifications:
- UNCC undergraduates that will return in Fall 2017 with Senior standing in Mechanical Engineering, Civil Engineering, Physics, or similar fields,
- Minimum GPA of 3.0,
- Excellent verbal and written communication skills in English,
- Experience in programming language (e.g. MATLAB, Fortran, C/C++), and
- Experience in renewable energy systems analysis (e.g. related courses in this area).
Abstract:
Health and environmental consequences of conventional fossil fuels are drawing more interest in expanding the use of renewable energy sources. The primary challenges in supplying the required electricity from wind are the variability, uncertainty, and the cost of electric power generation. An earlier work presented the results of system concept tradeoffs using one-year wind/load data from Pennsylvania New Jersey Maryland (PJM) Interconnection LLC. While the one-year results showed a wind plus natural gas system can reduce emission as much as 50% below that of an all-natural gas system with only a modest increase in generation cost, typical power system modeling extends to three years. In this work, the developed model is employed to estimate the magnitude of cost versus emission performance using three-year wind/load data at PJM region, using cost estimations published by the Energy Information Agency. The year to year variation and the stability of the curtailment curves are studied and compared with each other. Also, the curtailment curve obtained from multiple years wind/load data is compared with that from one year to see whether averaging multiple years is useful. Finally, transmission and grid-scale storage parameter variations, namely the storage capacity, capacity cost, and efficiency are studied to estimate the system cost with storage as a function of emission levels. A main conclusion is that the cost-performance curve “hockey sticks”, high emission reduction comes at high cost.
During the CRS summer program, this methodology will be reviewed and a MATLAB code, as a strong toolkit to conduct similar studies in different regions and for different renewable energy sources will be developed and tested. Also, the storage and transmission scenarios will be added to the developed code to more accurately estimate the Levelized cost of energy.

Minimum Qualifications:
- UNCC undergraduates that will return in Fall 2017 with Senior standing in Mechanical Engineering, Civil Engineering, Economics, or similar fields,
- Minimum GPA of 3.0,
- Excellent verbal and written communication skills in English,
- Experience in programming language (e.g. MATLAB, Fortran, C/C++), and
- Experience in renewable energy systems analysis (e.g. related courses in this area).
Project Name: Identification of Prevention through Design solutions used in the US construction Industry

Mentor Name: Nicholas Tymvios

Mentor Department: Engineering Technology and Construction Management

Abstract:
Prevention through design (PtD) is a concept where designers are asked to consider construction worker safety during the design process. The consideration of safety early in a project’s life-cycle has been linked to cost savings arising from the need to rework building elements to account for safety before construction starts. In addition the involvement of designers allows the implementation of safety controls that are more reliable and effective. Other countries have enacted legislation requiring designers to practice PtD, but such efforts have been fruitless in the US. Because of this, it is necessary to demonstrate to designers that PtD solutions can be implemented and do not require excessive planning or cost. This idea falls in line with the CDC-NIOSH NORA Goals that aim to create a repository for design solutions and best practices for the US construction Industry (NORA Goal 13.1.5).

For this project, the student will work on identifying from literature existing solutions, and start with the development of an electronic PtD solutions repository. The student will be involved in literature review, as well as some initial interviews and discussions with Charlotte area designers in order to start the creation of the repository.

The findings will be the first step to provide the US construction industry with immediate solutions that can be implemented, and to present the findings to NIOSH for the wider dissemination of the information in the US.

Minimum Qualifications:
Currently enrolled as a Civil Engineering Technology, Construction Management, or Civil Engineering student.
Project Name: Investigating Magnetic Gearing Designs for Improved Manufacturability

Mentor Name: Wesley Williams

Mentor Department: Engineering Technology and Construction Management

Abstract:
Magnetic gears provide a non-contact means of transmitting torque that eliminate many of the contact based failure mechanisms of traditional mechanical gearboxes. As such, they have applications in renewable energy generation, robotics, aerospace, and naval environments where servicing a gearbox is expensive, if possible at all. UNC Charlotte has been active in magnetic gearing research over the past five years, designing, simulating, and building multiple gearboxes in the course of several state and federally funded grants.

The proposed summer research is to explore new topologies or refine existing designs to improve the manufacturability of magnetic gears. In addition we will be evaluating ways to achieve increased gear ratios while maintain torque capabilities. Success in one or both of these goals will work to improve the overall Technology Readiness Level (TRL) of magnetic gears, which is a measure of how close they are to being viable for commercialization. It is anticipated that students will have a mix of design, calculation, fabrication and testing activities while working alongside both mechanical and electrical engineering graduate students. In addition to refining their CAD and analysis skills, students will have the opportunity to work with prototyping equipment including additive manufacturing (3D printing), CNC machining, and laser cutting.

Minimum Qualifications:
Solidworks proficiency
Machine shop experience (mill, lathe, etc.)
Strong performance in lab courses
Project Name: Free Play: Studies of Play in African American Literature

Mentor Name: Janaka Lewis

Mentor Department: English Department

Abstract:
This project will look at representations of childhood play in 19th and 20th century publications in African American literature and other print, visual, and electronic media. Seeking to examine how play was used to negotiate and define social identity, especially in moments of crisis and transition such as American slavery, emancipation, and civil rights and social justice movements, this project will also look at multimedia representations of play--publications, ads, online sources, videos, and documentaries, to see what arguments are made about the uses and usefulness of play and social interaction.

Minimum Qualifications:
Some background in literature analysis and/or cultural studies, access to electronic media. Exposure to university or other archives is a plus but not mandatory.
Project Name: Seeking to Understand the Plight of War-Affected Children

Mentor Name: Sarah Minslow

Mentor Department: English & Global Studies

Abstract:
For this project, a student researcher will assist Dr. Minslow in preparations for a manuscript on war-affected children. The manuscript includes chapters on child soldiers and displaced children with an emphasis on the different roles children play during conflict and how this influences their identity development. There are more than 600 million children living in conflict zones around the world, so this issue needs to be understood and addressed on a global scale. Additionally, the manuscript will include sections on how to use children's and young adult literature to teach young people about conflict in ways that are not traumatizing for young readers. The student research will conduct a literature review, do literary and film analysis, and draft and revise papers for potential inclusion in the final manuscript. Additionally, the student may develop lesson plans and recommendations for teaching texts about war-affected children in school settings.

Minimum Qualifications:
The project is best suited to students majoring in English, History, Global and International Studies, Political Science, Childhood and Family Development, Psychology, or Education or students who are minoring in Holocaust, Genocide, and Human Rights or Children's Literature and Childhood Studies.
Project Name: Early modern English recipes--from manuscript to digital

Mentor Name: Jennifer Munroe

Mentor Department: English

Abstract:
Early modern English manuscript recipe books, most often held and used by women for cookery and medicine, contain an abundance of information about everyday practices and thus inform our understanding of women’s history and early modern writing. Because they are handwritten and exist in only one copy, however, their contents remain largely unaccessible to a wider audience; even when these handwritten copies are digitized, they require transcription to be searchable and broadly usable. This project builds on work by EMROC (the Early Modern Recipes Online Collective, which includes scholars from around the world) whose aim is to take digitized copies of manuscript recipe books (16th and 17th century English), transcribe them using an interface developed by the Folger Shakespeare Library, and use the transcriptions as part of a public-access database. Students interested in doing this work would help transcribe cookery and medicinal recipes into this software. As such, they will be contributing to an international initiative to make these books accessible, but students will also use their transcription work as a foundation for a scholarly project that thinks about some aspect of women's (textual, medical, domestic, ecological) history.

Minimum Qualifications:
Some background in English and/or History would be the most obvious candidates, but students from numerous disciplines might be interested. No experience with transcription necessary.
Project Name: Contemporary African American Poetry

Mentor Name: Dr. Malin Pereira

Mentor Department: English Department/Honors College

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 interpreting the work of several contemporary black poets, including Elizabeth Alexander, Rita Dove, Yusef Komunyakaa, Natasha Trethewey, Cornelius Eady, 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's research project can be on the poet(s) of their choosing.

Minimum Qualifications:
3.2 GPA: major or minor in English, Africana Studies, Education, Women's and Gender Studies, or Communication Studies.
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
2017 Charlotte Research Scholars
Research Project Submission

Project Name: Mapping disease-caused tree mortality with satellite and airborne 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, natural disturbances (including those caused by emerging infectious diseases or insects), have been observed to substantially impact the biodiversity, structure, and functioning of forest ecosystem. Remote detection of tree mortality caused by diseases or insects 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 develop a forest disease mapping algorithm to effectively capture the spatial and temporal patterns of disease-caused tree mortality in a coastal California ecoregion. To do this, the student is expected to develop a remote sensing model integrating satellite and airborne data with field measurements.

Minimum Qualifications:
Image processing or geography/biology.
Project Name: Soils and Geomorphology of River Terraces of the Catawba River

Mentor Name: Martha Cary Eppes

Mentor Department: Geography & Earth Sciences

Abstract:
This research would give you a strong field experience for your resume. You would be digging and describing soils in terraces near Charlotte. We seek to understand how the Catawba River has cut down into its channel over long time scales. Soils enable us to understand the age of the terraces. We hope to use our mapping and dating of terraces to allow us to observe any tectonic deformation in this tectonically inactive(?!?) part of the world. Time permitting, you may also participate in laboratory analyses of the soils.

Minimum Qualifications:
There are no minimum qualifications.
Project Name: Soils and Geomorphology of Alluvial Fans in Uwharrie National Forest

Mentor Name: Martha Cary Eppes

Mentor Department: Geography & Earth Sciences

Abstract:
This research would give you a strong field experience for your resume. We seek to understand where and when alluvial fans have formed due to small streams spilling out into larger floodplains typical of the piedmont region. Soils enable us to understand the age of the fans. We hope to use our mapping and dating of fans to allow us to understand how humans vs. climate change influence the landscape. Time permitting, you may also participate in laboratory analyses of the soils.

Minimum Qualifications:
There are no minimum qualifications.
Project Name: Rock cracking by thermal stresses and subcritical crack growth

Mentor Name: Martha Cary Eppes

Mentor Department: Geography & Earth Sciences

Abstract:
Geologists have not really considered fracture mechanics in thinking about physical weathering of rock. This project could be anything from computer analysis of weather & climate data as it relates to cracking to field work measuring cracks in the field. In particular there is a large need for data analysis.

 Minimum Qualifications:
Depending on the interest of the student, coding experience would be a plus. This could be a project for a computing science, mechanical engineering or civil engineering student looking to broaden their expertise.
Project Name: What information do planners need to conserve biodiversity in their jurisdictions?

Mentor Name: Dr. Sara A. Gagné and Dr. Wei-Ning Xiang

Mentor Department: Geography and Earth Sciences

Abstract:

Land cover and land use change is a major cause of biodiversity loss worldwide. In the US, much of this change happens under the jurisdiction of city, county, and town planning departments. Therefore, local planning agencies have an outsized role in helping to conserve biodiversity. Planners struggle to balance this role with other, often competing goals, such as building housing for a growing human population. Given these realities, there is an urgent need for planners to have access to information that will help them incorporate biodiversity conservation into their work. Ecologists are responding to this need (see for example, Gagné et al. 2015. A simple landscape design framework for biodiversity conservation. Landscape and Urban Planning 136: 13–27), but they may not be sufficiently cognizant of the complexities of planning to provide planners with the right information. In a nutshell, ecologists are telling planners what they should do but don’t know what planners can and want to do. This is the knowledge gap that our project seeks to fill.

We are looking for a highly-motivated and creative student to help us design and carry out a survey of US planners to determine the information they need to conserve biodiversity in their jurisdictions. The successful applicant will work closely with Dr. Gagné, a landscape ecologist, and Dr. Xiang, a landscape planner, to select samples, create survey questions, coordinate survey implementation, analyze responses, and communicate results. As such, the successful applicant will have the opportunity to participate in all aspects of a typical research project.

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. We are seeking to increase knowledge at the intersection of research and application across the domains of environmental science and human geography. If you’re interested in joining this vibrant project that will look great on your resume, please apply!

Minimum Qualifications:

None.
Project Name: Studying air quality
Mentor Name: Brian Magi
Mentor Department: Geography and Earth Sciences

Abstract:
Air quality is a major concern for many urban areas. Charlotte has been fortunate to escape from persistent air quality problems in the recent few years. Data from measurement stations in Mecklenburg offer evidence showing this. This project has at least a few possibilities. One approach could be 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. A second approach could be more field work based, and be framed as a study of air quality in the region by deploying with handheld air monitoring sensors to collect near EPA quality monitoring stations in the area, or to design a limited-data collection project near a specific source that is uncharacterized by county air monitors. A third approach could be to take a case study from the recent past, such as the fire smoke that originated in the eastern Appalachian foothills of NC and impacted Mecklenburg county, and analyze the weather and chemistry that played out.

Minimum Qualifications:
If interested in data analysis, then strong familiarity with Microsoft Excel is required, and programming (Matlab, Python, C, C++, Fortran, and/or scripting) is preferred. If interested in field work, Excel and a car are needed.
Abstract:

Building from a National Institutes of Health (NIH) funded initiative exploring the social determinants of health for the Hispanic immigrant population in Mecklenburg County, this project examines the extent to which neighborhood based restructuring acts as both a spatial and a social determinant of community health. To date, research tends to assess health determinants as static and yet, particularly in the context of restructuring cities like Charlotte, such determinants are in state of constant flux. Housing costs and condition, transportation routing and accessibility; social status and economic opportunity; service and business landscapes are all highly fluid and as they change they have differential impact on both health access and outcome. Such instability is particularly challenging for communities who are vulnerable to both health disparities and to restructuring in the neighborhoods in which they live. This project uses a mixed methods approach to explore the relationships that exist between changing urban spaces and changing determinants of health in SW Charlotte and areas of dense and transitioning Hispanic immigrant settlement.

Minimum Qualifications:

Exceptional writing and presentation skills; previous experience working with Hispanic immigrant populations; Proficiency in Spanish and a preferred major in Geography and/or Public Health, Nursing or pre-med related field of study.
Project Name:  Black Freethinkers: African American Secularism, 1800-1975

Mentor Name:  Christopher Cameron

Mentor Department:  History

Abstract:
From the early 19th century to the 1960s, black churches have played key roles in struggles for social justice ranging from abolitionism to the Civil Rights Movement. This role has obscured the essential conservatism of most black churches during this time period and the role of other religious or nonreligious orientations in pushing for social and political equality. Black Freethinkers explores the ideology and activity of those African Americans who rejected belief in God and believed that secular humanism provided a better foundation for political change than monotheistic religion. From Frederick Douglass to Zora Neale Hurston to A. Phillip Randolph, black freethinkers have been central to African American intellectual and political life.

Minimum Qualifications:
Project Name: “French Kiss: A History”

Mentor Name: Dr. Christine Haynes

Mentor Department: History

Abstract:

During summer 2017, I am seeking assistance with preliminary research for a new book project (my third), tentatively titled “French Kiss: A History.” (My second book project, with which I was assisted in summer 2013 by Charlotte Research Scholar Chris Kinley who has now completed a M.A. degree and begun work for a Ph.D. at Ohio State University, is now going into production with Harvard University Press.) While kissing is obviously an ancient practice, its association with France is, I suspect, a recent development which paradoxically is a product of war. Evidence suggests that the notion of the “French kiss” was invented by British and American soldiers in France, first in the Great War of 1914-1918 and again during and after the Second World War, when the “French” kiss was Americanized—for example in the famous photo of the Liberation of France in Life magazine in 1944 featuring an American soldier kissing a Frenchwoman on top of a jeep. To begin to substantiate this argument, I seek help in investigating journals and memoirs by Anglophone soldiers stationed in France during these two conflicts; newspaper and magazine reports on British and American soldiers in France; images, including photographs, of Frenchwomen kissing men, especially of foreign origin; and fictional representations, including in films, of kissing, especially in the context of war. For now, all of this research can be conducted in Charlotte, in the UNC-Charlotte and possibly Davidson College libraries and via the numerous digital repositories available via the Atkins Library website. Once completed, however, this preliminary research will enable me better to write grant applications to travel to French libraries and archives for rarer sources, from the French perspective, to flesh out the story of the origin of the “French” kiss.

Minimum Qualifications:
History major, preferably writing an honors thesis
Good research and writing skills
Ability to work independently and take initiative
Ideally, at least limited knowledge of French
On June 8, 1917 a group of 18 German men were delivered to Hot Springs, NC where they were to be interned as “enemy aliens” of the United States. Five days later, another fifty-eight 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 civilian internees—German citizens who had been caught by surprise while travelling or working in the United States when America declared war on their country.

Appalachia in the Trenches is the name of an article I am working on that examines the history of the German Civilian Internee Camp that existed in Hot Springs, NC from June 1917 through August 1918 (though there is some discrepancy on this). For this Summer 2017 CRS Project, I am seeking an undergraduate research assistant to help me in collecting and analyzing research materials related to this project. Although the intern will examine some secondary material in books and journals, the majority of the 8-week research time will be dedicated to identifying, collecting, and summarizing primary sources that help us to discover and learn what life was like for both the German prisoners and the Americans who interacted with them over the two year period that the camp existed. These materials include reading through 2-3 years of historical newspapers from the region, combing through state and federal archival finding aids to locate and order government documents, identifying and locating resource materials hidden away in state libraries and historical societies, using genealogical and marriage records to locate prisoner-descendants, and using the online tools in the National Archives website to find details regarding specific prisoners and their post-war fates. 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 old-fashioned, printed text both online and on paper.

**Minimum Qualifications:**

Completion of HIST 2600 or equivalent research skills course
Proficiency in the use of Atkins Library Online Catalog, ILL, and historical research databases and Chicago/Turabian citation styles.
Project Name: From the Western Front to the Queen City: Charlotte in the Great War

Mentor Name: Heather Perry

Mentor Department: History Department

Abstract:

How did the First World War impact the Carolinas? What military and economic contributions did the city of Charlotte make to the war effort? What happened when the deadly Spanish Flu hit the Queen City? The Charlotte Mecklenburg Library is planning a number of public events in the greater Charlotte region in order to remember and commemorate the role and experience of the city and surrounding area in the Great War (1914-1918).

From the Western Front to the Queen City is a CRS project designed to aid this effort. In this project, the student will help research and piece together the experiences of soldiers stationed at Camp Greene—the US Army training camp established in Charlotte in 1917. Research includes reading through the 3 newspapers published at Camp Greene and documenting the daily activities of the soldiers and the ways they interacted with local residents. The student will focus on two aspects of life at Camp Greene: soldiers’ social and cultural experiences during training and the impact of Camp Greene on life in Charlotte. The intern will also comb through the photograph and postcard collections found in the Carolina Room of the Charlotte Mecklenburg Library as well as the Atkins Library Special Collections. Finally, the student will use local and national records trace the war-time and post-war fate of the men who trained in Charlotte with a focus on those who remained in the area after the war. Many of these materials can be accessed through on-line repositories and databases, however, other materials are only available in their original format and cannot be removed from the special collections of either library. The student intern must be able to provide own transportation to/from the Carolina Room in Uptown Charlotte and the Atkins Library Special Collections (UNCC) and should expect to spend 2 weeks researching full time at each location.

Minimum Qualifications:

1. Completion of HIST 2600 –OR, equivalent research skills seminar
2. Experience using and reading online newspaper collections and databases
3. Mastery of Chicago/Turabian citation styles.
## Project Name:
Chemical Weapons and Secrecy in the British Empire

## Mentor Name:
Prof. Peter Thorsheim

## Mentor Department:
History

## Abstract:
I am seeking a Charlotte Research Scholar to assist me with my FRG-funded study of the history of chemical weapons testing in the British Empire. After decades of denial, British officials recently admitted that their predecessors orchestrated a systematic effort to purge sensitive documents from the colonies on the eve of their independence. By July 2016, 19,956 files (some of which are boxes consisting of hundreds of pages of documents) had been added to the National Archives catalogue from the “migrated archives” that the British government had kept secret since the end of empire, and more are being added all the time. Because of the massive size of this collection, surveying and analyzing what it contains is extremely labor intensive. The catalogue of this collection, which has been given the reference number FCO 141, can be searched online (discovery.nationalarchives.gov.uk). In most cases the description is limited to whatever was written on the cover of the original box or folder: usually the name of the colony, a few words describing the general contents, and the range of years the file covers. The research that I have already completed on Britain’s chemical weapons program provides clues about where to search within this newly released collection of documents. I have found evidence, for example, that in the middle of the twentieth century British chemical weapons scientists conducted research in Bechuanaland (now known as Botswana), India, Malaya (now Malaysia), and Nigeria, and I know the dates of some of the field tests they carried out in these colonies. Using such parameters, I have identified a large number files in the National Archives that require investigation. The assistance of a Charlotte Research Scholar will help me to analyze the documents that I have collected, and (if he or she is able to travel to London) to photograph additional files in the UK National Archives that I require for my research.

## Minimum Qualifications:
Excellent research, analytical, and communication skills. Strong performance in upper-level (3000 or above) history courses, preferably with experience in British history. Ideally, the research scholar would be in a position to do research at the National Archives in London.
Abstract:

The purpose of this work is to 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 are thought to play a role in regulating many aspects of skeletal muscle health, including the myogenic program and insulin responsiveness. Our lab is currently identifying candidate Micro RNAs via previously published micro array data, and in silico mapping.

The myogenic program is the process by which uni-nuclear muscle cells (myoblasts) proliferate and fuse 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. Therefore, a better understanding of the cellular and molecular events that regulate the myogenic program could lead to in vivo experimentation aimed at enhancing skeletal muscle regeneration. The mechanisms by which micro RNAs regulate the myogenic program will be determined by using commercially available specific inhibitors and mimics to alter its expression. The CRS student will then measure the proliferation and fusion of these muscle cells. Next the student will determine how the inhibition and activation of these Micro RNAs alter the expression of muscle regulatory factors, transcription factors specific to the myogenic program.

Skeletal muscle is the largest insulin responsive tissue in the body. The development of insulin resistance in skeletal muscle is the leading cause of hyperglycemia, a predictor of type 2 diabetes. Furthermore, hyperglycemia could be the result of skeletal muscle degradation or atrophy, simply by reducing the amount of skeletal muscle available to handle the glucose load in the blood. Micro RNAs have been shown to regulate insulin responsiveness in the liver. In skeletal muscle however, if is not yet known whether these same Micro RNAs alter insulin sensitivity in skeletal muscle. First the CRS student will use commercially available specific micro RNA inhibitors and mimics to modulate micro RNA activity. Next muscle cells will be treated with fatty acids and glucocorticoids known to alter insulin responsiveness. Then acutely treating cells with insulin and determining changes in the protein expression of insulin-sensitive kinases will characterize changes in insulin sensitivity.

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: Follow the Leader: Leadership Preferences of Academic Librarians

Mentor Name: Nicole Spoor

Mentor Department: Atkins Library

Abstract:

The project entails researching what type of leadership followers feel is most effective. The scholar and mentor will develop an instrument to measure the leadership preferences among academic librarians. The scholar will have the opportunity to research current literature on the topic of leadership and apply the knowledge to the creation of a survey that will be dispersed nationally. The data collected will be analyzed, looking for patterns that speak to how librarians prefer to be led. The impact of this study on librarianship could be great. Librarians in leadership positions can use the data to be more aware of the general leadership preference of the academic librarians that they lead. On a larger scale, the survey developed could be used to collect findings that are more generalizable across various populations of followers.

Minimum Qualifications:
None required
Project Name: Pivoting Mechanism for Maintenance-Free and Dynamic Cell Culturing
Mentor Name: Hansang Cho, Ph.D.
Mentor Department: Mechanical Engineering and Engineering Science

Abstract:
Cell culturing conditions have been most commonly practiced under static flows, rather than more physiologically relevant dynamic flows. It is well agreed that cells prefer to grow and perform normal functions under medium circulation in dynamic conditions. However, medium is manually changed and provided in static conditions for conventional cell culturing environments. To provide such a dynamic flow, with less effort on the maintenance for cell growth, a pivoting mechanism is designed and will provide the gravity driven dynamic flow of medium. It will switch about a fixed pin joint in order to alternate two chambers; a source and a sink. Inducing the dynamic flow is achieved by creating a height difference between the two chambers, which causes the media to flow through to the sink chamber until an equilibrium pressure is obtained causing the flow to cease. The pivoting mechanism will be operated either by a manual switch or a timer-controlled motor for automation. Such a mechanism will be implemented into an arrayed platform to achieve a high throughput for larger scale repetition. It is anticipated that cell culturing in dynamic conditions would allow for a better physiological environment for the cells to express the relevant behaviors while phasing out conventional static culturing techniques.

Minimum Qualifications:
If applicable (200 characters maximum)
Project Name: Wave-energy dissipation for experiments with swimming robots

Mentor Name: Scott David Kelly

Mentor Department: Mechanical Engineering and Engineering Science

Abstract:

Laboratory development of an aquatic mobile robot can be impeded by a mismatch between the environmental conditions under which the robot is intended to operate and those that can be simulated in the lab. The nominal dynamics of such a robot can be altered substantially, for instance, by wave reflections from the boundaries of a small water tank. The proposed project concerns the development and testing of a strategy for absorbing wave energy at the boundaries of a shallow water tank currently used for experiments with surface-swimming robots. While the simple dissipation of hydrodynamic energy is the primary goal, the project may double as an investigation of novel technology for harvesting wave energy in a manner that can be scaled for deployment in a coastal environment.

An overview of the supervising professor's research program is available at http://kellyfish.net.

Minimum Qualifications:

Experience with the design and construction of simple mechatronic systems is preferable but not essential.
Project Name: Exploiting elastic compliance in the design of snakelike robots

Mentor Name: Scott David Kelly

Mentor Department: Mechanical Engineering and Engineering Science

Abstract:

The energy efficiency of mobile robots that mimic animals like snakes and eels can be improved by exploiting body elasticity in parallel with the direct actuation of internal degrees of freedom. Such robots can be fully mobile even if they’re underactuated in the sense that only some of their internal degrees of freedom are manipulated directly by motors. The proposed project explores a basic question concerning the design of robots comprising sequences of identical rigid links: If fewer actuators are available than there are joints between the links, but springs can be mounted in place of motors at unactuated joints, then which joints should be assigned motors and which assigned springs? The project will involve the construction of a simple wheeled robot and the evaluation of its self-propulsive performance under different parametric conditions.

An overview of the supervising professor's research program is available at http://kellyfish.net.

Minimum Qualifications:

Experience with the Arduino microcontroller platform and/or motion-tracking technology is preferable but not essential.
Project Name: Wake visualization within a self-propelling array of fishlike hydrofoils
Mentor Name: Scott David Kelly
Mentor Department: Mechanical Engineering and Engineering Science

Abstract:

A self-propelling array of sinusoidally pivoting hydrofoils represents a simple mechanical analogue of a swimming fish school. The collective energy efficiency of such an array depends significantly on the relative positioning of the foils and on the relative phasing of their oscillations. Variations in these parameters engender variations in the hydrodynamic interactions among foils. The proposed project will investigate simple methods for visualizing the flow within an existing robotic hydrofoil array, evaluating options like rheoscopic fluids, hydrogen bubbles, and fluorescent dyes, and will use one or more of these methods to characterize the differences in wake structure that accompany extremes in propulsive efficiency.

An overview of the supervising professor's research program is available at http://kellyfish.net.

Minimum Qualifications:

Basic familiarity with the dynamics of viscous fluids is preferable but not essential.
2017 Charlotte Research Scholars
Research Project Submission

Project Name: Dimensional Metrology
Mentor Name: Jimmie Miller
Mentor Department: Mechanical Engineering and Engineering Science

Abstract:
..The project will involve a student interested in the Science Technology Engineering or Mathematics (STEM) field, working in the Center for Precision Metrology. The project will be student-tailored in concert with the capabilities and desires of the chosen student.

Possible/example projects:
  o Metrology project proposed by student
  o Calibrations of linear or rotary motion stages.
  o Data acquisition and analysis using a nanometric position sensor.
  o Write interface program for USB sensor(s).
  o Freeform surface data analysis and stitching
  o Thermal Characterization and analysis
  o Comparison of various standardized methods for determining the squareness between orthogonal positioning axes.
  o Literature research in the use and modeling of a specific application of dimensional metrology...
  o Student initiated project.
  o Model programming and user interface for machine tool metrology.
  o Design and manufacture of an applied dimensional metrology system or gage.

Mandatory Qualifications
  o EE ME, Physics  CE, SE, or Math  student acceptable with sufficient background.

Desired but not mandatory qualifications:
  o Familiarity with the LABVIEW, C, Excel, Matlab or other programming environment
  o Understanding of data acquisition techniques and mathematical analysis.
  o Knowledge of some analysis software such as Excel, Matlab, Mathcad or other similar software.

Lord Kelvin on metrology": 'when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind: it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science”

...John Quincy Adams on metrology : "...necessary to every occupation of human industry; to the distribution and security of every species of property; to every transaction of trade and commerce; to the labors of the husbandman; to the ingenuity of the artificer; to the studies of the philosopher;.... “
Project Name: Fatigue Strength of Wrought Iron Wire

Mentor Name: Ron Smelser

Mentor Department: Mechanical Engineering and Engineering Science

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: Automation of a step height measuring instrument with picometer performance

Mentor Name: Stuart Smith

Mentor Department: Mechanical Engineering and Engineering Science

Abstract:
The goal of this project is to design mechanisms for the automation of a stylus based profiling instrument. The instrument itself has a stylus with picometer resolution that traverses on a novel flexure based translation stage. In its current state, all drives, adjustments, and signal conditioning electronics are manually operated. These will all be replaced with state of the art new technologies. Because this involves development of computer hardware, mechanism design, and electronic signal conditioning, it will require a researcher with multidisciplinary skills generally considered to be in the field of mechatronics system design. In particular, the instrument will be controlled using a Raspberry pi interfaced with a programmable gain ADC/DAQ, DDS, and all auxiliary device communications will be over an SPI bus. The programmable op-amp is from Burr-Brown (TI) and is model #: PGA202KP. The ADC is from Linear Technology (model #: LTC1609ACSW http://www.linear.com/product/LTC1609).

Upon assembly and validation of the automated instrument it will be necessary to undertake a performance evaluation to calibrate the profiler and determine the repeatability and stability of measurements. In the past, it has been shown that this type of sensor can produce measurement repeatability at sub nanometer levels. This corresponds to feature height measurements that are considerably less that the dimensions occupied by a single atom in a solid. Consequently, this system must be substantially isolated from seismic, thermal and acoustic noise.

Minimum Qualifications:
I already have a student (Jonathon Piland) who wants to do this project. Jonathon is a mature student who has hands on experience that is needed for this conceive, design, implement type project. He also has the necessary academic ability to understand the underlying theoretical concepts.
Project Name: Computational study of the impact of grain boundaries on the mechanical and thermal properties of boron nitride

Mentor Name: Alireza Tabarraei

Mentor Department: Mechanical Engineering and Engineering Science

Abstract:

Two-dimensional hexagonal boron nitride (h-BN), a member of the graphene-like two-dimensional materials family, offers an excellent combination of high thermal conductivity and mechanical strength. Such properties bring h-BN unique characteristics and applications distinct from other graphene-like 2D materials. High thermal conductivity of h-BN makes it desirable for thermal management for applications such as nanoelectronic devices where efficient heat dissipation is a key to the performance and miniaturization of such devices. Its high mechanical strength provides potential applications in many devices where higher mechanical robustness is necessary.

Currently, chemical vapor deposition (CVD) technique is the most efficient method for the synthesis of large-scale and high-quality sheets of two-dimensional boron nitride. However, boron nitride sheets obtained from CVD technique are polycrystalline, composed of individual grains stitched together at the grain boundaries. Grain boundaries alter the physical and mechanical properties of the boron nitride sheets. An effective use of hexagonal boron nitride in nanodevices necessitate a fundamental understanding of the impact of grain boundaries on the mechanical and physical properties of hexagonal boron nitride.

In this project we will use nonequilibrium molecular dynamics method to study the impact of grain boundaries on the thermal and mechanical properties of monolayer hexagonal boron nitride. The undergraduate student will work closely with a graduate student on generating the structure of grain boundaries and to conduct molecular dynamics simulations.

Minimum Qualifications:
A sophomore, junior or senior student with an engineering or science background with a minimum GPA of 3.5.
Project Name: Falls Risk Assessment and Prevention with Wearable Sensors

Mentor Name: Nigel Zheng

Mentor Department: Mechanical Engineering and Engineering Science

Abstract:

In the United States, one of every three people 65 years and older falls each year according to the National Council on Aging. Fall-related injuries are the major cause of hospitalization for older adults. About one quarter of those who fall suffer moderate to severe injuries that reduce mobility and independence, and increase the risk of premature death. Researches indicate that most falls are preventable. Multifactorial intervention strategies, that identify and modulate an older adult’s risk factors, are particularly effective in lowering fall rates in high risk groups. Clinical assessments of an older adult’s physical risk factors for fall, such as Tinetti Mobility Test, are often subjective and time-consuming. The Tinetti Mobility Test includes observations of 15 activities of daily living, such as sitting, arising from sitting and walking. These tests are often conducted in clinic or during a home visit by a physical therapist. However, elderly people often take multiple medicines and their effects on mobility may not be properly assessed. Our on-going research identified an older adult’s physical risk factors for fall, characteristics of fall and sign of potential falls in groups with different risk levels. We have collected three-dimensional motion data during clinical assessment of 30 people with different risk levels for fall. The objective of this project is to develop a wearable low-cost motion monitoring device which could provide a complete mobility profile over a long period of time, which is an important component of our physiological profile approach to fall risk assessment and prevention. Low-cost accelerometer and orientation sensors will be used to monitor mobility and balance of a subject during activities of daily living. Data collected from this wearable device will be compared with the data collected in our lab. The student will learn basic principles of human motion analysis and biomechanics.

Minimum Qualifications:

Familiar with MatLab
Project Name: Super-resolution imaging using plasmonic near-fields and inverse scattering algorithms

Mentor Name: Vasily Astratov

Mentor Department: Physics and Optical Science

Abstract:
This project has two directions. The first direction is based on imaging of nanoscale structures and biomedical samples through dielectric microspheres. This direction is closely related to pioneering development of microspherical nanoscopy in the Astratov’s Lab. The goal of this project is to study novel resolution capabilities offered by the nanoplamonic arrays fabricated in collaboration with Air Force Research Laboratory. The student will obtain direct experience with various types of imaging including fluorescence and confocal imaging, as well as with more advanced plasmonic structured illumination. The goal of these studies is to extend the capabilities and to increase the resolution of the previously developed methods further beyond the classical diffraction limit. The second direction is based on using light scattering measurements followed by the image reconstruction through the inverse scattering algorithms. The key feature of this project is a close collaboration with the Department of Mathematics at UNCC where the algorithms for inverse scattering have been developed. The project involves building an experimental setup, measuring the scattering patterns from dielectric microspheres with different diameters and from nanoplasmonic structures with different characteristic feature sizes. It also involves studies at various wavelengths of light and angles of incidence. The project will put a student in close interaction with the collaborators from the Department of Mathematics. Both directions involve very active collaboration with the graduate student with a series of specific tasks for an undergraduate student.

Minimum Qualifications:
Some minimal experience with the optical components is required, good team working skills are required
Project Name: Laser Clearance of Blocked Ventricular Catheters for Hydrocephalus Treatment

Mentor Name: Nathaniel Fried

Mentor Department: Physics and Optical Science

Abstract:
Hydrocephalus is a condition in which cerebrospinal fluid (CSF) accumulates in the ventricles of the brain, and increased fluid pressure may lead to brain damage, if left untreated. This condition affects newborn babies, elderly adults, individuals with dementia, and military personnel with traumatic brain injuries. The primary treatment is placement of a catheter into the ventricles to drain excess CSF. The most common complication is a blockage of the catheter due to infiltration by brain tissue debris.

There is currently no accepted non-invasive or minimally invasive technique for clearing blocked ventricular catheters. A simple and inexpensive, office-based, minimally invasive method would prevent surgical complications. Recent advancements in laser and endoscope technologies may enable minimally invasive clearance of blocked ventricular catheters. Thulium fiber lasers (TFL) can deliver high power through small optical fibers for precise tissue vaporization. Compact, inexpensive, miniature endoscopes are also available for image-guided laser tissue vaporization procedures.

It is hypothesized that delivery of TFL energy through an ultra-small fiber with specially designed fiber optic tips under image guidance using a miniature endoscope, may provide a rapid, safe, and effective means of clearing blocked catheters. The following parts of the project will be addressed: (1) Explore optimal TFL parameters for rapid and safe vaporization of tissue phantoms in a catheter model; (2) Test miniature fiber optic probes as delivery systems; (3) Integrate laser fiber and endoscope into a single port for insertion into catheter, for safe, rapid, and efficient laser vaporization of tissue debris.

The results should provide a foundation for future development of a simple, safe, inexpensive, office-based, minimally invasive method of clearing blocked ventricular catheters in patients suffering from hydrocephalus.

Minimum Qualifications:
Motivated, hard working student interested in learning about lasers, fiber optics, and medicine. Previous laboratory experience a plus but not required. Background in Physics, Electrical Engineering, and/or Mechanical Engineering preferred.
Project Name: Coupled modes phenomena in layered whispering gallery fiber microresonators

Mentor Name: Tsing-Hua Her

Mentor Department: Physics and Optical Science

Abstract:
A short strand of optical fibers as a glass stem of extreme smoothness can support light to circulate a million times before it dies out. Such an extraordinary property has been explored for many interesting phenomena such as optical sensors or filters. In this project we will explore adding three thin dielectric layers on the fiber to make additional highways or waveguides for the light to travel. Specifically, we will make these waveguides to couple each other to produce so called supermodes. Supermodes in coupled resonators have richer dynamics than a single resonator and has been explored as photonic means to slow down the light. Such slow light structure is extremely compact and stable, which holds promise for miniaturized rotational sensor or gyroscope. In this project, the student will learn physics of fiber microresonators and concepts of resonator modes in microcavity. The student will spend substantial amount of time on experiments to learn techniques to interrogate these resonator modes and supermodes. The student will have hand-on experience to learn to shrink the size of an optical fiber 100 times smaller using a laser melting technique. The student will have access to advanced equipment such as tunable lasers and optical spectrum analyzer.

Minimum Qualifications:
Diligent, hardworking, inquisitive, responsible, honest, and considerate. Mission oriented and can deliver results. Good on hand-on work. interest in physics and optics.
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 with 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
Project Name: Laser Ablation for Novel Graphene Plasmonic Devices

Mentor Name: Tino Hofmann

Mentor Department: Department of Physics & Optical Science

Abstract: Plasmonic devices based on graphene instead of metal structures have spurred wide interest due to the promise of operation frequencies ranging from the terahertz to the visible and with ultra-high speed, low driving voltage, low power consumption, and compact sizes [1,2]. Currently, the fabrication of these plasmonic structures is realized using lithographic approaches. However, employing lithography as a patterning technique results in the exposure of graphene to photoresists and solvents which impair the electrical and optical properties of graphene layer.

The Charlotte Research Scholar will participate in a research project which is focused on the development of contact-less patterning techniques which will allow structuring of epitaxial graphene without exposure to damaging chemicals. Our approach is based on contact-less Laser ablation. Pristine epitaxial graphene samples fabricated on SiC substrates will be used as a starting materials. The goal of this research is to determine Laser process parameters which will allow controlled ablation epitaxial graphene without damaging the SiC substrate.

During the CRS period, the student will (a) use infrared spectroscopic ellipsometry in order to determine the optical properties of epitaxial graphene; (b) participate in the Laser ablation of epitaxial graphene for a range of process parameters; (c) use infrared microscopy techniques to determine Laser damage thresholds and optimum ablation conditions.

These studies will expose the student to state-of-the-art optical thin film characterization, numerical analysis techniques, and Laser processing equipment. The student will work closely with graduate students and postdoctoral researchers in the group. The close interaction with more experienced researchers will ensure training for the operation of equipment 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
Project Name: Investigating thermo-mechanical properties of supercooled organic liquids and the glass transition through molecular simulation

Mentor Name: Donald Jacobs

Mentor Department: Physics and Optical Science

Abstract:
Many theories have been developed to explain the ubiquitous dynamical slowing down observed in glassy materials that is critical to their thermal-mechanical properties. A common premise among these theories is that local structural rearrangement of atoms stops as the system falls out of equilibrium below the glass transition. Surprisingly, X-ray photon correlation spectroscopy experiments have recently revealed fast dynamics is present in materials classified as strong glass formers below the glass transition temperature where relaxation times and viscosity were expected to diverge. The authors of this recent 2014 Nature paper insist a new microscopic theory is needed that does not invoke diverging relaxation time scales. Because theoretical models require simplifying assumptions, restoration of these theories is not too alarming. On the other hand, considerable progress has recently been made in quantifying mechanical properties of glass networks using constraint counting, which has lead to new glasses being manufactured, such as Gorilla glass from Corning Inc. In the meantime, the Jacobs lab at UNC Charlotte has developed a novel statistical mechanics approach based on constraint theory for understanding glass-forming networks in terms of rigidity percolation. In this project, the student will run and analyze molecular dynamics simulations to test the physical properties of various molecular compositions, and this data will be correlated to experimental data. There will be opportunity for the student to be involved in writing C++ code to implement analysis of the simulation data in terms of rigidity and free volume as a percolation problem.

Minimum Qualifications:
Proficiency in at least one programming language is required. Familiarity with Linux or Unix would be helpful.
Project Name: Gold nanoclusters for biomedical applications

Mentor Name: Irina Nesmelova

Mentor Department: Physics and Optical Science

Abstract:

Gold nanoclusters, Au NCs, are attracting a wealth of attention in many areas of nanotechnology due to their unique optical properties and high biocompatibility. However, Au NCs synthesis is a relatively new and still developing field (1). Recent reports that Au NCs can be formed and stabilized by proteins are exciting, because they give a great promise for replacing less biocompatible quantum dots for imaging and targeting applications as well as for toxic molecules detection. Proteins are natural components of a live cell, have highly specific binding partner recognition ability, and therefore can be used as a noninvasive and non-toxic delivery system of a “fluorescent label” (e.g., Au NC) to the target. Among the advantages to this protein-directed synthesis is also its relatively low environmental impact. Mild reaction conditions, aqueous solution chemistry, and absence of strong reducing agents make the formation of Au NCs a green chemical synthesis. Quite often, only pH conditions in the reaction are altered to optimize the protein’s reducing ability or to change the conformation to increase organic-metal bonding and stabilization.

The key challenge here is to be able to synthesize protein-stabilized Au NCs in a predictable and controllable manner using the whole variety of functionally important proteins. Thus far, only standard proteins such as lysozyme, bovine serum albumin (BSA), insulin, tryspin, and a few other proteins have been used to synthesize Au NCs (2-4). These studies provide the proof of principle that the protein-stabilized Au NCs can be formed, but the understanding how proteins synthesize nanoparticles and the knowledge of protein-nanoparticle interactions are still lacking. Since the protein plays a vital role in stabilizing, reducing, and arranging gold atoms into stable nanoclusters, the formation of a single Au NC product is highly dependent on the conformation of the protein. Thus, a comprehensive characterization of protein-stabilized Au Ncs is in high demand.

In this project, a student with the background in physics, chemistry, engineering, or biology, will synthesize and characterize protein-stabilized Au NCs. At the end of the project, the student will gain experience with several biophysical methods that are commonly used for the investigation of biomolecules and will learn the synthesis of protein-directed Au NCs.


Minimum Qualifications:
Background in Physics, Chemistry or Biology
Project Name: Investigation of Optical Scattering Cross Sections of Random Dielectric Surfaces.

Mentor Name: Menelaos K. Poutous.

Mentor Department: Physics & Optical Science.

Abstract:
Light energy incident on a boundary separating two regions with different refractive indices, is redistributed to at least two specular and two diffuse components. The specular transmittance and reflectance are the most commonly referred to as Fresnel reflection and transmission; whereas reflective and transmissive scatter are classified as diffusive effects. For optical elements that require high energy throughput, Fresnel reflectivity is suppressed using “anti-reflective” boundaries, in most cases comprising of thin-film coatings (ARC). Another way to reduce Fresnel reflectivity is to randomly structure the boundary surfaces, where the defining feature scale (roughness) is smaller than the incident light wavelength.

Random structured surfaces (rARSS) can reduce Fresnel reflections in a similar way as gradient-index boundaries do. The optical boundary surface is engineered to have cylindrical, rectangular, conical or irregular features, distributed randomly across its surface area. The features have random or quasi-random structure parameters, such as their height or their lateral “footprint”. The feature density is high, meaning that they are compactly arranged, without large gaps and spacing between individual features. The scale of the individual feature parameters is subwavelength for the transverse feature cross sections, and of the order of a quarter to half-wave in depth (or height, depending on perspective). As such, they act as a random “carpet” of material fibers, through which incident light waves transition from the incoming to the outgoing medium. Classification analysis for rARSS is difficult, due to the random nature of the features, and because normal-incidence experiments, which are widely performed, may have similar AR results for different feature distributions.

The Optical Structured Surfaces Laboratory (OSSL) has been investigating rARSS in fused silica optics, the mainstay material of most optical components in the visible and near IR part of the spectrum, for the last four years, under multiple grants from the Naval Research Laboratory. A variety of optical functions have been investigated including high-transmission (>99%), high-power laser-induced damage, polarization insensitivity, and effects on lensing components. Recently, under the direction of Prof. Poutous, the Lab’s graduate students and post-doctoral fellows have been investigating the characterization of the random optical surface structures, based on statistical model descriptions. The goal is to understand how different “randomness” affects the propagation of light waves through the structures and, to what extend the resulting AR performance can be engineered or controlled, beyond the empirical methods currently used. This is a unique approach that can yield further understanding of the light-surface interactions, and allow for future development of better optical components (such as lenses, prisms and laser windows) or devices (such as detectors and imagers).

The successful applicant will work closely under the guidance of Prof. Poutous and the graduate student team at OSSL, in order to collect surface metrology data using various instruments, such as a scanning electron microscope, a UV-confocal microscope and, an IR scatterometer, in order to quantify the random statistics of the surface structures and correlate them with the optical performance. The CRS recipient will also be required to use in-house developed software to analyze the data collected and identify possible trends.

The work performed may lead to contributions towards the submission of a conference proceedings paper or journal article, depending on the findings and the analysis performed.

Minimum Qualifications:
Basic knowledge of optics and electromagnetics. Basic capability to program and execute routines in MatLab. The ability (and desire) to be trained to use some of the various metrology and optical measurement instrumentation, such as: scanning electron microscope, confocal UV microscope, IR scatterometer. The desire to contribute in the on-going research on random surfaces and their optical properties. The ability to adhere to Laboratory safety rules and regulations is required. The OSSL 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.
Project Name: LWIR spectroscopic identification of harmful residues on surfaces.

Mentor Name: Menelaos K. Poutous.

Mentor Department: Physics & Optical Science.

Abstract:
Real-time, stand-off chemical sensing of harmful residues (solids) is a major concern for environmental and health reasons. Traditional spectroscopic approaches to sensing rely on detecting specific signals directly related to the target chemical, i.e. spectral signatures. Infrared (IR) spectral absorption techniques have been shown to precisely identify hazardous materials, by utilizing various laboratory data collection methods. We are investigating a detection approach based on long-wavelength infrared spectral signatures (LWIR, 8-12µm, 1250-833cm⁻¹) collected from surface reflections at ambient conditions, for the identification of chemical residues on various surfaces (metallic, plastic, etc.)
The LWIR spectral region offers distinct advantages over other IR spectral regions. Firstly, there is no atmospheric water-vapor absorption in the 8-12µm window. This allows for detection under ambient conditions, which is the desired field technique. The relationship between the sensitivity of a LWIR spectrum and the number of LWIR nitrous and nitride bands is currently investigated. The effort focuses on increasing the selectivity and sensitivity of the detection method, because of the presence of stronger vibrational bands corresponding to the fundamental vibrations of the nitro (NO₂) group, a major component of hazardous chemicals. We are examining the effect of optical detection through ambient-conditions spectral reflectometry for chemical hazardous simulant combinations, to determine how to best discriminate between simulant signatures and potential environmental interferents. Using this approach, we compare LWIR reflection and absorption spectra, and evaluate the probability of detection and probability of false alarm, for residues of hazardous simulants and environmental interferents.
Detection and discrimination of chemical residues on environmental surfaces in the LWIR spectral region presents a number of basic scientific challenges. Some of them are: how resident surface composition affects target LWIR chemical signatures, how resident surface roughness and structure affects target LWIR chemical signatures through scatter, and thermal background effects in the LWIR which will directly impact sensing results for any optical system (heat interference).
The Chemical Sensing Optics Laboratory (CSOL) has been investigating identification of traces of harmful vapors and solid residues in the middle and long-wave IR for the last three years, under multiple grants from the Office of Naval Research. Recently, under the direction of Prof. Poutous, the Lab’s graduate students and post-doctoral fellows have been investigating the detection and identification of nitrous and organic compounds on metallic surfaces with various degrees of roughness. The goal is to understand how different “randomness” (roughness) affects the reflected spectral signals from the residues under field conditions, not in a sanitized laboratory setting. This is an approach that can yield new scientific knowledge relating to stand-off detection of hazardous residues on environmental surfaces.
The successful applicant will work closely under the guidance of Prof. Poutous and the graduate student team at CSOL, in order to collect reflection spectra from different metallic surfaces, with various degrees of roughness, and determine confidence detection and identification levels, and interferent effects.
The work performed may lead to contributions towards the submission of a conference proceedings paper or journal article, depending on the findings and the analysis performed.

Minimum Qualifications:
Basic knowledge of spectroscopy and chemical sample preparation is required. The ability to be trained to use a high-resolution spectroscopic reflectometer is desired. The willingness to contribute in the on-going research for the identification of harmful chemical residues on surfaces is sought. The ability to adhere to Laboratory safety rules and regulations is required. The Chemical Sensing 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.
2017 Charlotte Research Scholars
Research Project Submission

Project Name: Freeform Optics
Mentor Name: Dr. Thomas Suleski
Mentor Department: Physics and Optical Science

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
Abstract:
Surgical continues to be the foundation of treatment for most solid mass tumors. However, cancerous tissue is often indistinguishable from healthy tissue by visual inspection alone and few diagnostic imaging tools are available for tumor detection in real time. This makes tumor removal challenging and can result in high mortality rates as the result of recurrent tumors. Recent research has demonstrated that optical spectroscopy can be used to distinguish between healthy and diseased tissue. Hyperspectral imaging (HSI) is a hybrid imaging modality that combines imaging and spectroscopy and provides a 2D image that contains spectral information in each pixel. Conventional HSI systems employ spatial or spectral scanning techniques that reconstruct the spectral image after scanning is complete. Multiple research groups have successfully used these systems for a range of medical applications, but this HSI methodology lacks the real-time imaging capabilities needed for surgical guidance. Real-time HSI could provide a much-needed diagnostic imaging tool to facilitate residual tumor detection and result in better patient outcomes.

This project will develop a real-time HSI imaging technique that can be used as a surgical navigation aid. The basic unit of the proposed HSI system is a spectral pixel. Each spectral pixel is composed of several bundled doped optical fibers, with each fiber acting as a narrowband filter. The spectral pixels are aligned with an array detector and the output of the detector is used to calculate the spectral content of each spectral pixel. An array of spectral pixels, a spectral camera, can capture spatial and spectral information in a single snapshot image. The anticipated commercial endpoints for the spectral pixel HSI system are three-fold: a device to be used during open surgery to increase the accuracy of tumor excision, a device to be used with endoscopic/laparoscopic probes during minimally invasive surgery and pre-surgical biopsy and a hand-held device for use in clinic for skin cancer diagnosis. Real time HSI opens up a host of possible applications beyond surgical guidance such as monitoring wound healing, assessing peripheral artery disease and detecting ischemic tissue.
Project Name: Ethnic Fractionalization and Rebel Group Sexual Violence

Mentor Name: Justin Conrad

Mentor Department: Political Science

Abstract:
Why do some rebel organizations engage in more sexual violence against civilians than other groups? This study explores the role of ethnic fractionalization in driving sexual violence by rebel groups. The goal of the project is to identify both the theoretical and empirical links between fractionalization and sexual violence, using existing and newly collected data on rebel groups around the world.

Minimum Qualifications:
Required: Completed a social science methods course
Preferred: familiarity with STATA & Excel, 3.5 GPA or better
Project Name: What Inspires a College Student to Choose Teaching?

Mentor Name: Jason Giersch

Mentor Department: Political Science

Abstract:
Previous research shows that teacher quality is important for student achievement and people choose a career in teaching for altruistic, extrinsic, and intrinsic reasons. But does the mix of motivations differ by gender, race, or personality? Using a unique dataset generated here at UNCC, this project will apply statistical methods, including multiple regression, to find patterns in what inspires students to consider teaching as a career choice.

Minimum Qualifications:
Must be experienced at reviewing academic literature and using software such as Stata or SPSS to merge and clean data and perform regression analysis.
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: Is it Rigged? Election Administration and Voting in North Carolina

Mentor Name: Dr. Martha Kropf

Mentor Department: Political Science & Public Administration

Abstract:

The general research question examined here is how did election administration issues affect the 2016 election in North Carolina, and in the U.S. more generally? The 2016 gubernatorial election in North Carolina turned on the counting of provisional votes. After election night, Governor-elect Cooper led incumbent Governor McCrory by fewer than 5,000 votes. The provisional votes—generally counted last—apparently made a difference in that race.

Provisional votes have been called “a failsafe” or “safety valve” because the program provides a would-be voter an option to vote even if that person is not listed on the voter registration list, or when a poll worker or other election official challenges whether a person is eligible to vote. If that happens, a person is able to cast a provisional vote. Without such a program, a would-be voter would be out of luck. A provisional ballot is kept separate from other ballots until such time that election officials can determine whether or not the ballot should count toward the total. For some states, the provisional voting application counts as a registration to vote if election officials cannot otherwise establish the person's registration.

As luck would have it, data concerning provisional votes, who cast them, the reasons why they are cast, and whether they are counted is listed on the North Carolina Board of Elections website. Thus, we are able to examine these data in order to understand how this administrative program affects election results.

The last time I mentored a student, we were able to attend a funded conference at Purdue University in Indiana and the student and I published a book chapter. I hope to repeat that experience.

Minimum Qualifications:

1. POLS 2220 (Research Methods) or equivalent and earned an A
2. Political science major not necessary- an interest in data & politics is
3. Future goal of a graduate degree in Political Science, Public Policy or related discipline
Project Name: Accountability for Gross Violators of Human Rights: From Law to Practice

Mentor Name: Dr. Gabriela Tarazona-Sevillano

Mentor Department: Department of 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 Spain. Two key concepts are crucial in achieving accountability: (1) Universal jurisdiction, as Spain asserted to try in Spanish 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.
Abstract:
This project involves the analysis of conflict during civil wars in the contemporary era. It is part of a multi-year research program supported by the Department of Defense’s Minerva Research Initiative. Specific areas of research inquiry include: understanding how rebel movements finance their activities through natural resource exploitation and crime, analyzing the dynamics of conflict over territory between rebel and government forces, forced migration during conflicts, and understanding why civil war combatants use violence against civilians.

Research assistants for this project learn to collect and analyze data. We have a number of data projects ongoing, including researching rebel finance from natural resources and crime, analyzing battle outcomes to understand when combatants seize or lose control of territory, and collecting information on abuses of human rights by rebel and government forces. Research assistants learn how to devise data collection strategies, how to ensure that their research is reliable and valid, and have opportunities to learn new tools (such as the use of Geographic Information Systems and data analysis) in their own research projects.

Minimum Qualifications:
Minimum qualifications include majoring or minoring in Political Science and/or have completed coursework on data analysis. Classwork in political science or global studies that deals with conflict or with specific regions of the world is useful, as is reading knowledge of foreign languages.
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 2017 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: Testing a Culturally Adapted Minimal Intervention for Overweight/Obese Women

Mentor Name: Fary Cachelin

Mentor Department: Psychology

Abstract:
Our long-term goal is to advance the treatment of obesity and related problems for ethnic minorities by developing effective and accessible interventions. The aim of this study is to test the efficacy of a culturally adapted behavioral self-help program to reduce BMI and related health risks in ethnic minority women, who are a group typically not able to access health care. We expect that treatment with the program will result in reductions in BMI and risk factors for cardiovascular disease (i.e., blood pressure, lipids) and type II diabetes (HbA1c) post-treatment and over the follow-up (6- and 12-months). Specifically, we expect that increased leisure time physical activity (PA) and fruit and vegetable consumption (FV), and reductions in binge eating (BE) behaviors will be responsible for the expected improvements in BMI and health risks. This research is important because overweight and obesity present serious health risks in ethnic minority populations and very few lifestyle interventions have been found to be successful. Potential participants will be recruited from Carolinas Health Care System primary care clinics. Interested individuals will complete an eligibility screen and, if they report overweight/obese status accompanied by regular binge eating and insufficient physical activity, confirmatory assessments will be conducted. Respondents meeting study criteria will be randomly assigned to the experimental intervention or to the control condition (wait list). Those in the intervention condition will receive a culturally adapted self-help manual and nine guidance sessions over a 12-week period. Treatment effectiveness will be evaluated in terms of reductions in BMI, related health risk factors, and binge eating, and increase in physical activity and fruit and vegetable consumption:

Aim 1. To test the efficacy of a culturally adapted CBTgsh for reducing BMI, waist circumference (primary outcomes), and risk factors for cardiovascular disease and type 2 diabetes (blood pressure, lipids, and HbA1c; secondary outcomes).

Aim 2. To test the efficacy of culturally adapted CBTgsh for increasing leisure time physical activity and fruit and vegetable consumption, and reducing binge eating (secondary outcomes).

Exploratory Aim. To examine mechanisms by which the intervention contributes to changes in BMI, waist circumference and risk factors for cardiovascular disease and type 2 diabetes.

This study will be the first to test a culturally adapted evidence-based minimal intervention for the treatment of overweight/obesity with ethnic minority women through addressing co-occurring behavioral problems (i.e., binge eating) and insufficient physical activity that interfere with weight loss.

Minimum Qualifications: 3.5 GPA or higher
Project Name: Social Motivation and Interpersonal Goals

Mentor Name: Amy Canevello

Mentor Department: Psychology

Abstract:
Egosystem and ecosystem theory of social motivation suggests that people function in the space of two independent motivational systems (Crocker & Canevello, 2012, 2014, 2015). The egosystem is characterized by a preoccupation with one’s relational value. When this motivational system is activated, feelings of belonging and social connection are viewed as conditional or contingent such that belonging and connection are “earned” by proving one’s worth and value. The ecosystem is characterized by the view that people are interconnected with each other in nonzero-sum ways so that caring about others’ well-being is good for others and the self and does not come at the expense of the self. When this motivational system is activated, people care about others’ needs as well as their own and they have intentions to help and not harm others or the self. This leads them to behave in ways that take both their own and others’ needs into account.

A growing body of research has explored the implications of these systems for interpersonal relationships and for own and others’ well-being. However, less empirical work has tested the theory’s more basic predictions. The goal of this project is to test some of these hypotheses.

Minimum Qualifications:
Must have taken research methods in Psychology. Must also have some experience working with human subjects.
Project Name: Psychosocial Influences on Cardiovascular Reactivity Among African Americans

Mentor Name: Andrew Case

Mentor Department: Psychology

Abstract:
This study examines psychological and social influences on the relationship between perceived racial discrimination and cardiovascular reactivity (assessed via heart rate variability and blood pressure) in a sample of African American college students. Globally, African Americans bear the greatest burden of cardiovascular disease (CVD); and, racial disparities in CVD prevalence, morbidity and mortality in the United States account for a significant proportion of the shorter life expectancy observed among African Americans. There is a small body of studies that has examined perceived racial discrimination (PRD) as a predictor of HRV among African Americans. Findings suggest that greater amounts of PRD are associated with low HRV. Similarly, perceived discrimination has been found to predict high blood pressure (BP), another risk factor for CVD. There is now a critical need to identify psychological, social, and behavioral influences on the relationships between PRD and HRV and between PRD and BP. Identifying these influences may inform appropriate intervention and prevention efforts to reduce CVD risk among African Americans. Data collection for this project will be completed in May 2017. I am willing to work with a mentee to develop a project related to this study.

Minimum Qualifications: Have taken a course in physiology or health psychology. I have a current mentee who is exceptional and plans to apply to the Charlotte Research Scholars program. She would be an excellent fit for this project. Her name is Jessica Prince. My preference would be to mentor her as she is familiar with this project.
Project Name: Eating behaviors and health among young men
Mentor Name: Virginia Gil-Rivas
Mentor Department: Psychology

Abstract:
More than two-thirds of the US adult population is overweight or obese, and these individuals are at increased risk for developing a number of chronic diseases, such as diabetes, cardiovascular disease, and certain types of cancers. Previous research has suggested that binge eating is one important risk factor for excess weight gain and obesity. A majority of extant research examining binge eating and its risk factors has focused on samples of White women, and thus we have limited information regarding binge eating among racial/ethnically diverse populations and men. Thus, this study examines binge eating among men of various racial/ethnic backgrounds and factors hypothesized to be associated with developing binge eating (e.g., childhood obesity, psychiatric distress and diagnoses, parental psychiatric diagnoses and obesity, critical comments about shape and weight), as well as variables related to the maintenance of these behaviors (e.g., social, work, and school-related stressors, medical history, gender norms). The results from this study will provide important information on these under-researched and under-served populations and may contribute to efforts to improve prevention and treatment programs aiming to reduce overweight and obesity among young adults.

Minimum Qualifications:
Completion of research methods with a B or better and experience using SPSS.
Abstract:
Being a first-time mother comes with a plethora of new experiences. These experiences can be very rewarding, but they can also introduce many new stressors. The decisions that mothers make in infancy regarding caregiving have long-lasting consequences for their child's health and wellness. Choosing to breastfeed is one of these types of decisions. This Charlotte Research Scholar track presents a motivated, rising scholar with the opportunity to expand his/her knowledgebase about the confluence of factors that impact breastfeeding outcomes in the Charlotte community, and, ultimately, maternal and infant wellness. The Scholar will work with Dr. Scott and her research team on either (or both) of the following active studies:

1) **The iCare Study** – which aims to understand the relationship between sensitive caregiving and breastfeeding in first-time mothers. This is a longitudinal, mixed-methods study that is conducted in collaboration with Dr. Laura Armstrong, a faculty member in the UNCC Department of Psychological Science.

2) **The Carolinas Healthcare Employees Study (CHEBS)** – which aims to examine breastfeeding attitudes, experiences, and outcomes among Carolinas Healthcare System employees, and perceptions and awareness of workplace breastfeeding policies. This is a multi-phase, mixed-methods study conducted in collaboration with Dr. Yhenneko Taylor, Director of Research at the Center for Outcomes Research & Evaluation.

Through both of these action-research projects, the Charlotte Research Scholar will gain hands-on experience conducting research in healthcare and community settings, and develop the capacity to engage in applied research. S/he 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.empowering-progress.com](http://www.empowering-progress.com)

**Minimum Qualifications:**

*If applicable (200 characters maximum)*

The following are required qualifications:
1) UNC Charlotte undergraduate that will return in Fall 2017;
2) At least a Junior standing;
3) Minimum GPA of 2.8;

The following are preferred but not required qualifications:
1) experience in healthcare 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
A lack of research on the health of gender minority individuals contributes to their marginalization and discrimination, as well as increasing health disparities (Winter, Diamond, et al., 2016). Gender minority individuals, or individuals whose sex does not correspond directly with their gender, include trans men (assigned female sex at birth, identify as men), trans women (assigned male sex at birth, identify as women), and gender fluid/gender non-binary individuals (those who do not identify as men or women, regardless of their sex). The proposed study examines the perceived resilience, or how individuals resist negative health outcomes through resources and assets, in gender minority individuals in Mecklenburg County, NC. This study will explore resilience in-depth qualitatively and quantitatively, through the use of longitudinal photo-elicitation interviews (in which participants’ photos prompt interview discussion) and a follow up survey (online and paper versions).

Gender minority individuals experience higher rates of violence, sexually transmitted infections (including HIV), mental health disorders (and suicide), and substance use than cis-gender populations (those whose assigned sex corresponds to their gender). Gender minority individuals in Mecklenburg County face oppression in part due to recent state legislation (HB2) that prohibits antidiscrimination policies; this legislation has increased stress for gender minority individuals in Charlotte.

**Significance**

This multi-method longitudinal study will identify how gender minority individuals perceive their own resilience, or how they resist negative health outcomes. As many studies of gender minority individuals’ health have been either quantitative or qualitative, the use of multiple methods and visual methods will advance knowledge in this topic area. Additionally, this study includes trans individuals as well as other gender minority individuals (e.g. genderfluid, genderqueer, gender non-binary). The health of gender minority populations beyond trans women has been under-researched. The larger spectrum of gender minority individuals in this study permits examination of the influence of gender identity on health and resilience.

**Minimum Qualifications:**
- Safe Zone certification or willing to pass Safe Zone training before summer 2017
- Experience with interviewing, qualitative research, and/or active listening/counseling is preferred
Project Name: Chronic Social Adversities and Physiologic Risk Factors

Mentor Name: Melinda Forthofer

Mentor Department: Public Health Sciences

Abstract: This project provides one or more students with the opportunity to join a team investigating the feasibility of measuring the relationships between chronic social adversities and physiologic risk factors for chronic diseases in a highly vulnerable population of refugees in Mecklenburg County, NC. The Principal Investigator (PI) is a Professor with an extensive track record of extramurally funded interdisciplinary research related to the role of social factors in chronic disease prevention among underserved populations. The proposed research will use noninvasive measures of biomarkers for stress hormones related to chronic diseases. The study objectives include: (1) field test and refine measures of chronic social adversities with a sample of community-dwelling refugees in Mecklenburg County, NC; and (2) refine protocols for collecting biomarkers of salivary cortisol and c-reactive protein with other vulnerable populations. Ultimately, the project will provide much needed preliminary data to support competitive extramural grant proposals aimed at investigating the impact of chronic adversity (e.g., poverty) on pre-disease physiologic risk factors and identifying promising intervention targets for cost-effective disease prevention strategies.

Minimum Qualifications:
Coursework in public health and/or social work
Project Name: Symptom Perception and Trigger Identification in Asthma: Effects of Age and Race

Mentor Name: Andrew Harver

Mentor Department: Public Health Sciences

Abstract:
Pediatric asthma is associated with significant economic, physical, and psychosocial costs; and the burden of asthma is disproportionately evident among racial minorities and children from socioeconomically disadvantaged families. Non-Hispanic black (NHB) youths are not only diagnosed with asthma at higher rates than non-Hispanic white (NHW) youths but also experience more frequent asthma episodes; are more likely to have routine office visits for asthma; and are more likely to have emergency department visits for asthma symptoms. Asthma mortality rates remain higher in African Americans compared to whites; blacks are 2 to 3 times more likely to die due to asthma compared with whites. Socioeconomic (SES) disadvantage adds complexity to the epidemiology of race, ethnicity, and asthma. Children from lower socioeconomic backgrounds experience more frequent symptoms and poorer asthma-related outcomes; and multiple indicators of SES (e.g., parental education, occupational prestige, and income) are inversely related to asthma morbidity including health-related quality of life. The relationship between SES and asthma morbidity appears complex; contributing factors include access to care, environmental exposures, genetic variation, psychosocial stress, and race.

Indoor and outdoor allergens, intense emotion, irritants, physical exercise, and respiratory infections trigger asthma symptoms, and both national and international asthma management guidelines emphasize the relevance of trigger knowledge and avoidance to achieve asthma control. Although asthma triggers are often discussed with health care providers, trigger management remains suboptimal in clinical practice and individuals with asthma often report not knowing their triggers. In this project, we will examine trigger knowledge and management in both black and white children, to determine effects of age and race on symptom perception and trigger Identification in asthma management.

Minimum Qualifications:
Junior or senior standing; needs to be independent, a self-starter, and dependable; health/life sciences major preferred; previous research experience – and interest in clinical research - a plus.
Project Name:  Physical Activity among Children in Charlotte

Mentor Name:  Elizabeth Racine

Mentor Department:  Public Health Sciences

Abstract:
Dr Racine and colleagues have been working with Charlotte Mecklenburg Schools collecting physical activity data among about 15,000 elementary school students. Our research team is currently analyzing the data and disseminated the results to the local community and the research community. A Charlotte Research Scholar is requested to help us draft research manuscripts. This would include conducting literature reviews and learning and/or using SAS statistical software to conduct analyses. The Scholar may also develop fact sheets for the local community (and schools) highlighting the findings of the study.

Minimum Qualifications:
Very good writing skills
An interest in statistics
An interest in public health
Experience or strong interest in developing infographics and graphs for fact sheets

Preferred Qualifications
Experience conducting data analysis particularly using SAS
Experience writing in the public health discipline
Project Name: Evaluating Holocaust Education – Intentions and Outcomes

Mentor Name: Barbara Thiede

Mentor Department: Department of Religious Studies

Abstract:
Courses on the Holocaust are now a standard feature of college courses across the nation. The Holocaust has become iconic in popular culture, from film to children’s literature. As scholars in the field have long noticed, the Holocaust has been “marketed” in ways that frequently distort historical realities. Marketing has occurred in the realm of popular culture but has also clearly affected students and coursework in college classrooms. In this project, the student will:

1. Research and evaluate current pedagogical assessments of Holocaust teaching in college: Why are such courses taught and what is their actual outcome? What does the current literature on Holocaust pedagogy offer? The student will provide an in-depth survey of current academic literature as part of the project.

2. Research the current literature on the marketing of the Holocaust in popular culture. Are there any measures indicating how and where most American students get their information on the subject?

3. Construct a set of readings and a sample syllabus for an entry-level college course focusing on how the Holocaust has become embedded in American popular culture. This sample syllabus should include an explanation of the pedagogical purpose of such a course.

4. Construct a model for evaluating the outcome of the course on student education.
Project Name: Using linked data to examine the trajectories and service utilization of families and children experiencing homelessness

Mentor Name: Andrew Reynolds

Mentor Department: Social Work, CHHS

Abstract:
A: Purpose: There is much research documenting the service utilization patterns of individual experiencing homelessness and cost-effective interventions that improve housing outcomes. However, there is much less research on service utilization patterns among homeless families or interventions to improve outcomes for this population. In the Charlotte region, chronic homelessness among individuals has reduced 45% since 2010 while family homelessness has been reduced only 3%. The goal of this study is to provide evidence to the experiences of families experiencing homelessness to inform policy efforts to better serve this population.

B. Research Questions: The purpose of this study is threefold: 1) to describe the service utilization patterns of families experiencing homelessness in the Charlotte region, 2) to compare these patterns to other low-income families in the Charlotte region, and 3) to identify risk and resilience factors for subsequent homelessness, child welfare involvement, criminal justice involvement, and child academic and behavioral outcomes. We hypothesize that families experiencing homelessness will have similar service utilization rates as other low-income families but will be at increased risk for negative social, behavioral, and health outcomes.

C. Methods: This study links data from local county resources housed through the Institute for Social Capital with the data linkage infrastructure offered through the US Census Bureau. The sample will include 910 families who experienced homelessness in 2014 - identified through the Charlotte-Mecklenburg Homeless Management Information System (HMIS). Descriptive analyses will examine the interaction of families who experienced homelessness with the social welfare system more broadly through linkage with Census data including TANF, SSI/SSDI, SNAP/WIC, Medicaid, and local data sources from the school district, the Department of Social Services, and the Sheriff's Office in Charlotte-Mecklenberg. Survival analyses and logistic regression models are used to identify risk and resilience factors for families experiencing homelessness.

Minimum Qualifications:
This project is a large undertaking which aims to examine how families experiencing homeless interact with health, education, criminal justice, and social services systems. Students with interests in poverty, families with low incomes, inequality, schools, child welfare, and criminal justice are encouraged to consider this position. The student will be involved in conducting literature reviews, preparing presentations and written materials, attending weekly supervisory meetings, and conducting data analyses. The work may also provide opportunities for students to work with administrative and/or Census data related to homelessness in the Charlotte region. Excellent oral and written communication skills with an ability to work independently is a requirement. The student must to have a strong quantitative background. The student must have taken at least one research methods course as well as at least one introductory statistics course, with experience in advance statistics (e.g. regression) preferred. Students studying or with a background in social work, education, health/human services, psychology, sociology, statistics, or a related field a plus.
Project Name: Vocal Accommodation as a Marker of Status, Dominance, and Prestige

Mentor Name: Joseph Dippong

Mentor Department: Sociology

Abstract:
Status and power are elementary dimensions of social life, influencing group interactions in both positive and negative ways. In many situations higher status people possess valuable skills and knowledge necessary to facilitate successful task outcomes, such as when an experienced medical doctor oversees and advises the work of a resident physician. On the other hand, status and power structures can inhibit successful task completion when stereotypes and cultural beliefs about lower status actors lead group members to overlook or ignore potentially valuable contributions. When examining socially sensitive processes like status inequality, examining non-conscious behaviors is useful for circumventing self-serving biases that might appear when directly asking individuals about their behavior. One such non-conscious behavior—vocal accommodation—may serve as an indicator of actors’ social status, whereby lower status actors engage in a substantially greater degree of accommodation than higher status actors. Research on vocal accommodation offers the potential for an unobtrusive measure of status.

My research seeks to advance social scientific knowledge about the relationship between social status and vocal accommodation by examining patterns of accommodation and social influence in status-differentiated groups. Specifically, my research aims to advance knowledge on the non-conscious communication of dominance and deference in three ways: 1) by assessing the extent to which predicts influence between status-differentiated task partners; 2) by comparing patterns of influence between groups engaged in cooperative tasks and those engaged in competitive tasks to examine how vocal accommodation functions based on specific task motivations; and 3) by differentiating the unique effects of dominance and deference on perceptions of social status.

Minimum Qualifications: None.
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, 191 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.
Project Name: The Roots of STEM Success: Transferring from Community College

Mentor Name: Elizabeth Stearns

Mentor Department: Sociology

Abstract:
Our late-stage empirical multi-phased study will illuminate the structural and individual factors that contribute to women and people of color’s lower probability of completing a STEM (science, technology, engineering, or mathematics) major, compared to White men. We focus on the experiences of community college students. Although the issue of underrepresentation of certain groups in STEM majors has been extensively researched, the pathway to and through community college—a pathway that is disproportionately taken by underrepresented groups—has been largely neglected. During the spring of 2015, my research team and I collected survey and interview data from students who were attending community college in North Carolina and were interested in transferring to a four-year university. Those interviews have been transcribed and some preliminary coding has been done. This summer’s tasks will focus on analysis of interviews with respect to the factors that inspire students’ interests in STEM and keep them involved with STEM activities or, conversely, the factors that may hinder their advancement in STEM fields.

Minimum Qualifications: Social science background (sociology preferred); interest in learning qualitative research methods
Project Name: In-Service Teachers’ Perceptions of the Benefits of a Summer Teaching and Leadership Symposium

Mentor Name: Cindy M. Gilson

Mentor Department: Special Education and Child Development - AIG

Abstract:
The purpose of this project is for the undergraduate mentee to gain and/or strengthen his/her qualitative methodological knowledge and skills by supporting an in-progress research study. The data for the mentee's project will be derived from a larger qualitative study that seeks to understand how a group of in-service teachers responded to participating in a summer teaching and leadership symposium.

The data for this study includes field notes, surveys, audio-recorded interviews, and audio-recorded small group collaborative work. The data collection phase will be completed by June of 2017. The majority of data analysis will be conducted by the faculty member on the research team; however, depending on the mentee's interest areas, he/she will be mentored in foundational knowledge of qualitative research design and theory. The mentee will also learn basic methods for transcribing and coding data, keeping analytic and methodological memos, and arriving at themes by analyzing a selected data set from the study that is of interest to him/her. The mentee will also be shown the basics of IRB applications and protocols for data safety monitoring. If applicable, the mentoring will emphasize a real-world application of the qualitative methods that could be used in the mentee's future research projects and/or profession.

Minimum Qualifications:
The mentee should have an interest in the basics of qualitative research and strong typing skills. If possible, the student should be interested in the field of education.
Abstract:

Though Milton is generally regarded as the only sonneteer of importance between Donne and the Romantics (a span of roughly 100 years), his Italian sonnets have not received the attention that they deserve. Only Milton’s English sonnets have garnered proper scholarly attention. This is in large part because there does not exist an English translation of Milton’s Italian sonnets that captures their elegance, technical artistry, and complexity. The extant translations all fail to communicate the power of these sonnets. Some, like those in the *Variorum Milton*, lean too heavily toward matching the technical aspects of the poems. Others, like those in the *Riverside Milton*, lean too heavily toward matching the poems’ figurative language and general content. At best, these translation are serviceable; at worst, they do much violence to Milton’s achievement. The best translation of the sonnets (by J.S. Smart) is not even in the form of poems at all. What is needed is a translation of Milton’s Italian sonnets that communicates both what Milton was saying on a line-by-line level and how he said it on a compositional level. We need a translation of these sonnets that does not radically change the sentence structure, rhyme scheme, or meaning (either global or local) of the poems. This is not an impossible task. It has been accomplished for many poets in many languages. The lack of such a translation for poems of the high quality of Milton’s Italian sonnets represents a significant gap in Milton scholarship, and this gap must be filled.

Minimum Qualifications:
Student must display competency in Italian. Students who have completed a 2000 level English course will be given preference, but this is not a strict requirement.