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Book of Abstracts FALL 2018 OUR Symposium

Abstracts

1. **Angelo Walker**, Junior, Biomedical Engineering, Faculty Mentor: Dr. Uitenham, Synthesis and Characterization of Fluorescent Protein Nanoparticles to Image and Treat Cancer

Fluorescent proteins are invaluable tools that enable tracking of gene expression, cell cycle, and cancer cells in living animals. Fluorescent proteins originated from the jellyfish *Aequorea Victoria*, which expresses the green fluorescent protein (GFP). Fluorescent proteins were awarded the 2008 Nobel Prize in Chemistry. Traditional fluorescent proteins are limited in wavelengths, consume oxygen, and produce a stoichiometric amount of hydrogen peroxide upon chromophore formation. Far-red fluorescent proteins are desirable for imaging deeper in living animals because less light is scattered, absorbed, and/or reemitted by endogenous biomolecules. Dr. Rodriguez developed a new class of fluorescent protein by evolving an allophycocyanin alpha-subunit from a cyanobacterium, *Trichodesmium erythraeum*. The selected protein was named small Ultra-Red Fluorescent Protein (smURFP), which is biophysically as bright as enhanced green fluorescent protein (eGFP). smURFP is currently the brightest far-red fluorescent protein available. Recently, patented radioactive fluoride chemistry developed by Drs. Rodriguez & Richard Ting (Weill Cornell Medicine) was tested in humans with positron emission tomography (PET) imaging and allows for improved lymph node mapping compared to clinically used magnetic resonance imaging (MRI) and single-photon emission computerized tomography (SPECT) agents. These new chemicals labelled with radioactive fluoride can miss small anatomical features and require extensive synthesis for attaching drugs and/or dyes for photodynamic therapy. smURFP was evolved to express extremely well in *E. coli* and gram quantities are easily purified in a day. smURFP is extremely pH and temperature stable, which are excellent properties to develop materials for biomedical imaging of human anatomy and disease. I purified the fluorescent protein, smURFP, and synthesized fluorescent protein nanoparticles. Synthesis was optimized by varying protein concentration, protein cross-linker, and sonication time. Fluorescent protein nanoparticles were characterized by size and fluorescence. I encapsulated solvatochromic, fluorescent dyes to safely mimic cancer drugs, such as doxorubicin, and analyzed incorporation. smURFP nanoparticles easily encapsulate small molecule drugs. The smURFP is easily modified for photodynamic therapy and PET imaging. The smURFP nanoparticles should enhance PET signal to image small anatomical features and very small, metastatic tumors in humans. These nanoparticles encapsulate drugs and modification allows for photodynamic therapy for treatment.

2. **Olajide Olatidoye**, Senior, Chemistry, Faculty Mentor: Dr. Marion Franks, Synthesis and Characterization of 2TM- Hydroxychalcones

Chalcones are known to be anti-bacterial, anti-microbial, anti-HIV, anticancer, anti-malarial, antioxidant, anti-inflammatory, and anti-viral agents. They are a class of compounds that have chemical activities that activate biological pathways in order to inhibit carcinogenesis. They are also known to have cancer chemopreventive properties. Cancer chemoprevention is the use of natural and synthetic molecules to inhibit the process of carcinogenesis. A chalcone can undergo 1,4-Michael addition with soft nucleophiles through its enone system. Many biological systems utilize the Michael addition to activate chemopreventive pathways and anticancer responses². In this work, 2'-hydroxychalcones were of interest because they have increased 1,4-Michael acceptor activities. The 2'-hydroxy substituent is able to hydrogen bond with the carbonyl oxygen of the enone system in order to increase the compound's reactivity toward soft nucleophiles. The 2'-hydroxychalcones that were synthesized using several types of aldol condensation reactions. Using various derivatives of synthesized chalcones, we have increased the free radical scavenging ability in the compounds in order to improve chemoprevention. Synthesized compounds were characterized via ¹H-NMR.

3. **Destina Riggins**, Senior, Biology, Faculty Mentor: Dr. Misty Thomas, Genomic resequencing of Iron (II) resistant strains of *Escherichia coli*

Background: Bacterial resistance to antibiotics have caused an increase in usage of heavy metals as antimicrobials in an attempt to control the rate of antibiotic resistance. However, very few studies have been done to address the use of heavy metals and the genetic adaptations that occur as a result. Understanding the genetic changes that results from adaptation will help to elucidate the mechanism of resistance used by gram-negative organisms. **objective:** To assess the genetic changes that result in the genome of *E. coli* as a result of adaptation of iron (II) resistance. **Methods:** Evolved strains were pelleted by Dr. Ewunkem and sent to us for extraction and sequencing. Extractions were done using the methods outlined in the standard Omega Bio-tek Bacterial DNA Extraction Kit protocol and eluted in 50mL elution buffer. DNA samples were then quantified using the fluorescent based dsDNA kits from Promega and measured using a quantifluor. mLibrary preps were conducted using the DNA flex kit from illumine and sequenced on Illumina MiSeq at JSNN. Fastq files were then processed using the Breseq pipeline to look for variation. **Results:** Genomic sequencing shows single nucleotide changes in *ptsP* which is involved in nitrogen metabolism, *fecA* which is a ferric citrate outer membrane transporter, *ilvG* involved in valine biosynthesis and finally in *rpoB*, the beta-subunit of RNA polymerase. **Conclusions:** The majority of genes identified to carry mutations are primarily involved in metabolism, indicating that these strains may be decreasing metabolic rates in order to potentially prevent entry of excess iron into the cell. In addition, the

mutation in *fecA* may indicate that transport of iron into the cell may be decreased also in order to prevent survival. Future directions: Due to the requirements of high levels of efflux, metal resistance is often associated with antibiotic resistance. Therefore, the next goal is to take these iron resistant strains in order to see if they are also resistant to common antibiotics. Broader Goals: By understanding mechanisms of metal resistance before they appear in nature makes it easier to develop methods to counteract resistance before it is prominent.

4. **Joshua McDuffie**, Junior, Civil Engineering, Faculty Mentor: Summer PI - Dr. Shideh Dashti, Experimental study on the seismic response of embankments on liquefiable soils improved with stone columns

Over the past few decades, methods used to reduce the liquefaction hazard in vulnerable areas have increased in number and complexity. On this subject, numerous studies have shown the insertion of granular columns to be an effective mitigation technique against settlement and lateral deformation by structures founded on liquefiable soil profiles. Granular columns are constructed by the insertion of coarse aggregate into the soil by means of compaction and vibration. The effectiveness of granular columns as a mitigation technique has been shown to involve three mechanisms: 1) ground densification during column installation; 2) shear reinforcement added by column stiffness, and 3) enhanced drainage capacity. There is, however, a lack of understanding concerning the extent to which each of the mechanisms contribute to the overall mitigation and what factors are improved by the process. Being able to comprehend the relative contributions of the mechanisms would lead to the development and refinement of a more efficient stone column mitigation system design. We used reduced scale centrifuge modeling to examine the influence of the three distinct aspects under controlled conditions and compared them to an unmitigated system. The system of interest was a 4 m tall gravel embankment founded on dense Monterey sand ($D_r \approx 90\%$) with a liquefiable layer of Ottawa sand ($D_r \approx 40\%$) between it and a denser layer of Ottawa sand ($D_r \approx 90\%$). The columns inserted had an area replacement ratio (A_r) of 10% and were modified as needed to isolate each mechanism. The experimental results will provide insight into the influence of this ground improvement technique on key engineering demand parameters of interest in design, such as acceleration and settlement. In a larger scope, it will also allow for the calibration of numerical models and advance understanding involving the ground improvement method based on granular columns.

5. **Courtney Richard**, Senior, Food and Nutritional Science, Faculty Mentor: Ramine Alexander, Antioxidant Activity of Mango (*mangifera indica*) Kernel Extract

Purpose and Rationale: An extensive amount of has been conducted to prove that the regular consumption of fruits and vegetables provide health benefits. These health benefits are due to

the antioxidants found within the fruit, which are known to have anti-inflammatory, anti-cancer, and anti-aging effects. One commonly consumed fruit is the mango, which is often used to manufacture fruit juices, smoothies, and fruit cups. The kernel of the mango is rich in antioxidants, but is typically disposed of because it cannot be eaten raw and is not a commonly consumed food. By measuring the antioxidant activity in a sample of mango kernel extract it can be determined if mango kernel can be used as a natural antioxidant supplement or ingredient for food enrichment. Using mango kernel would also reduce waste production and provide an additional source of revenue in agriculture. Methodology: To determine the antioxidant activity of mango kernel total phenolic amount (TPA) and total antioxidant capacity (TAC) assays were used. The mango kernel extract was first dissolved in 1ml of water, then TPA was measured using Folin-Ciocalteu's phenol reagent and then compared against gallic acid equivalents. The mango kernel extract was also dissolved in 1ml of water before TAC was determined by ABTS and DPPH radical decolorization assays and data was measured (in mg) against vitamin C and BHT equivalents. Findings: Measuring the antioxidant activity of mango kernel extract using 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid (ABTS) and 2,2-diphenyl-1-picryl-hydrazyl-hydrate (DPPH) showed a significant increase in antioxidant activity in high concentrations of mango kernel extract (MKE). TAC measurements showed increasing amounts of phenols in higher concentrations of MKE. Conclusions and Implications: Based on the findings, mango kernel is high in antioxidants, which suggests that mango kernel, a byproduct, could potentially be used as a natural fortificant to increase antioxidant properties in foods that don't have high antioxidant content.

6. Heaven Jordan, Senior, Food & Nutritional Sciences, Faculty Mentor: Dr. Heather Colleran, The Effects of a 16-Week Exercising Program on Inflammatory Markers in Human Milk

Exercising during pregnancy is prominent for lowering systemic inflammation. Information on the effects that exercising has on human milk inflammatory markers is limited. Thus, it is critical to closely monitor both the control group and the exercise group post-partum to analyze the pro- and anti-inflammatory signals in human milk. A consistent exercising program has been found to reduce the proinflammatory markers within human milk, but specifically within colostrum. An exercising program has also been found to increase the number of fractalkine concentrations within human milk, which may foster neurodevelopment and neuroprotection in newborns. Post-baseline measurements randomization into either the

exercise group or control group. The exercise protocol included a 60-minute exercise, at a maximum heart rate intensity of 65-80%, three days per week. The exercise intervention included both aerobic and strengthening training. The control group was instructed to avoid structured exercise and both groups were instructed normal dietary intake. Both groups were also given multivitamin supplements that contained 100% RDA, including 400 IU of vitamin D and 400 mcg of folic acid. mature human milk proinflammatory and anti-inflammatory cytokines (fractalkine, interleukin [IL]-1 β , IL-6, IL-8, IL-10, interferon [IFN]- γ , and tumor necrosis factor [TNF]- α) will be measured using Luminex xMAP technology.

7. **Gabriel Faulcon**, Freshman, Animal Sciences, Faculty Mentor: Dr. Uchenna Anele, Use of fungi and solid state fermentation to improve the nutritive value of corn stover

Small- and medium-scale cattle farmers are constantly faced with the challenge of maintaining economic viability in the face of changing seasons and cattle feed. Their dependency on forage resources means that strategies that maximize the use of forage resources as well as minimize inputs while maintaining acceptable levels of cost of beef cattle is the way to go.

Combinations of Kudzu, a common invasive species and corn stover were subjected to solid state fermentation with *Pleurotus ostreatus* and compared with grass hay for their nutritive value using the in vitro gas production technique. Treatments consisted of mixtures of corn stover (C) and Kudzu (K) as 1) 100C:0K, 2) 75C:25K, 3) 50C:50K, 4) 25C:75K, or 5) 0C:100K, fermented for 0, 35 and 77 days. The study was arranged as a 5 x 3 factorial design with 3 replicates. In vitro gas production was measured at 3, 6, 24 and 48 h of incubation using rumen fluid from 2 dairy cows fed standard diet at the CAES University Farm. In vitro gas data were fitted to a non-linear equation to calculate asymptotic gas (M), rate of gas production (k) and lag time (L). Interactions ($P < 0.05$) between treatments and fermentation time were noted for M, k and L. Asymptotic gas was highest ($P < 0.05$) for 0C:100K and 100C:0K on day 77. Results show that the treated corn stover was comparable to the control which is a good quality hay. Typically, corn stover has lower digestibility compared to grass hay but the inclusion of Kudzu before treating with *Pleurotus ostreatus* resulted in a superior by-product which can be utilized by limited resource farmers to maximize profit.

Key words: Corn stover, in vitro gas production, *Pleurotus ostreatus*, solid state fermentation, fiber digestibility

8. **Mercer Butts**, Freshman, Animal Sciences, Faculty Mentor: Dr. Uchenna Anele, Sustainable livestock production through efficient use of crop residues

Digestibility and efficient use of crop residues by cattle is limited by the presence of lignin. However, solid state fermentation (SSF) of these residues with white rot fungi (WRF) results in the breakdown of lignin with concomitant release of nutrients and bioactive compounds

which could benefit cattle productivity. Batch culture technique was used in the present study to evaluate the potential of utilizing SSF with WRF to improve dry matter (DM) digestibility of corn stover in ruminants. Five dietary treatments consisting of mixtures of corn stover and Kudzu in varying ratios (100:0, 75:25, 50:50, 25:75 and 0:100) were inoculated with *Pleurotus ostreatus* and subjected to SSF for 0, 35 and 77 days. Treatments consisted of mixtures of corn stover (C) and Kudzu (K) as 1) 100C:0K, 2) 75C:25K, 3) 50C:50K, 4) 25C:75K, or 5) 0C:100K, fermented for 0, 35 and 77 days. The study was arranged as a 5 x 3 factorial design with 3 replicates. Treatment effect ($P < 0.001$) and treatment x fermentation time interaction ($P < 0.001$) were noted on in vitro DM digestibility (IVDMD). On day 77, treatment 4 had the highest ($P < 0.001$) IVDMD value while treatment 1 had the lowest ($P < 0.001$) IVDMD. There was no difference ($P > 0.05$) between treatments 3, 5, and the control. Numerically, the ranking of their IVDMD values from the highest to the lowest is: 4 > 2 > 5 > control > 3 > 1. Based on our results, subjecting crop residues to SSF removes the limitation that lignin typically place on their utilization in ruminants. Keywords: Batch culture technique, crop residues, dry matter digestibility, feed efficiency, *Pleurotus ostreatus*

9. **Jared Via**, Senior, Biological engineering, Faculty Mentor: Abolghasem Shahbazi, Industrial Hemp: Determining Growing Conditions in North Carolina

Industrial hemp (IHP) is a multi-purpose crop delivering seeds, fibers and bio-active chemicals that has the potential for a number of uses and markets. Legalization of production of IHP in North Carolina has made it necessary to establish a databank on best management practices (seed variety, planting practices, soil type, nutrient management and pest management). The objective of this is to determine the effect of different nutrient management and IHP cultivars on cannabidiol (CBD) production. Two varieties (Therapy by Oak City Hemp and Cherry Otto by Flat River Hemp) and four different fertilizer rates (F1: 0%; F2: 33%; F3: 66% and F4: 100% of nutrient solution General Hydroponics©) was used in this study. The transplants of each IHP varieties were planted early June 2018 using a randomized complete block split-plot experimental design with fertigation rate as the main plot factor and IHP variety as the sub-plot factor. Preliminary results indicated that the Therapy variety yielded 0.01 % tetrahydrocannabinol (THC) and 6.2% CBD at F1; 0.08 % THC and 3.86% CBD at F2; 0.1 % THC and 5.5% CBD at F3; and 0.07 % THC and 6.51% CBD at F4. Cherry Otto yielded 0.05 % THC and 3.2% CBD at F1; 0.05 % THC and 5.4% CBD at F2; 0.09 % THC and 3.48% CBD at F3 and 0.07 % THC and 3.86% CBD at F4. Our IHP production information will provide first-hand information for growers to develop new markets for potential IHP products. Keywords: Industrial hemp, CBD production, fertilizer rates Topic areas: Plant Health and Production and Plant Products, Renewable Energy, Natural Resources, and Environment

10. **Breon Henley**, Senior, Civil Engineering, Faculty Mentor: Dr. Stephanie Luster-Teasley, Polymer Comparison in Controlled Release Oxidation Pellets

The purpose of this project was to compare the effectiveness of different polymers used in biodegradable Controlled-Release Oxidation Pellets. Controlled-release pellets are used to administer an oxidant encapsulated in a polymer in which the polymer releases the oxidant through its permeable membrane over time opposed to all at once. This method can be used to treat wastewater over time in a way that does not disturb vegetation and has no adverse effects on the water itself. For this project, the polymers chosen were Polyvinyl acetate(PVAc) and a mixed polymer makeup of poly (ethylene oxide) (PEO) and Polycaprolactone (PCL). The oxidant chosen to be observed was Potassium Permanganate, KMnO_4 . Together, the KMnO_4 and the chosen polymers remediates bacterial contamination as well as hydrocarbon contamination. in water. This method was analyzed by measuring the absorbency and concentration of the oxidant released from the pellets in deionized water over a time span of three hours and at 24 hours.

11. **Jourdan Dickens**, Sophomore, Biology, Faculty Mentor: Dr. Misty Thomas, Purification of the CusS protein into liquid nanodisks

Background: Silver is an antimicrobial agent that helps reduce the rate of bacteria growth. Silver kills bacteria by interacting with the cell wall and membrane, as well as disrupting DNA replication, transcription, and translation. Previous work using experimental evolution found four mutations leading to silver resistance in the *cusS* gene. The purpose of this is to determine if any of the mutations in the *cusS* gene will change the function of the CusS protein and to determine if these changes will indeed make the bacteria resistant to silver.

Question: How do mutations in the *CusS* gene change the function of the CusS protein? How do these changes make the bacteria resistant to silver?

Methods: The wild-type and mutant *cusS* genes were previously cloned into a protein expression vector. These samples were used to grow overnight cultures and then subsequently used to inoculate 1L cultures and grown to an optical density of 0.5 at 600nm. Once this was reached, cultures were induced with 1mM IPTG overnight at room temperature. Samples were then run on an SDS-PAGE gels to test for expression of the wild type protein.

Conclusions: The wild type protein was successfully purified into the insoluble fraction of the cell lysate.

Future Directions: After purifying the wild type CusS protein, the CusS protein would be isolated from the membrane to study it biochemically by inserting the CusS protein into a

liquid nanodisk. Lipid nano disk keeps the membrane proteins in their natural form to be studied. This will be completed again using the mutant type CusS protein to compare the function from the wild type CusS protein.

Broader Impact: Two-component response systems have been proposed to be a potential target for drug development and therefore this work will help us to better preventively understand the mechanisms of silver resistance before it is widespread in nature and possibly have the opportunity to keep it under control.

12. **Aaron Phillips**, Junior, Biology, Faculty Mentor: Dr. Misty Thomas, Understanding the mechanism of silver resistance in *Escherichia coli* by evaluating mutations in CusS.

Authors: Aaron Phillips, Joseph Graves Jr. and Misty Thomas Background: Silver has been used as an antimicrobial agent for ages. However, bacteria have developed a method of resistance to combat silver as an antibiotic. The CusS protein allows a bacterium to sense the presence of silver in order to activate expression of an efflux pump required for the removal silver from within to cell to extracellular matrix. Under normal exposure to silver this system is adequate, however, when silver concentrations become too high, the system becomes overwhelmed and kills the bacterial cell. Our previous work has shown that mutations in the *cusS* gene lead to silver resistance, and therefore the goal of this project is to understand how these mutation lead to changes in the mechanism of this protein and therefore resistance to this potent antimicrobial agent. Question: To elucidate the underlying molecular mechanisms leading to silver resistance in *Escherichia coli* by studying the change in function of CusS associated with silver resistant mutations. Methods: The *cusS* gene was previously cloned into a pET19b expression vector and transformed into *E. coli* for overexpression. For expression we begin with growing bacterial overnight cultures and subsequent large scale (1L) subculturing. After the subculture reaches an optical density of 0.5 at 600nm protein expression is the induced using IPTG. After overnight expression at room temperature, cells are harvested through centrifugation and stored at -80oC. Cells are then lysed using sonication and centrifuged to separate the soluble and the insoluble fractions. Results: As expected, we see expression of the CusS protein in the insoluble fraction of the insoluble fraction. This was expected, as CusS is a membrane bound protein and therefore we expected expression in the insoluble membrane fraction. Future Directions: To study functional changes functional changes associated with each CusS mutation, we will continue to purify CusS into into styrene malic-acid lipid nanoparticles to stimulate the natural environment of the membrane and then subsequent purification using its histidine-tag and affinity chromatography. Broader Impact: Understanding CusS protein can lead to advancements in antimicrobial medications. It can

also help combat antibacterial resistance especially in regards to silver which is not extremely prevalent currently in nature.

13. **Simone Blaylock**, Senior, Chemistry, Faculty Mentor: Dr. Marion Franks, Emporium Abstract Blaylock

The Chemistry Department at North Carolina A&T State University (NCAT) used an emporium model to improve student learning in General Chemistry 1 (CHEM 106) course. Student learning was measured by a nationally accredited standard test and compared to students in a traditional teaching model. The ALEKS (Assessment and LEarning in Knowledge Spaces) software package while being present in the emporium laboratory. Preliminary findings suggest that students who participated in the emporium courses and completed the assignments did better on standardized hour exams and nationally standardized tests that were given.

14. **Valorie Chasten**, Senior, Food and Nutritional Sciences, Concentration in Food Science, Faculty Mentor: Dr. Salam A. Ibrahim, developing a screening system for identifying efficient inhibitors of the choline kinase of *Streptococcus pneumoniae*

Gram-positive pathogens such as *Streptococcus pneumoniae* can have deleterious effects on both human and animal health. Antibiotics and antimicrobials have been developed to treat infections caused by such pathogens and to prevent food contamination. However, resistant strains emerge continuously. Thus, new strategies for controlling Gram-positive pathogen growth must constantly be developed. Putative inhibitors of Gram-positive isoforms of the enzyme choline kinase have been shown to block the growth of *S. pneumoniae*. However, the strength of inhibition and the mechanism of action of these inhibitors on *S. pneumoniae* choline kinase (sChok) is unknown. The aim of this project was to establish a system for screening sChok inhibitors by characterizing their strength of inhibition and determining their mechanisms of action. The sChok enzyme was expressed in BL21(DE3) cells and enriched using IMAC chromatography. The LDH/PK system of quantifying kinase activity was adapted for use with sChok. Inhibitor strength was determined by calculating IC₅₀s. A simple comparative kinetic method was applied to determine inhibitor mechanism of action. The K_m choline and K_m ATP of sChok were 164.247 +/- 59.92 μM and 144.523 +/- 17.8 μM, respectively, while the V_{max} choline and V_{max} ATP was 103.562 +/- 9.125 and 67.5896 +/- 2.352, respectively. Two promising sChok inhibitors were identified: MN58 and 717, with

IC50s of 500 μM and 0.2 μM respectively. MN58 and 717 had competitive and uncompetitive mechanisms of action, respectively.

15. **Amir Barnett**, Sophomore, Biological Engineering, Pipeline Construction impacts on small mountain streams: evaluating stream geomorphology, water quality, and benthic macroinvertebrate diversity

The Mountain Valley Pipeline is a natural gas pipeline crossing through Appalachian karst geology and mountain streams posing environmental concerns. Deforestation and construction on mountain grades can increase erosion and release nutrients, which can affect small streams. By examining stream morphology, sediment deposition, water quality and benthic macroinvertebrate diversity we characterized four reaches in the Mill Creek watershed (Montgomery County, VA): two isolated from pipeline construction and one on each side of the pipeline right-of-way. To identify physical stream health and relative impairment, we measured stream geometries and classified stream substrate to calculate relative bed stability. We installed embedded sediment samplers above and below the pipeline right-of-way to capture fine sediments for a comparison of quantity and composition. In addition, we measured water quality using a hand-held water quality sonde (YSI) and grab samples. We determined benthic macroinvertebrate diversity using modified procedures from the EPA's Rapid Bioassessment Protocol. Samples from above and below the pipeline crossing, with varying distances, were quantified and aggregated. Study results provided quantitative and visual evidence that the below pipeline stream was physically altered compared to upstream or isolated sites. The downstream site had greater sediment loads, evident in our bed sediment sampling and pebble counts, along with an impairment rating utilizing relative bed stability methodology. However, ecologically, the benthic macroinvertebrate community showed minimal variation by site and longitudinal distances. This study sufficiently establishes baseline information; further monitoring should evaluate physical stream properties and ecosystem health as pipeline construction continues and reclamation plans are implemented.

16. **Jemari Johnson**, Sophomore, Industrial and Systems Engineering, Faculty Mentor: Hilda Goins, Data Structuring in Alzheimer's

Cognitive function is defined as a person's performance in objective tasks that require conscious mental effort. Cognitive impairment occurs when a person has trouble performing objective tasks such as remembering, learning, or concentrating. has shown that environmental factors such as heat, glare, and noise are known to be stressors of people with cognitive impairment. Behavioral and Environmental Sensing and Intervention (BESI) for caregiver empowerment is a team of ers from the engineering and medical fields tasked with understanding the environmental factors that influence agitated behaviors in People with

Dementia(PWD). BESI is a cyber-human system comprising a tablet for inputs by the caregivers, sensors placed in different locations in the home, a wrist-worn wearable device for the PWD, and a base station in the home. The BESI system collects large amounts of environmental data using dispersed relay stations that extract data from the home of the PWD. This data describes audio, light and other ambient stimuli inside the home. However, in order to understand how environmental factors impact agitation states, it must be understood what combination of factors cause agitation in PWD. BESI then uses this data combined with caregiver inputs to understand how to minimize or prevent agitation in the PWD, which is a major source of stress for caregivers. To analyze this data, it must be structured in a manner that is easier to work with. To structure the data, I prep large amounts of raw data, organize the data and reduce the data in an attempt to understand how environmental factors cause stress. The data structuring process is a key input to model the data using statistical models and machine learning to understand what environmental factors cause agitation in PWD. These methods can be utilized in medical and other studies, and will advance our ability to design and develop effective cyber-human interventions for caregivers of PWD.

18. **Darius Herbert, Senior**, Chemistry, Faculty Mentor: Dr. Ming Dong, Structural analysis of human Branched Chain Aminotransferase.

Structural analysis of human Branched Chain Aminotransferase The human branched chain aminotransferase proteins (hBCAT), hBCATm (mitochondrial) and hBCATc (cytosolic), catalyze the transamination of the branched chain amino acids (BCAA), leucine, valine and isoleucine, to their respective α -keto acids and glutamate. Subsequent oxidation of the resulting α -keto acids, by the branched chain α -keto acid dehydrogenase complex (BCKDC), generates Acyl-CoA, which enters the TCA cycle. Mitochondrial BCAT (hBCATm) is found in the pancreas, kidney, stomach and brain, is thought to be responsible for the majority of transamination outside the central nervous system. Meanwhile, the cytosolic isoform (hBCATc) is predominantly expressed in the brain and the peripheral nervous system, as well as the placenta and ovary. These enzymes play significant roles in amino acid metabolism and whole-body nitrogen shuttling, in particular with respect to the de novo synthesis of the neurotransmitter glutamate in the brain. Interestingly, the transamination is regulated by the redox center CXXC motif of the protein, where the mutants of the redox center leads to a compromised hBCAT activity. Our goal is to have a deeper understanding of the redox regulation with structural analysis.

19. **Lexis Deshazor-Burnett**, Junior, Biology, Faculty Mentor: Dr. Checo Rorie, CRISPR-Cas9-Mediated Knockout of Histone Demethylase KDM6A in Pancreatic Cancer

Clustered Regularly Interspaced Short Palindromic Repeats(CRISPR)-Cas9 originates from a system in bacteria used to protect them from invading phages and plasmids. CRISPR for genome editing involves the usage of a Cas9 protein and a single guide RNA (sgRNA) that form a complex and target the complementary sequence indicated by the sgRNA. CRISPR-Cas9 genome editing causes double strand breaks and creates random insertions and deletions causing an out of frame transcript. We sought to knockout KDM6A, a histone demethylase, located on the X chromosome. KDM6A is a tumor suppressor gene and is frequently mutated or lost in pancreatic cancer. In pancreatic cancer, KDM6A loss, leads to activation of oncogenes, such as Δ Np63, MYC, and RUNX3, due to the deregulation of the COMPASS-like complex. In order to study the molecular mechanisms in human tumorigenesis, we sought to use CRISPR-Cas9 genome editing to knockout KDM6A in difficult to transfect pancreatic cancer cell lines. To achieve this, we will clone into the lentiCRISPR_V2 lentiviral vector to infect the pancreatic cell lines. In pancreatic cancer that retains KDM6A, we aim to determine if CRISPR-mediated knockout of KDM6A causes aberrant activation of oncogenes such as Δ Np63, MYC, and RUNX3, and squamous-like metastatic pancreatic cancer to develop.

20. **Jeffrey Shelton**, Sophomore, Chemistry, Faculty Mentor: Dr. Checo Rorie, Fluoride containing compounds elicits a differential cytotoxic response on human breast cells.

Sodium fluoride (NaF) is a commonly used preventive agent in many dental products, used to aid in the prevention and decrease of dental caries. Sodium fluoride (NaF) along with sodium hexafluorosilicate (F_6Na_2Si) and fluorosilicic (H_2F_6Si) acid solution are added to public drinking water to increase the accessibility of fluoridation to the public to help reduce the incidence of dental caries. However, previous observations and studies have revealed that the overconsumption of fluoride may lead to fluorosis in teeth and bones, and that high concentrations of these fluoride containing compounds show detrimental effects to cellular health. Previous studies showed that elevated levels on NaF caused toxic effects on *C. Elegans* and some human cell lines. Here we wanted to investigate the cytotoxic effects of fluoride compounds on the human breast cancer cell lines HCC70, HCC1806, and HCC1500. We revealed that all of the fluoride containing compounds elicited both a dose and time course cytotoxic response on the human breast cancer cell lines. We then exposed the breast cell lines to 10uM of all three fluoride containing compounds, NaF, F_6Na_2Si , and H_2F_6Si for 24hrs and revealed a differential cytotoxic effect on the cells and between the different compounds. Light microscopy revealed that NaF had the greatest physical toxic effects on the cell lines, while the other fluoride containing compounds had very little physical effects. Interestingly, cell viability trypan blue exclusion assays revealed that H_2F_6Si had the greatest cytotoxic effect on the breast cell lines resulting in over 90% death. These studies reveal that while fluoride at low concentrations may help to prevent dental caries, at high concentrations fluoride containing compounds may also cause cytotoxic effects on human breast cells and may

provide implications that these compounds could potentially be used as treatment options for breast cancer.

21. **Edward Dickerson**, Sophomore, Bioengineering, Pre-Med, Faculty Mentor: Mrs. Sharon Wellman, Restoration of Joint Motion by rhPRG4 in Mutant Mice that Recapitulate CACP Syndrome in Humans

The CACP syndrome is a rare autosomal recessive condition caused by mutations in the PRG4 gene, which encodes a lubricating glycoprotein present in the synovial fluid as well as the surface of articular cartilage. At the present time, there is no cure or specific treatment for CACP syndrome. The skeletal component of the CACP disease begins at birth or early adolescence and worsens with age. Lubricin (rhPRG4) is a surface-active glycoprotein that plays a key role in preventing cartilage damage in healthy synovial joints. The purpose of this study is to investigate if joint functionality percentages are altered from the diagnosis of lubricin (rhPRG4) in the synovial cavity located in the knees and understand gait disturbance in an animal model of CACP syndrome. Current work in the lab is determined to seek if lubricin will increase the joint functionality percentages of the mice as well as eliminating any foreseen discomfort and hardship related towards gait. A machine called DigiGait was used to show the mice's gait parameters. Before receiving the injection, the Prg4^{-/-} mice were placed on the machine's treadmill for control purposes. Areas of focus range from changes in stride length to paw angel percentiles. The same Prg4^{-/-} mice were injected with lubricin in both of their knee joints and placed back on the DigiGait. This procedure was repeated study exactly how long the lubricin is effectively benefiting the mice's gait. Each possible treatment data phase was analyzed via calculated percentiles, always comparing new gait activity to the control's gait activity. There has been an increase and a decrease in some of the parameters, with the mice showing better strength, control, and authority of their synovial joints after the injection. This study has significant implications into understanding the development of CACP syndrome, as well as, articulating a movement dedicated towards increasing the healthfulness of those affected by CACP syndrome. Preserving the functionality of the human body is essential, and it is important to understand what else can be done scientifically to keep the joints of the human body feeling marvelous and valuable.

22. **Ahmeer Majied**, Architectural Engineer, Faculty Mentor: Dr. Vicki Foust Group.

The goal of this was to analyze and assess the NCAT campus dumpsters and provide recommendations for reducing cost of dumpsters, adjusting quantity of dumpsters, placement of recycling dumpsters, and adjusting pick up schedule of dumpsters. Students were split into teams and assigned to different quadrants. Teams assessed the fullness of the dumpsters in there quadrants twice a week for two months and recorded results in a google form. In the

duration of this we observed some inconsistency/issues for each quadrant. However, we were able to create alternative solutions that will help resolve current campus dumpster issues.

23. **Steven Sessoms**, Senior, Architectural Engineer, Faculty Mentor: Dr. Vicki Foust Group, The Deep Dive: A Dumpster Assessment at NCAT

The goal of this was to analyze and assess the NCAT campus dumpsters and provide recommendations for reducing cost of dumpsters, adjusting quantity of dumpsters, placement of recycling dumpsters, and adjusting pick up schedule of dumpsters. Students were split into teams and assigned to different quadrants. Teams assessed the fullness of the dumpsters in there quadrants twice a week for two months and recorded results in a google form. In the duration of this we observed some inconsistency/issues for each quadrant. However, we were able to create alternative solutions that will help resolve current campus dumpster issues.

24. **Kyle Barrentine**, Junior, Psychology, Faculty Mentor: David Hachen, can personality impact the management of networks.

College students with larger networks tend be extroverted, and consequently have lesser depressive symptoms. Despite this, there is a dearth of on how extroversion levels can impact the management of a network. Can the mismanagement of a network cause depression, and can extroversion – or lack thereof – play a significant role? The current study sought to address this question with 3 hypotheses; (1) can extroversion predict network size, (2) can depression scores predict extroversion and network size, and (3) can a variation in network size due to extroversion attribute to depression scores. For this study, ers utilized the Net Health data set, which included behavioral and network data from a large (n = 714) majority Caucasian (65.6%) sample of college students from a private religious Midwestern university. A simple, and multivariate linear regression were conducted to test these hypotheses. Residuals were used to assess the variation of network size due to extroversion. There was a positive significant effect found between the residual term and extroversion (b = 0.972, p = < .001), which supported the hypotheses. This suggests that limiting a social network may benefit a college student. For college students who are introverts, there is an apparent need for them not overemphasize friendships, as this may create additional stress which could hinder academic performance.

25. **Jada Elleby**, Senior, Sociology, Faculty Mentor: Tobin Walton, "Your Hair Isn't Appropriate, this is too Tight: How are African American Girls Being Targeted in United State School Dress Code Policies?"

The purpose of this is to examine how the United States school systems uses contemporary policies, and dress codes in attempt to increase discipline and academic performance. In 1969, the U.S. Supreme Court passed a law that implemented school dress code policies due to the

Tinker vs. Des Moines Independent School District. The present analyzes how dress code policies in Guilford County school systems effect students differently according to gender and race. We will investigate how the dress code policies are used as a notion of control by specifically observing how these policies are targeting African American girls by not considering their culture and somatotype.

26. **Adiya Moore**, Senior, Biology, Faculty Mentor: Misty Thomas and Scott Harrison, Too much of a good thing? Differential gene expression in Escherichia coli associated with the evolution of resistance to heavy metals.

DNA sequencing of experimentally evolved iron (II) resistant strains of Escherichia coli (E. coli) K-12 MG1655, identified 21 genes which selectively swept the populations. The goal of this study is to analyze the differential mRNA expression patterns of 50 selected genes (based on gene networks associated with the 21 genes found in DNaseq) using the nanoString technology. For this study, we used three different lines of E.coli K-12 MG1655 with 5 replicates of each all grown in standard DMB media. We used E.coli K-12 MG1655 grown in standard DMB media as our control, an experimentally evolved iron (II) resistant strain, that is maintained in 1750 $\mu\text{g/mL}$ iron (II) sulfate and an experimentally evolved silver resistant strain (Tajkarimi et al. 2017), subsequently evolved to then become iron (II) resistant maintained in presence of 1750 $\mu\text{g/mL}$ iron (II) sulfate. Strains were then grown into lag, log and stationary phase in presence and absence of iron (II) sulfate, RNA was extracted and quantified then sent to nanoString (<https://www.nanostring.com>) for quantification of gene expression patterns of our 50 selected genes. The differences observed in growth rates of the different strains and under stress of iron sulfate indicated that there is likely a changed in gene expression between the different strain/conditions tested. Overall, the iron resistant strains responded by own regulating the iron regulator protein gene fur and iron transport genes. In addition, the iron resistant strains, in the presence of iron, downregulated genes that play a role in survival and reproduction. This accurately correlates with lower fitness levels shown during the growth of these strains; which may be a method these strains use as a defense until the environment is suitable for growth.

This study will provide further information regarding how E. coli can adapt and evolve in presence of heavy metals such iron and silver and understanding these mechanisms before they appear in nature is a proactive approach to addressing an inevitable problem. The limitations in our study are that nanoString technology is cost-effective method and cuts down on data analysis, there is the likely possibility that we are missing out on some key expression findings. Therefore, subsequent to the nanoString experiments we will then analyze the sample samples using RNA-seq in order to get a complete view of all differential expression under our tested conditions.

27. **Myah Bynum**, Senior, Sociology, Faculty Mentor: Dr. Tobin Walton, does cheap labor have a correlation with the population increase of private prisons?

This study will determine if cheap labor is a potential cause of the increase of private prisons. The increased rate of private prison populations has been steadily rising for the past 10 years. This study is aimed at finding the specific rules and regulations to facilitating a private prison. It's important to study the history of the population increase, that way, long standing patterns will cease to exist or be revised.

28. **Renee Waters**, Senior, Psychology, Faculty Mentor: Dr. Maldonado- Devincci, The BTBR mouse model of autism spectrum disorder shows impairments in cognition and social memory

Autism spectrum disorder (ASD) is characterized by social impairments, communication deficits, and increased repetitive behaviors (NIMH, 2018). It is also often associated with cognitive deficits (Matson and Shoemaker, 2009). Neuroimaging studies of ASD humans have identified abnormalities in the hippocampus (Schumann et al., 2004), a brain region involved in social behavior and cognition. Since ASD has been associated with cognitive impairments and social deficits, we hypothesized that BTBR mice, an idiopathic mouse model of ASD, have deficits in hippocampal-related behaviors. Consistent with the literature, BTBR mice were less sociable in the 3-chamber social test than controls (Mcfarlane et al., 2008). While control mice spent more time with novel than familiar mice, BTBR mice spent equal amounts of time with the novel and familiar mice. In the social recognition test, mice are exposed to a novel mouse in trial 1 and after a delay period re-exposed to the same, now familiar, mouse in trial 2. Control mice had normal social memory as measured by their decreased interaction times with the familiar mouse in trial 2, however the BTBR mice spent equal amounts of time interacting with the exposed mouse in both trials. We further confirmed another report (Seese et al., 2014) by showing that BTBR mice had cognitive impairments in the object location test such that they were not able to discriminate between a novel and familiar location of the object. Ongoing work is exploring whether physical exercise can improve ASD-related impairments in sociability, social memory, and cognition in BTBR mice.

29. **Paris Parsons**, Junior, Biology, Faculty Mentor: Dr. Misty Thomas, Antibacterial activity of a new silver-based antimicrobial spray

Background: Escherichia coli has previously been shown to evolve and develop resistance to a variety of antibacterial agents including silver. Silver (Ag) has been used as an antimicrobial

agent since 1000 BCE; and silver nanoparticles are widely used today in food packaging and surgical garments. In presence of silver, bacteria have the ability to maintain homeostasis through expression of the *cusCFBA* efflux system, although upon exposure to high concentrations silver is extremely lethal. In our previous work, we evolved silver resistant strains of *Escherichia coli* K-12 MG1655 and will use these here in this study to evaluate new silver based antimicrobial cleaning sprays. Objective: Analyze the minimum inhibitor concentration (MIC) of four silver-based compounds using both a WT strain of *E. coli* K-12 MG1655 and a silver resistant strain. Methods: The experiment follows a MIC assay protocol. Make a stock concentration of silver: 10g/L 1:100 dilution of the stock (100uL of silver + 9.9mL of LB media) – this will be used for all of the assays (LBAg) = 0.1g/L = 100 mg/L = 100 ug/mL. Take the OD reading of bacterial culture and dilute it to 0.05 to use for MIC (OD) x (how much of your bacteria to add) = (0.05) (2000uL) Add 100uL of LB media into column 1 of a 96 well plate (rows A-C and F-H) (control). Add 95uL of LB media into column 2 of the plate (control). Add 95uL of LB media to columns 3 through 11. Add 95uL of LB and 95 uL of compound to column 12. Take 95uL out of column 12 and add it to column 11, mix up and down by pipetting (100 ug/mL final Ag). Repeat this serial dilution method up to column 3. Take 95uL out of column 3 and discard it. Designate rows A-C to k-12 strain and rows F-H Ag resistant bacteria. Add 5uL to every well that has media EXCEPT for column 1. Put in the Tecan-HP plate reader, select plate ID: BD Falcon 96 Flat Bottom Transparent Polyethylene Terephthalat, and take the OD at 600nm. Put in the incubator to shake for 24 hours. After shaking for 24 hours, take an OD reading at 600nm. Conclusions: Results show that compound C, inhibits the growth of the WT strain at a compound concentration as low as 1.5625% and Ag resistant strain at 3.125%. Compounds A, B, and D are controls and display growth inhibition significantly higher than that for compound C. Inhibition of bacteria growth required elevated concentrations of 12.5-50% from those particular compounds. The MIC for WT strain is 50% concentration and 3.125% concentration for the resistant of Compound A. The MIC for both WT strain and Ag resistant strain is 25% concentration of Compound B. Compound D inhibits growth of WT strain at 25% concentration and Ag resistant at 12.5% concentration. Future Directions: Test MIC levels of the four compounds on a variety of other bacterial species to gain a broader view of their effectiveness across gram-negative and gram-positive bacteria.

30. Sydney Townsend, Sophomore, Biology, Faculty Mentor: Dr. Misty Thomas, Deciphering the mechanisms of silver resistance in *Escherichia coli*.

Background: Silver has been used medicinally since 750 AD. It's widespread use as an antimicrobial agent in medical and health settings has made the menacing threat of resistance more possible in the near future. While there is little known about the mechanisms of silver

resistance, our previous work shows mutations within specific genes that may contribute to resistance in *Escherichia coli*. These genes include *cusS* which controls silver homeostasis through expression of the *CusCFBA* efflux pump, *ompR* which is required for porin synthesis, *purL* which is involved in purine synthesis, and *rpoB* the RNA polymerase beta-subunit. Question: This study focuses on evaluating *cusCFBA* efflux pump expression in *Escherichia coli* strains that are either silver resistant or harbor single *cusS* mutations. Hypothesis: Both resistant and single mutant strains harboring *cusS* mutations will exhibit an increase in expression of genes associated with the *cusCFBA* efflux pump operon. Method: We began by growing 10mL cultures of up both silver resistant and single *cusS* mutant strains of *E. coli* acquired from our previous work in presence and absence of silver. RNA was then extracted from each sample using the Monarch RNA extraction kit from NEB® and quantified using a Quantiflor® from Promega. Each sample was then diluted to a final concentration of ~300ng/uL. RT-PCR was then used to evaluate gene expression of target genes. We first looked at the housekeeping gene *cysG* to ensure normalized expression across samples, then we evaluated *cusC* expression to assess expression of the efflux pump. Results: Assessment of our *cysG* data showed equal expression across all samples indicating its validity as a control for this experiment. *cusC* expression show up regulation in some of our cell lines and a decrease in expression in others. Future direction: We will now evaluate expression of other genes in the operon as well as porin expression through looking at *ompC* and *ompF* also using RT-PCR. Broader Impact: This study will help us to understand the mechanisms of silver resistance before resistance becomes widespread in nature, in an effort to have measures in place as it becomes more prominent.

31. **Camille England**, Senior, Biological Engineering, Faculty Mentor: Dr. Vicki Foust, Recycling With Pride: A Feasibility Study Validating Infrastructure and Engagement as Recycling Best Practices.

According to the Department of Energy Quality, North Carolina Agricultural and Technical State (NCAT) University is recycling less than ten percent of its waste. Recycling with Pride has conducted a feasibility study to validate infrastructure and engagement recycling best practices through planning and implementing simultaneous recycling pilots in three different campus buildings: Administrative (Fort IRC), Residence (Pride Hall), and Academic (Carver Hall). To conduct this study, the incorporated of best practices for recycling infrastructure and engagement were implemented in each building. Data was collected using Google forms to capture daily recycling fillage and contamination rates. Throughout the study there was a consistent increase in recycling rates and a decrease in contamination rates.

32. **Sophia Hassan**, Junior, Biological Engineering, Faculty Mentor: Dr. Vicki Foust, Recycling With Pride: A Feasibility Study Validating Infrastructure and Engagement as Recycling Best Practices (group)

According to the Department of Energy Quality, North Carolina Agricultural and Technical State (NCAT) University is recycling less than ten percent of its waste. Recycling with Pride has conducted a feasibility study to validate infrastructure and engagement recycling best practices through planning and implementing simultaneous recycling pilots in three different campus buildings: Administrative (Fort IRC), Residence (Pride Hall), and Academic (Carver Hall). To conduct this study, the incorporated of best practices for recycling infrastructure and engagement were implemented in each building. Data was collected using Google forms to capture daily recycling fillage and contamination rates. Throughout the study there was a consistent increase in recycling rates and a decrease in contamination rates.

33. **Myla Barker**, Sophomore, Environmental Studies, Faculty Mentor: Dr. Vicki Foust, Recycling With Pride: A Feasibility Study Validating Infrastructure and Engagement as Recycling Best Practices

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34. **Angelica Hood**, Sophomore, Industrial and Systems Engineering, Faculty Mentor: Hilda Goins, Inclusive Practices in Alzheimer's : The Geographic Exclusion

The south is the highest ranking geographic region with death rates recorded related to Alzheimer's Disease. Often and sometimes, the phrase 'Alzheimer's disease' is used as the umbrella term that describes the process of mental deterioration of persons who are usually 55-85 years or older. Those affected exhibit a wide range of negative behaviors such as agitation, disengagement, and unpredicted outburst. The decline in the use of everyday skills can make it difficult for the caregiver to attend to and properly care for the person suffering from the disease. In return, this puts an immediate strain on the caregiver, which can result in improper care of the person with dementia. The Behavioral and Environmental Sensing and Intervention for Caregiver Empowerment (BESI) team, comprised of researchers and medical personnel from the University of Virginia, Carilion Medical Center/Carilion Clinic, and North Carolina A&T State University, records and assesses agitation episodes. Using caregiver centered technology, the purpose of this study is to eliminate or reduce the effect of agitation by determining which environmental factors are more prevalent during the episodes and communicating this information to the caregiver. Moreover, African Americans make up 58% of persons with Alzheimer's disease². Therefore, it is important that when this study is conducted, African Americans and all regions of the south must be considered. However, most of the families encountered throughout the BESI Project have been upper middle-class Caucasians located in Roanoke, Virginia.³ It can be inferred that there are numerous reasons why minorities have not been a part of Alzheimer's-related research. At the conclusion of this study, I will identify the key reasons why the Southern region of the United States reports a sharp incline of Alzheimer's related disease compared to other regions. Furthermore, I hope to identify why African Americans have not been exposed to studies such as the BESI Project, while identifying new methods to connect with African American Communities.

35. **Matthew Trotter**, Senior, Computer Science, Faculty Mentor: Dr. Jung Hee Kim, Measuring Collaborative Behavior in COMPS Student Problem-Solving Discussions.

This project attempts to observe and measure collaboration between students who are working together to solve problems in a computer programming class. Collaborative problem-solving is among the things that K-12 education is endeavoring to teach and measure, and appears in the most recent PISA international comparison of educational achievement. In COMPS (Computer Mediated Problem Solving) exercises students work together via online typed-chat. The communication is recorded and stored for further analysis. Using student dialogue files, the main activity consists of manually classifying student dialogue according to four categories of collaborative utterance. The four categories are: sharing ideas, negotiating ideas, regulating problem solving, and maintaining communication. In concert with other researchers, we are using the hand-labeled data to attempt to train computer text classifiers to identify these behaviors. From there we will count the different behaviors and look for patterns of interaction. This is expected to reveal the conversational fingerprints which are characteristic of successful and

unsuccessful student collaborations. This may be useful to more easily measure collaboration within a group and to obtain a better understanding of how collaboration aids understanding and learning.

36. **Alexys Riddick**, Senior, Chemistry, Faculty Mentor: Dr. Misty Thomas, Deciphering the mechanisms of silver resistance in *Escherichia coli*

Background: Silver has historically been used as an antimicrobial agent in medical and health settings, but due to its widespread use, the threat of resistance is eminent. The potential mechanisms of silver resistance are not well understood, however, our previous work using experimental evolution have shown that mutations within genes that control major outer porin synthesis (*ompR*), purine synthesis (*purL*), RNA polymerase (*rpoB*) and native copper/silver homeostasis (*cusS*) may contribute to silver resistance in *Escherichia coli*. Question: This study focuses on understanding the impact of identified mutations in the histidine kinase *cusS* in the mechanism of silver resistance by setting up the no-SCAR (Scarless Cas9 Assisted Recombineering) CRISPR genome editing technique in the lab for mutant analysis. Methods: Molecular modeling of three of our detected mutations; L12R, T14P and R15L show that they are located near the N-terminus cytoplasmic tail and the fourth N279H is located near the C-terminus in the dimerization domain. Using the no-SCAR CRISPR genome editing technique we are incorporating these point mutations into the *cusS* gene in the genome of *E. coli*. First, we designed primers to create a *cusS* guide RNA in the pKD plasmid using polymerase chain reaction (PCR) to amplify two portions of the plasmid and circular polymerase extension cloning (CPEC) to join the PCR fragments. The pKD-gRNA plasmid was confirmed to be intact after using gel electrophoresis and subsequently transformed into DH5 α cells. The pKD plasmid was then transformed into the competent cells containing the *cas9* plasmid. The cells containing the pKD and *cas9* plasmid will then be induced to produce Cas9 in order to cut the genome, transformed with ssDNA template with the appropriate mutations in order to induce homologous directed repair and insertion of the mutation. Future Directions: After mutant cell lines are confirmed through sequencing we will then do a phenotypic assessment by performing MIC assays for silver resistance as well as trying to understand the fitness cost of these mutations by performing growth and competition assays with the mutants. Broader Impact: Two-component response systems have been proposed to be a potential target for drug development and therefore this work will help us to better preventively understand the mechanisms of silver resistance before it is widespread in nature and possibly have the opportunity to keep it under control.

37. **Synphane Gibbs**, Sophomore, Biology, Faculty Mentor: Ming Dong, Enhancing Therapeutic Efficacy of Platinum Based Drugs by Pharmacologically Inhibiting PARP in Ovarian Cancer

Enhancing Therapeutic Ovarian cancer is the 5th leading cause of cancer-related death in women. The standard treatment includes platinum-based therapeutics which rely on inducing DNA damage mediated apoptosis. Unfortunately, poly (ADP-ribose) polymerases (PARPs), which play an important role in cellular DNA repair, are overexpressed in ovarian cancer cells. PARPs are hypothesized to reduce and delay the effect of chemotherapies that induce DNA damage such as Carboplatin in cancer treatment. In this study, we tested the hypothesis that inhibiting PARP activity would increase efficacy of platinum-based chemotherapeutics. We tested this by evaluating the effect of Carboplatin on OVCAR-3 cells in combination with the PARP inhibitor - Niraparib Tosylate. The effects of Carboplatin with Niraparib Tosylate were analyzed by measuring toxicity (MTT and crystal violet), DNA damage (comet assay and immunoblot analysis) and cell death markers (immunoblot analysis). Our data suggest a synergetic effect of Carboplatin and Niraparib Tosylate by enhancing Carboplatin toxicity to cancer cells.

38. **Evan Pardue**, Senior, Biology, Faculty Mentor: Dr. Robert Newman, Discovery of Novel Gene Candidates involved in Orsay Virus Replication in *C. elegans*.

Until the discovery of Orsay virus, there were no known viruses found to naturally infect the nematode *Caenorhabditis elegans*. Orsay virus infection in *C. elegans* provides a unique model to effectively study virus-host interactions in a laboratory setting. Upon infection, Orsay virus exhibits a subsequent decrease in the intracellular lipid droplet area within the intestinal cells of *C. elegans*. Our previous results lead us to believe that the *C. elegans* lipid droplets are important for the replication of Orsay virus, so we hypothesize that decreasing the intracellular lipid abundance within *C. elegans* intestinal cells will lead to a decrease in Orsay virus replication. To this end, we performed an RNA interference screen, which utilized exogenous feeding RNAi to knockdown target genes involved in lipid production and the lipophagy pathway. Total Orsay virus replication was quantified via qRT-PCR, and results were normalized to *rps-20*, a cellular gene unrelated to Orsay virus infection. In parallel, *C. elegans* that have undergone RNAi knockdown were fluorescently stained with Lipidtox and Nile Red. *C. elegans* contain two primary lipid storage granules, neutral lipid droplets and lysosome-related organelles, so using Lipidtox and Nile Red was necessary to show the overall distribution of lipid storage granules as compared to control worms that had not been subject to RNAi. Our results illustrated that one gene known as *sbp-1*, a sterol regulatory element-binding protein involved in lipid metabolism, confers a ~ 2.5 -log decrease in Orsay virus

replication. These studies show a correlation between decreased intracellular lipid abundance and decreased Orsay virus replication.

39. **Maria Ford**, Junior, Biology, Faculty Mentor: Dr. Misty Thomas, Assessing the Impact of Media on Antibiotic

Background: The antibiotic crisis has come about due to the overuse and abuse of antibiotics in human and animal welfare. Due to this, it is predicted that soon, antibiotics that will no longer work to treat even common bacterial infections due to resistance; and the ESKAPE pathogens (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Enterobacter species*, and *Mycobacterium tuberculosis*) are at the forefront of the antibiotic resistance crisis. Soil bacteria have commonly been exploited in the past for their ability to produce antibiotics. Here we describe our work successfully isolating 32 antibiotic producing bacteria from the soil and assessing the effect that culture medium has on the production of their antimicrobial compounds. Hypothesis: We hypothesize that if the antibiotic-producing soil bacteria are placed on different types of media, then it will affect their production of antibiotics as different media offers different nutrients and therefore different stressors which may influence the necessity for antibiotic production. Methods: The ability of soil bacteria to produce antibiotics against ESKAPE pathogen safe relatives on different types of agar was tested. Bacteria were isolated via serial dilutions of soil samples from various locations. Each isolate was picked and patched onto swab plates of the ESKAPE relative on one of Luria-Bertani Agar (LBA), Reasoner's 2A Agar (R2A), Trypticase Soy Agar (TSA) and Potato Dextrose Agar (PDA) and their ability to produce an antibiotic was assessed by characterization of zones of inhibitions. After analysis, 32 producing isolates were selected for their ability to produce an antimicrobial agent on one type of agar and subsequently plated on all 4 types of media to assess the changes in zones of inhibition on each media type. Results/Conclusions: 32 antibiotic producing soil isolates were identified and after screening these isolates and their antibiotic production on 4 different types of media, we found that media does have a significant impact on an isolates ability to produce an antibiotic. Significance: In understanding how culture medium affects antibiotic production by soil isolated bacteria, this allows us to create better screening methods for the detection and isolation of new antibiotics to fight the antibiotic crisis.

40. **Kelyah Spurgeon**, Junior, Biological Engineering, Faculty Mentor: Dr. Lijun Wang, The Role of Transcription Factor YY1 in the Expression of SNX3 and CPNE1.

The analysis of interactions between protein and DNA in the chromatin environment is essential to better understand the mechanisms governing gene expression in eukaryotes. Hybridization Capture of Chromatin-Associated Proteins for Proteomics (HyCCAPP) is a novel technology that identifies proteins bound to specific region of the genome. The HyCCAPP method enables sequence-specific capture of DNA using complimentary oligonucleotides followed by identification of the proteins bound to that region using mass spectrometry. In our studies, we investigated sequence variants in the promoter regions of the human genes CPNE1 (Copine-1) and SNX3 (Sorting-Nexin-3). CPNE1 on chromosome 20 is important for calcium-dependent cell membrane association and is associated with non-small cell-lung cancer in humans. SNX3 on chromosome 6 is involved in protein trafficking. Mutation of this gene is associated with microcephaly and microphthalmia. According to the literature, transcription factor YY1 (Yin Yang 1) has an activating effect on CPNE1 and repressing effect on SNX3 in their wild type forms. The goal of our analysis was to verify the change in expression due to mutations in the YY1 binding region in the promoters of these genes. Then, using HyCCAPP we will identify YY1 and other proteins involved in regulation of the mutated forms of SNX3 and CPNE1.

