The Newsletter of the Winthrop Eagle STEM Scholars Program

Volume 1, Issue 18-2

Summer 2020

Special Edition Newsletter

Summer Research 2020

Special points of Interest

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INSIDE THIS ISSUE:

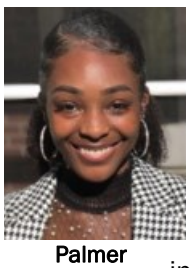
As usual, summer for Eagle STEM was busy! Eagle STEM Scholars were representing Winthrop University across campus and beyond. Students took advantage of varying opportunities. Following May graduation (and before our new freshmen arrived), we had 39 active Scholars. Sixteen of those scholars completed undergraduate research at universities including Winthrop, Clemson, Claflin, and the Naval Research Laboratory with the Department of Defense. This Summer Research Special Edition contains updates from these scholars so you are able to share in our excitement at all they accomplished! We are very proud of their achievements! Winthrop professors who dedicated their time to allow selected students to assist and learn in their research laboratories included Dr. Kristen Abernathy, Dr. Zach Abernathy, Dr. Eric Birgbauer, Dr. Victoria Frost, Dr. Christian Grattan, Dr. Jay Hanna, Dr. Ashley Licata, Dr. Matt Stern and Dr. Cindy Tant. Thanks to the department chairs, Dr. Dwight Dimaculangan, Dr. Robin Lammi, and Dr. Thomas Polaski and steering committee members and others not formerly mentioned who supported the summer research efforts for Eagle STEM Scholars in various capacities including Dr. Cliff Harris, Dr. David Meeler, Dr. Julian Smith, Dr. Kathie Snyder, Dr. Takita Sumter, Dr. Michael Whitney and Dr. Kristi Westover.■

Winthrop Eagle STEM Scholars Program Director, Amanda Cavin

My Research at Claflin University

by Merilyn S. Palmer

I had the opportunity of conducting research at Claflin University with Dr. Derrick Swinton. Our goal was to study the comparative analysis of gold nanoparticles (AuNPs) and gold nanoparticles with silica ($AuSiO_2$ NPs) as it applies to theranostics. Theranostics is the process of using one drug that is used to identify the target and the other radioactive drug is used to deliver the treatment . Our goal was to tailor the surface of the AuNPs so they would be able to effectively administer the drugs to their intended target. AuNPs are used because they have high physiochemical stability, are less toxic than other metals, and have stronger laser induced heating which leads to thermal expansion. The Silica is used to encapsulate the AuNPs because silica improves their stability in



Palmer

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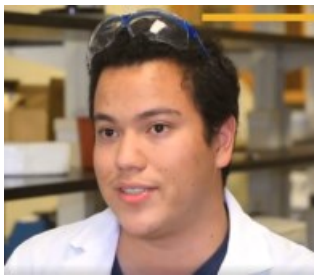
My Summer Research Experience

by Carlos Escoto-Diaz


Escoto-Diaz

This summer, I conducted research as a part of the Winthrop McNair Scholars Program. Usually, an incoming cohort of students gather on campus where each student can work on their individual research projects. However, this was not the case this summer, I was met with the challenge of completing a research product virtually. For the safety of students and mentors, we held virtual meetings to discuss progress and present our work. I continued my research with Dr. Matthew Stern, as I completed a literature review on the application of stem cells for the tissue engineering vascular grafts. This review applies to in-lab research as we are currently working on the recellularization of vascular grafts. This literature immersion will help to inform future projects that will involve using other cell types of interest for this purpose. As labs become more accessible, I look forward to seeing our summer research "come to life."

My Summer Research Experience

by Kiera Alexander


Alexander

My name is Kiera Alexander and I'm a senior at Winthrop University. This summer, I had the opportunity to work on research in the Human Nutrition department as a returning Ronald E McNair Scholar with Dr. Ashley Licata. While Human Nutrition research is very different from the Biochemistry Research I've completed in the past two summers, it provided me with even more necessary skills to analyze different research. I learned more about doing qualitative research versus quantitative research. Specifically, my research focused on *The Impact of COVID-19 on Food Insecurity and Resiliency in College Students*. This topic allowed me to obtain responses from the student's on campus in hopes that we can gain an understanding of what's causing food insecurity in college students and how it affects their ability to overcome certain obstacles. More importantly this research gives us a chance to provide resources in the future for students to use in the event they are facing issues with obtaining adequate food choices. While I was only given six weeks to complete this research during the very stressful pandemic, I was still able to present this research to the Winthrop community via a virtual research symposium. While this summer research experience wasn't an easy task by any means, it truly showed me how to critically think, problem solve, and work under pressure.

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Summer at the Naval Research Laboratory and Department of Defense

by Mina Heidari

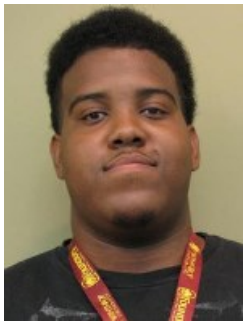
Heidari

This summer, I served as a research internship working for the Naval Research Laboratory and the Department of Defense. The experience was composed of ten weeks of research: eight weeks of mentor-navigated and hands-on learning and then two weeks of unsupervised time to put together a final presentation of all the research. Because I am a biomedical research concentration with an interest in medicine and genetics, I was paired with Dr. David Kidwell, an immunochemist in the field for over thirty years. SARS-COV-2 viral RNA tests, as we know them, consist of a (painful) nasopharyngeal swab run through PCR to amplify any viral RNA present. Working with Dr. Kidwell, our goal was to create an alternative test that would be noninvasive, low-cost, low-equipment, and isothermal so the test could be run in the workplace, and most importantly, at home. In order to design the new test, I researched isothermal amplification schemes, lateral-flow immunoassays, and RNA extraction methods from saliva to develop my ideal test: no boogers involved. The Naval Research Laboratory hosted meetings twice a week where other interns and I were spoken to by Nobel Prize-winning scientists, staff from top research institutions, and alumni from the program in order to network, as well as other research scientists at the NRL and DoD. At the end of the 10-week experience, I had entered my research into competitions, developed an isothermal point-of-care diagnostic SARS-COV-2 test, submitted a final technical report, and made countless connections through the Department of Defense networking sessions. I enjoyed getting to work alongside minority Ph.D. students and graduate school students who gave me advice and courage regarding pursuing science for my future.■

Summer Research

by Jomar Lewis

This past summer, I conducted research through the Ronald E. McNair Scholars Program under Dr. Christian Grattan, associate professor of chemistry here at Winthrop University. Due to COVID-19, my research experience was fully virtual and conducted in *silico*. My research focused on the modification of Sphingosine Kinase Inhibitor 1 (SKI-1). Sphingosine Kinase (SPHK) is a lipid kinase that is ubiquitously expressed in most cancers. SPHK catalyzes the formation of Sphingosine-1-Phosphate (S1P). S1P is linked to cell proliferation, survival, and migration. By modifying sphingosine kinase inhibitor 1, we could potentially prevent the formation of S1P, thereby making a potential anti-cancer drug. SKI-1 has 4 zones that can be modified. My research focused on various modifications of zone 2.■

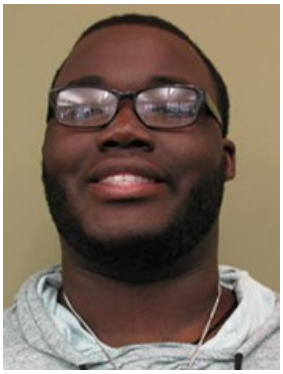


Lewis

My Summer Research Experience

by Kendarius Butler

This summer, I worked with Dr. Christian Grattan and the McNair Scholars Program to research the inhibition of sphingosine kinase. Sphingosine Kinase is an enzyme that is prevalent in cancer cells. It is responsible for converting sphingosine into spingosine-1-phosphate, a substance that is anti-apoptotic. To inhibit this enzyme, my lab partner and I were tasked with creating and testing new compounds *in silico*. We did this using UCSF Chimera, MarvinSketch, and an online web service known as Molinspiration. Our most important compound is a compound that mimics that properties of amygdalin, also known as Vitamin B17. We were able to figure out that the cyanide on amygdalin could be used to inhibit sphingosine kinase. In the future, we look forward to synthesizing this compound, along with the other created compounds, *in vitro*.■



Butler

My Summer Research

by Alyssa Brook

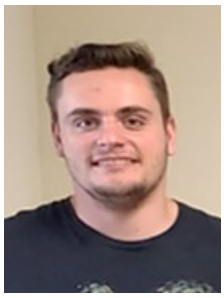
Clive

Ryan Lumbert and I worked with Dr. Zachary Abernathy and Dr. Kristen Abernathy to develop a model of ordinary differential equations that model the spread of HIV throughout a population. The most important aspect of our model is its dependence on complacency. We used optimal control methods to model and graph the relationship between the spread of HIV in a population and the amount of complacency in the population. We determined that complacency drives the spread of HIC and we can slow the spread by providing educational countermeasures.■

Summer Research Experience

by Jackson Barrett

Over the summer, I worked with Dr. Hanna and performed experiments in the area of organic synthesis. I learned a lot about organic chemistry techniques such as column chromatography and analysis techniques such as NMR spectroscopy. I also, had the opportunity to write a research paper with the other students in his lab. Overall, t was a very enjoyable experience and I would like to do it again next summer.



Barrett

My Research at Winthrop University

by Thomas Gonzalez


Gonzalez

My name is Thomas Gonzalez. This summer, I had the opportunity to worked with Dr. Eric Birgbauer in the Biology Department. The visual system is developed throughout the embryonic stage and is dictated by axon guidance molecules that tell the growing fibers of nerve cells, axons, where to grow. The ends of axons, called growth cones, continuously sprout out or collapse based on the axon guidance molecules. Research has shown that lysophosphatidic acid (LPA) causes growth cone collapse, so it is hypothesized that it is an axon guidance molecule. LPA binds to specific receptors, known as Lpars of which there are at least five known. Lpar4. Our research is trying to determine how axon guidance molecules help shape the visual system that we have today so we start at the embryonic stage where it begins. By working with an embryo that is somewhat similar to ours, we can further figure out how the system works and how our visual system builds itself. We are working to mutate the receptor that we believe to do a substantial amount of axon guidance by using CRISPR as a tool and then see how growth cones respond to LPA without Lpar4. Chicken eggs are used since we easily could take them out at embryonic ages in an artificial culture system in a cup. We have validated guide RNAs that can mutate chicken Lpar4 by using CRISPR. We will inject plasmids expressing these guide RNAs as well as Cas9 along with a tdTomato fluorescent tag into the developing embryonic chicken eye. After developing further, we dissect the chicken retina to see if retinal cells still respond to LPA with growth cone collapse in the absence of Lpar4.

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Summer Research Experience

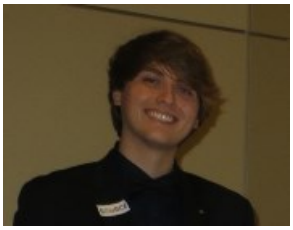
by Ryan Lumbert


Lumbert

During Summer 2020, I performed research here at Winthrop with Dr. Zachary Abernathy and Dr Kristen Abernathy through the South Carolina INBRE Program and Winthrop University Summer Undergraduate Research Experience Program (SURE). My partner Brooklyn Clive, and I explored the effects of performing optimal control on differential equations modeling the spread of HIV throughout a population. Our goal was to find a method to which maximized public awareness of the effects of HIV and how to prevent it, and which also had a minimal cost of implementation. We found that once an educational treatment was applied to the population, the total number of AIDS cases decreased dramatically (it was a fourth after treatment). The experience was enlightening, as it was my first time doing any sort of academic research in a university environment, and helped to inform me about what I wanted to do after I graduated.■

My Summer Research

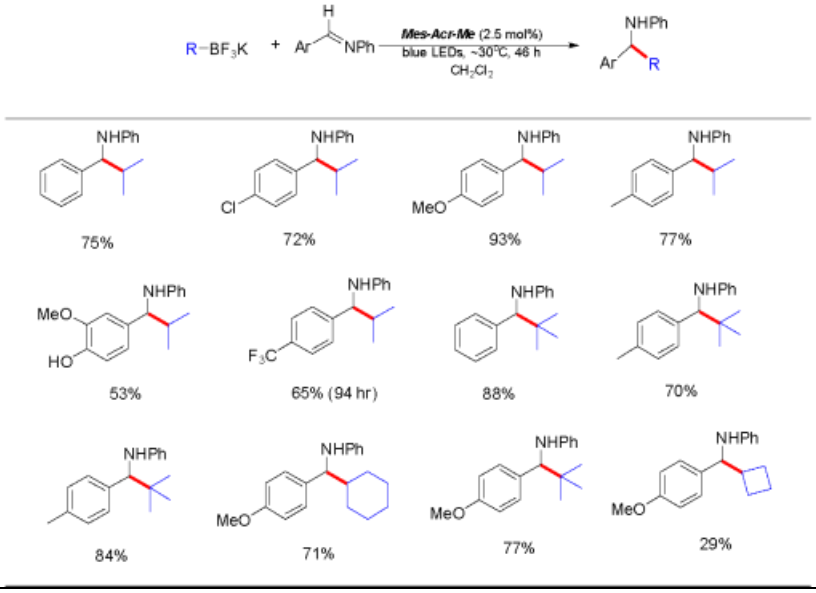
by Evan Thibodeaux



Thibodeaux

My research over the summer was in organic chemistry under Dr. Hanna. Our group is investigating the application of an organic photocatalyst, 9-mesityl-10-methyl acridinium tetrafluoroborate (Mes-Acr-Me), to the alkylation of aryl imines with potassium organotrifluoroborates. In the past, our group has employed a potassium isopropyltrifluoroborate for model reactions, but we desired to expand our BF_3K scope to see the effects of variation in the alkyl group of the organotetrafluoroborate. In addition, we also wanted to study the substituent electronic effects in the imine, which was done using a series of competition experiments. Results of our efforts this year are shown below in Table 1.■

Table 1. Scope and Limitations of the Reaction of Potassium Organotrifluoroborates with Imines



My Summer Research Experience

by Josiah Bauer

Bauer

This summer I worked with Tony Melton at Clemson University. I aided in the development of a new heat resistant strain of butterbean. I helped to maintain the plots of land and monitor the plants. And I was also responsible for implementing methods of pest control throughout the fields as well as carrying out the plot randomization patterns that my supervisor created.■

My Research Experience

by Lauren Patterson

This summer, I worked in Dr Tant's lab. The goal of our research was to find out the gut contents of dragonfly nymphs found in Rock Hill area. Dragonfly nymphs were collected from lakes, identified, and dissected. Once the gut and predator DNA was extracted, PCR was performed using pre-y-specific primers. Gel electrophoresis was used to see if any prey DNA was present in the dragonfly's guts. This research helps to give us a better understanding of the food webs in the local environment. ■

Patterson

Summer Experience

by Laela Walker

Walker

This summer, I worked with Dr. Frost to find cytotoxicity and superimmunity defensive traits in five genes from Larva, a subcluster K5 bacteriophage. SEA-GENES, in partnership with HHMI, allows student researchers to take the first steps in matching a specific function to each gene within a phage's genome. Larva genes 35, 42, 49, and 59 were amplified and assembled into a gene-specific plasmids for transformations into Larva's bacterial host, *Mycobacterium smegmatis*. The ultimate objective to achieve in the future is to create a library of genes for bacteriophages so they can be tested in future experiments to further evaluate their specific functions.

My Summer Research

by Eric Walters

This summer, I worked with my mentor Dr. Hanna. We had a virtual research experience through the McNair scholars program. For my project, I created a mock grant proposal for my area of study: Visible Light Mediated Photoredox Additions to Carbonyl compounds. That is a fancy way of saying that we use blue light to drive chemical reactions. I presented my research at the Winthrop McNair Scholars research conference. Overall is an awarding experience that where students get the unique opportunity to delve deeper into their field while being an undergraduate.

Walters

Research **continued**

Summer Research 2020

by Molly Quetel

Quetel

During the summer of 2020, I continued my research in Dr. Hanna's lab here at Winthrop. I started research with Dr. Hanna the fall of my freshman year. This summer, Dr. Hanna's research group investigated the organic photocatalyst Mes-Acr-Me with the alkylation of aryl imines. My part was to investigate the Potassium BF_3K reacting with different R-group substituents on the imines. Some of the different R-groups that I studied on the ring were F_3C, Tri-methyl substituted, methyl, and Cl. Even though that it was a shorter time period for research this summer, I enjoyed being a part of it!

Palmer **continued from front**

physiological environments due to it forming a scaffold of small pores. In our experiment, we found that protein corona (coating wrapping the nanoparticle) formed when the nanoparticle encounters biological fluids and that the protein absorbs with different affinities for the nanoparticle surface. My role in this experiment was using Ultraviolet/Visible Spectroscopy (UV/Vis) to determine the absorption spectra of varying forms of nanoparticle proteins at different concentrations or protein. The protein I used was bovine serum albumin (BSA). As the concentration of BSA decreased, the absorption bands widened. I am excited to continue my next step of the experiment which is obtaining NMR data of the AuNPs with the protein.■

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The Eagle STEM Scholars Program was formed as a result of the INBRE II diversity initiative to effectively matriculate more students from diverse groups into biomedical science Ph.D. programs. Winthrop, because of its diverse population of students, is uniquely poised to increase the number of under-represented minority, low income and first generation undergraduates in South Carolina who matriculate into Ph.D. biomedical science, bioengineering, biochemistry, biology and chemistry programs. It is taking steps to move over the next two decades towards national leadership in this area.