UNIVERSITY OF MINNESOTA

2019 SUMMER UNDERGRADUATE RESEARCH SYMPOSIUM

Life Sciences Summer Undergraduate Research Program (LSSURP)

Faculty Director: Dr. Colin Campbell

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Presenter: Aleksandra Bajer
Poster Number: 1
Home Institution: University of Minnesota - Twin Cities
Program: LSSURP
Faculty Mentor: Dr. Michael Smanski
Poster Title: **G-quadruplexes as Transcriptional Regulators in *Streptomyces coelicolor***
Abstract: *Streptomyces* bacteria are well-known for producing natural products including 75% of antibiotics used today. The *Streptomyces coelicolor* A3(2) genome harbors dozens of biosynthetic gene clusters (BGCs) potentially encoding novel natural products. Characterization of most BGCs is difficult because they are silent under laboratory conditions. Activation of silent BGCs requires a knowledge of the multiple layers of regulation by which *Streptomycetes* govern their activity. One of the proposed mechanisms of transcription regulation in *S. coelicolor* A3(2) is the G quadruplex (G4), an unusual DNA motif which is thought to modulate gene expression via unknown mechanisms. This study compared the transcriptional landscapes of both WT *S. coelicolor* and *S. coelicolor* that overexpressed RecQ, a helicase known to resolve G4's. WT *S. coelicolor* was grown with and without the presence of NMM, a known G4 stabilizing molecule, and the RecQ overexpression strain was grown with NMM as well. Total RNA was extracted from the strains in the above conditions and genome-wide transcription will be compared to investigate the role of G4's in transcription. Understanding how the G4 regulates transcription may pave the way for the discovery of new natural products and lead to a more complete understanding of the *S. coelicolor* A3(2) genome.

Presenter: Anthony Baker
Poster Number: 2
Home Institution: Nebraska Wesleyan University
Program: LSSURP
Faculty Mentor: Dr. Brenda Ogle
Research Advisor: Elizabeth Wilson, Lab Cohort - Jeffery Ai
Poster Title: **Optimization of 3D Bioprinting Supporting Material for Increased Fidelity of Complex Structures**
Abstract: Background: Current methods to print 3D complex structures with hydrogels are limited by constructs collapsing under their own weight. 3D bioprinting via Freeform reversible embedding of suspended hydrogels utilizes a support material to provide stability to structures during printing. Therefore, superior support materials allow for the creation of complex structures with higher fidelity. Goals: To create a support material with ideal particle size, uniformity, and rheology allowing for high fidelity of printed complex structures. To accomplish this, pH, stirring speed, cooling rate, lyophilization, and centrifugation were assessed. Study Design: To initiate coacervation, the pH levels of a water-ethanol solution were adjusted and gelatin type B and gum arabic were added and the solution cooled. Measurements were taken by assessing particle sizes via imaging and rheology. Results: Ideal particle formation (size and uniformity) was dependent on pH, cooling, and stirring rate. Particles between 8-15 micrometers achieved a Bingham plastic rheology necessary for printing complex structures. Particles should stay within a standard deviation of 2 micrometers for desired consistency. Conclusion: This study shows the ability to create a support material that allows for high fidelity printing of complex structures, thus allowing for printing of human structures, printing with cells, and incorporating perfusion.

Presenter: Albert Barrios
Poster Number: 3
Home Institution: California State University
Program: LSSURP
Faculty Mentor: Dr. Douglas Yee
Poster Title: **Insulin Receptor Isoform IRA/IRB Expression in Breast Cancer Cell Lines and Tumors**
Abstract:

Breast cancer is one of the most prominent, complex diseases composed of a population of heterogeneous cell subtypes. Breast cancer cells contain both Insulin-like Growth Factor Receptor Type 1 (IGFR1) and Insulin Receptor (IR) that promote the growth and survival of tumors. IR promotes both metabolic and mitogenic effects when overexpressed, and are composed of two different insulin receptor isoforms, IRA and IRB. IR Isoforms are both differentiated by utilizing IR isoform specific primers. The validation of IRA and IRB primers were determined via quantitative PCR on IRA and IRB overexpressing clones in MCF7 cells to overexpress IRA and IRB. It was subsequently validated by using human adipose and liver tissues that overexpress IRB than IRA. Over 40 breast cancer cell lines and ER+ patient tumor samples, were characterized to determine its IRA and IRB expression. Total IR, IGFR1, IRS1, and IRS2 were analyzed. Across breast cancer cell lines, IGFR1 and IR are expressed. In ER+ patient samples, IRA and IRS1 is expressed more than IRB and IRS2. Further analysis is needed to characterize any prominent cell lines for future experimentation.

Presenter: Anna Bastyr
Poster Number: 4
Home Institution: University of Minnesota - Duluth
Program: LSSURP
Faculty Mentor: Dr. Timothy Ebner
Research Advisor: Dr. Angela Nietz
Poster Title: **Cerebellar Nuclear Stimulation Alters Cerebral Cortical Activity in Mice**
Abstract:

The cerebellum plays an important role in executing coordinated movements, exerting influence over cerebral cortical processing. The cerebellar nuclei are comprised of the dentate, interposed, and fastigial nuclei, all having projections to the cerebral cortex. However, how cerebellar output modulates cortical activity remains poorly understood. To assay the effect of cerebellar output on cerebral cortical activity, we injected virally-encoded, fluorescently-tagged channelrhodopsin (CHR2) into the cerebellar nuclei of wild-type and Thy1-GCaMP mice. To assess viral expression patterns and cellular identity, tissue slices were stained using GAD67 and vGlut2 as markers for inhibitory and excitatory cells and imaged using confocal microscopy. We found both glutamatergic and GABAergic ChR2-EYFP expressing cells located in all three cerebellar nuclei, suggesting that ChR2 infection is not cell-type specific. Next, Thy1-GCaMP animals previously implanted with optical fibers and polymer skulls were head-fixed to a custom treadmill for *in vivo* stimulation and neuronal Ca2+ imaging. Cortical GCaMP signals in behaving animals were imaged using an epifluorescence microscope. ChR2-expressing cells were stimulated using a 473 nm laser (single pulse; 50ms) through the optical fiber. Fastigial nucleus stimulation resulted in time-locked, wide-spread increases in cortical GCaMP fluorescence, suggesting the fastigial nucleus exerts powerful modulatory control over cortical information processing.

Presenter: Ilham Batar
Poster Number: 5
Home Institution: University of Utah
Program: LSSURP
Faculty Mentor: Dr. Julie Olson
Poster Title: **Examining the Distribution and Effects of TMEV Infected Mice as a Model for Human Multiple Sclerosis**

Abstract: Theiler's murine encephalomyelitis virus (TMEV) is a mouse pathogen that infects the central nervous system (CNS), primarily in microglia. The TMEV infection in susceptible mouse strains leads to the development of demyelinating disease in mice similar to multiple sclerosis (MS) in humans. TMEV infect and activate an innate immune response in CNS resident microglia, in addition to chronic progressive demyelination. In order to examine the distribution of the virus as well as the degree of infection in microglia, we have used the *in situ* hybridization called RNAscope to examine the full course of infection. Our studies have shown us that the virus can be detected on day 1 and is able to spread throughout regions of the brain and spinal cord as early as day 2 after initial infection. The antiviral agent IFN-β is also detected in the brain and spinal cord early on as well, and is believed to enhance the expression of innate immune cytokines in response to TMEV, therefore affecting the development of the disease and its demyelination. With continued research and examination, this data will be able to lead us to a path of understanding the role of TMEV pathogenesis in mice and better comprehension of demyelinating diseases as well as providing insight on developing therapeutics for diseases such as MS in humans.

Presenter: Naiti Bhatt
Poster Number: 6
Home Institution: Scripps College
Program: LSSURP
Faculty Mentor: Dr. Stephen Engel
Poster Title: **Classification Analyses of fMRI Data can Predict Perceived Color**

Abstract: The McCollough Effect is an illusion where viewing colorful vertical and horizontal stripes causes black and white stripes to appear colorful. The brain locations that produce this illusion are unknown; the general goal of this project is to reveal them. We measured neural activity using fMRI while three participants viewed colorful and black and white stripes. To test whether visual cortex produces the McCollough effect, we trained classification algorithms to predict what participants saw from activity patterns across voxels. We first tested classification without the illusion, training three different classifiers to distinguish activity patterns associated with colorful stripes from those associated with black and white stripes. All classifiers performed well, with accuracies significantly above chance. Trained classifiers successfully classified patterns of activity from different scanning sessions, and classification was unaffected by stripe orientation. Overall, classification using linear discriminant analysis with 10-fold cross-validation produced the best results. These results indicate that classification analysis can predict what colors participants see. Our next step is to test whether the classifiers show the illusion, mistakenly classifying black and white stripes as colorful, when tested on data acquired when the illusion was present. Parts of cortex showing this are likely bases of the McCollough Effect.

Presenter: Allyson Caldwell
Poster Number: 7
Home Institution: University of Maryland - Baltimore County
Program: LSSURP
Faculty Mentor: Dr. Duncan Clarke
Poster Title: **Topoisomerase II Function Impairment affects Protein Localization in Chromosomes**
Abstract: Errors in mitosis that cause chromosomes to segregate improperly cause aneuploidy, which produces cells with an incorrect number of chromosomes and can result in birth defects and cancer.The focus of this study is on Topoisomerase IIα, which cuts both strands of the DNA helix to resolve DNA catenations between sister chromatids, and without which chromosomes separate abnormally. One protein that assists with the arrangement of the chromosomes is Plk1-Interacting Checkpoint Helicase (PICH), which participates in the organization of chromosome arms. Our objective is to investigate the effects of Topoisomerase IIα inhibition on the localization of PICH and other proteins on sister chromatids in mitosis. Our results reveal that PICH and Aurora B, a kinase responsible for regulating the attachment of microtubules to the kinetochores, localize at the kinetochores and arms of the chromosomes after inhibition of Topoisomerase IIα. These proteins function to stop the cell cycle in metaphase to prevent the cell from separating sister chromatids that still have catenations, as well as removing the inhibited Topo II from the chromosomes. These findings are significant because they will provide a better understanding of the molecular mechanisms that cause aneuploidy.

Presenter: Daniel Cambron
Poster Number: 8
Home Institution: Florida International University
Program: LSSURP
Faculty Mentor: Dr. Robert Kratzke
Poster Title: **Tyrosyl-DNA Phosphodiesterase 2 Inhibition Sensitizes Chemoresistant Mesothelioma Cells to a Topoisomerase II Poison**
Abstract: Tyrosyl-DNA phosphodiesterase 2 (TDP2) is an enzyme responsible for repairing errors caused by topoisomerase II poisons during DNA replication. TDP2 inhibitors that prevent the correction of these errors have recently been discovered and are available for testing in cancer cell lines. Here, the research on TDP2 inhibitors in combination with etoposide (ETP), a topoisomerase II poison, targeting malignant mesothelioma (MM) is reported. MM cells were treated in vitro with ETP or ETP combined with a TDP2 inhibitor, either ZW-1226 or ZW-1231, and cell survival evaluated. Following 72 hours of treatment, Cell Counting Kit-8 was employed to measure cell viability. Cell lines H513, H2373, and H2461 were sensitized to ETP by ZW-1226, while H2373, H2461, and H2596 were sensitized to ETP by ZW-1231, and the combined treatment led to suppressed cell survival. Furthermore, ZW-1226 was ineffective in sensitizing H2596 cells and ZW-1231 was ineffective in sensitizing H513 cells to ETP, no enhancement of cell death was observed. TDP2 inhibition with ZW-1226 or ZW-1231 sensitized resistant H513, H2373, H2461, and H2596 to ETP and cell viability was extensively reduced compared to each drug alone at the indicated doses. This data supports further pre-clinical investigation of TDP2 inhibition for MM in murine models.

Presenter: James Cassell
Poster Number: 9
Home Institution: Tufts University
Program: LSSURP
Faculty Mentor: Dr. Jop van Berlo
Poster Title: **Measuring Downstream Effects of Endoglin Knockdown on Smads**
Abstract: After injury, adult cardiomyocytes exhibit minimal proliferation (<1%), which leads to excessive fibrotic tissue, loss of cardiac function and eventual heart failure. Heart disease is the leading cause of death in both men and women in the United States, so understanding and harnessing the limited cell division of cardiomyocytes for therapeutic strategies is crutial. It has been experimentally shown that the knockdown of endoglin, a coreceptor for transforming growth factor beta (TGF-β), induced cardiomyocyte proliferation – suggesting endoglin inhibits cardiomyocyte cell cycle mitosis. The mechanisms of endoglin's inhibition of cardiomyocyte proliferation is not currently known, though. The goal of my project was to determine the downstream effects of endoglin knockdown on Smads, the main signal transduction proteins for TGF-B receptors. Smads become activated once phosphorylated by TGF-β receptors and subsequently translocate to the nucleus, where they then can regulate transcription. Considering these qualities, I was able to compare Smad activation after endoglin knockdown. I assessed both overall and nuclear specific changes in Smad and phospho-Smad levels via Western Blotting, changes in Smad and phospho-Smad localization using immunocytochemistry (ICC), and changes in Smad's transcriptional ability with a luciferase assay.

Presenter: Cameron Chambers
Poster Number: 10
Home Institution: Bowie State University
Program: LSSURP
Faculty Mentor: Dr. Craig Bierle
Poster Title: **Evaluating the Potency of siRNA Targeting Guinea Pig Cytomegalovirus**
Abstract: Human cytomegalovirus (CMV) is an opportunistic herpesvirus and most common cause of congenital infections. One in 200 newborns in the United States are diagnosed with congenital CMV. Short interfering RNA(siRNA) are an emerging class of therapeutics and in this project we, sought to test the potency of siRNA inhibition on guinea pig CMV. Using guinea pig lung cells (JH4) and custom designed guinea pig siRNA targeting seven viral genes, we tested the inhibitory effect of siRNA at several time points post-infection. siRNA-treated JH4 cells were infected and GPCMV replication assayed by luciferase and titration assays . The preliminary experiments have led us to focus on the three most effective siRNA, targeting GP57 (major DNA-binding protein), GP86 (Major capsid protein), and GP123 (IE1 transcriptional transactivator). siRNA targeting these genes resulted in up to a 100-fold reduction in GPCMV replication. Moving forward in an invo trial with siRNA transfection to determine if treatment provides protection against congenital infection when the mother is experiencing primary infection.

Presenter: Crystal Cheng
Poster Number: 11
Home Institution: Cornell University
Program: LSSURP
Faculty Mentor: Dr. Ameeta Kelekar
Poster Title: **Metabolic Control of Human T-cell Activation by Glutamine and Downstream Metabolites**

Abstract: Noxa was initially identified as a Bcl-2 family pro-apoptotic protein but has since also been shown to play a growth-promoting role in human hematopoietic cells. The protein is significantly induced in T-cells following activation and facilitates the activation-associated metabolic switch from oxidative phosphorylation to aerobic glycolysis and to dependence on glutaminolysis for energy production. A better understanding of human Noxa's novel contribution to T-cell metabolism could improve cancer immunotherapies. To further define the requirement for glutamine and Noxa in T-cell activation, we performed mitochondrial stress tests, which measure oxygen consumption rate (OCR) and extracellular acidification rate (ECAR), on T-cells cultures activated in either in glutamine-free medium or in medium containing glutamine, or downstream citric acid cycle metabolites, alpha ketoglutarate (αKG) and glutamate. We found that mitochondrial activity of T-cells activated under glutamine-deprived conditions was restored by αKG and glutamate. However, a significant increase in glycolytic rate following mitochondrial ATP synthase inhibition, occurred only in the presence of glutamine, suggesting that mitochondrial respiration was utilizing an alternate pathway, such as fatty acid beta oxidation (FAO), in its absence. Further work is needed to determine whether these T-cells switch to FAO, and whether Noxa plays a role in regulating the switch.

Presenter: Emily Cianflone
Poster Number: 12
Home Institution: Winona State University
Program: LSSURP
Faculty Mentor: Dr. Deepali Sachdev
Research Advisor: Rebecca Berg, Ivy Johnson
Poster Title: **Comparing the Effect of a NK Cell Based Immunotherapeutic Agent to a Humanized Antibody on IGF-1R Levels in Breast and Prostate Cancer Cells**

Abstract: Hormone receptor positive (HR+) breast and prostate cancers express the type I insulin like growth factor receptor (IGF-1R) that drives growth and metastasis of these cancers. Binding of insulin like growth factors (IGF-I and IGF-II) activates the Phosphoinositide 3-Kinase (PI3K) and Mitogen-activated protein Kinase (MAPK) pathways. Patients with HR+ cancers recur despite prolonged treatment with hormonal therapies and need new therapeutic options. HR+ cancers could be treated by targeted immunotherapies that direct Natural Killer (NK) cells to the marker IGF-1R expressed on these cancer cells. The Sachdev lab and collaborators have generated a novel NK based immuno-therapeutic agent that activates NK cells to kill IGF1R+ breast cancer cells. The objective of this study was to compare the effect of this NK-based IGF-1R targeted drug to a humanized antibody against IGF-1R (huEM164) on levels of IGF-1R in HR+ breast and prostate cancer cells. In MCF-7L, a HR+ breast cancer cell line, huEM164 downregulated IGF-1R levels as expected. In contrast, the NK cell based immunotherapeutic drug did not downregulate IGF-IR. To identify additional models of HR+ prostate cancer, we analyzed components of the IGF-1R signaling system in the androgen-dependent HR+ human prostate cancer cell line, LAPC-4. LAPC-4 expressed the insulin receptor but minimal levels of IGF-1R proteins. IGFs and insulin did not further enhance phosphorylation of Akt over basal levels. Other prostate cell line models will need to be used to test the function of the drug as LAPC-4 does not express IGF-1R. This data suggests that the NK cell based immunotherapeutic drug can therefore be used against HR+ cancers with IGF-1R as it does not downregulate IGF-1R.

Presenter: Jenelle Collier
Poster Number: 13
Home Institution: Ohio Wesleylan University
Program: LSSURP
Faculty Mentor: Dr. Nicola Grissom
Research Advisor: Gerardo Rojas, Ariel Duerr, Max Ritchie, Mackenzie Lund, Nicola Grissom
Poster Title: **A Mouse Model for Neurodevelopmental Disorders shows an Increase in Amphetamine-Induced Stereotypical Behaviors**

Abstract: Neurodevelopmental disorders, especially autism spectrum disorders, are associated with multiple etiological mechanisms and symptom presentations. However, a core symptom across autism-spectrum disorders are repetitive locomotor behaviors. Autism is a highly genetic disorder, and one of the most frequently associated genetic variants with autism is chromosome 16p11.2 hemi-deletion. More than 30 percent of carriers have an autism diagnosis. In a mouse model of 16p11.2 hemi-deletion, gene expression and protein levels related to dopaminergic function in the striatum were disrupted. The striatum regulates locomotor behavior via dopaminergic input. This suggests that repetitive behaviors in autism may be driven by altered dopamine activity in the striatum. A well-validated technique for evaluating striatal dopamine function and locomotor behavior in mice is amphetamine-induced locomotor sensitization, which we tested in 16p11.2 hemi-deletion model mice. In response to daily amphetamine, wildtype mice increased their distance traveled, but the increase was less prominent in the 16p11.2 del mice. Instead, the 16p11.2 del mice performed stereotyped rotations, which was not seen in wildtypes. These data suggests a difference in sensitivity to dopamine stimulation in 16p11.2 mice that promotes repetitive behavior, supporting the possibility of dopaminergic dysregulation in the striatum in autism-related genotypes.

Presenter: Henry Daniels
Poster Number: 14
Home Institution: University of Minnesota - Twin Cities
Program: LSSURP
Faculty Mentor: Dr. Erin Carlson
Poster Title: **Synthesis of Clickable Probes for Activity-based Labelling of Penicillin Binding Proteins**

Abstract: Penicillin-binding proteins (PBPs) play a critical role in bacterial cell division and growth. Several different PBP isoforms occur in a given species, and although their general function is known – the biosynthesis of peptidoglycan – the particular function of each isoform remains mysterious. Due to the growing prevalence of antimicrobial resistance it is important for us to identify new ways to combat infections, and PBPs are prime targets for new drugs because they are unique to bacteria. To elaborate on our understanding of these enzymes, chemical probes capable of selectively targeting specific isoforms are required. Until recently, such a capability has been elusive due to high levels of structural homology amongst PBPs, but now the Carlson lab has identified B-lactones as a privileged scaffold for selective PBP probes, and has developed a semi-selective activity-based "clickable" probe. In order to continue exploring Beta-lactones as selective probes it is necessary to improve access to the scaffold. To achieve this we have developed an improved method for the synthesis of the lactone. With these new methods we will now be able to expand our library of Beta-lactone probes and move forward with our attempts to elucidate the roles and regulation of individual PBPs.

Presenter: Nicole Diaz
Poster Number: 15
Home Institution: Florida International University
Program: LSSURP
Faculty Mentor: Dr. Lihsia Chen
Poster Title: **L1 Genetically Interacts with Ras to Affect Excretory Canal Cell Development**
Abstract: Congenital hydrocephalus is a life-threatening condition resulting from cerebrospinal fluid build-up in brain ventricles. The mechanisms underlying the disease are unknown and there are limited available therapies. Mutations in the L1 gene, encoding a neuronal cell adhesion molecule, cause hydrocephalus. Interestingly, siblings with the same L1 mutation can present the disease with varying severity levels, suggesting the presence of genetic modifiers. Identifying such genetic L1 interactors in mammals is difficult because of their complex genome. With a single L1 homolog, sax-7, a simple genome, and well established genetic tools, *Caenorhabditis elegans* is an accessible model system to identify such interactions. The lab previously identified a genetic interaction between sax-7 and ras, resulting in a synthetic phenotype that correlates with a fluid homeostasis defect. Consistent with the excretory system playing a role in fluid regulation in *C. elegans*, sax-7 ras double mutant adults display defects in the excretory canal, the major cell in the excretory system. The aim of this project is to determine whether the excretory canal abnormality is due to developmental or maintenance defects by examining its presence in younger animals. These findings will provide insight into how loss of L1 results in hydrocephalus.

Presenter: Danielle Dudley
Poster Number: 16
Home Institution: Normandale Community College
Program: LSSURP
Faculty Mentor: Dr. David Zarkower
Research Advisor: Kellie Agrimson, Anna Minkina, Robin Lindeman, Vivian Bardwell
Poster Title: **Liver Receptor Homolog 1 (LRH1) is Required in Spermatogonial Stem Cells for Normal Spermatogenesis in the Mouse Testis**
Abstract: Spermatogenesis is the continuous process by which spermatogonial stem cells (SSC) differentiate into mature spermatids throughout the entire male reproductive lifetime. Misregulation of the SSC population can result in germ cell depletion and eventually male infertility. Liver Receptor Homolog 1 (LRH1) is an orphan nuclear receptor transcription factor known to be important for metabolic, steroidogenic, and developmental processes throughout the body. Lrh1 is expressed in several cell types in the testis. To evaluate its function, we used a Cre-lox mouse breeding scheme to specifically delete Lrh1 in germ cells. We performed histological analyses on testes from mice aged from 9 days post-partum to one year post-partum. Up to six months in age there was a progressive loss of germ cells in the Lrh1 mutants vs. controls suggesting Lrh1 likely plays a role in SSC self-renewal. However, at 8 months the germ cell population began recovering and by one year spermatogenesis appeared normal in the Lrh1 mutants. We hypothesize that a compensation mechanism may trigger activation of a quiescent reserve stem cell pool, perhaps when active stem cell numbers reach a certain minimum threshold. Future studies will investigate the cell population and signaling pathways involved in this apparent recovery.

Presenter: Adanna Ekekwe
Poster Number: 17
Home Institution: University of Maryland - Baltimore County
Program: LSSURP
Faculty Mentor: Dr. Marija Cvetanovic
Poster Title: **Purkinje Cell Expression of Mutant Ataxin-1 in Mice Effects Activity of Neurons in Prefrontal Cortex and Hippocampus**

Abstract: Multiple lines of evidence suggest that the cerebellum has anatomical and functional connections with the prefrontal cortex and the hippocampus which influence cognitive planning. However, how a dysfunctional cerebellum will affect neuronal activity in prefrontal cortex and hippocampus remains unknown. Spinocerebellar ataxia type 1 (SCA1) is a neurodegenerative disease caused by an expanded repeat of CAG (glutamine coding) nucleotides in the AXTN-1 gene. This mutation causes a loss in Purkinje cells in the cerebellar cortex. The Purkinje cells are the only output neurons of the cerebellar cortex. SCA1 patients have a dysfunctional cerebellum causing them to have a disability in balanced movements and coordination such as during walking. SCA1 Patients also demonstrate deficits in cognition. This deficiency in cognition may be correlated to the decreased amount of output neurons coming from the cerebellar cortex. We used Purkinje cell-specific SCA1 transgenic mouse model ATXN1[82Q] mice that have an Ataxin-1 mutation limited to the cerebellar Purkinje cells causing their dysfunction to analyze neuronal activity in the hippocampus and prefrontal cortex with cFOS staining. We have found increased cFOS staining in the prefrontal cortex and hippocampus of ATXN1[82Q] mice, indicating increased neuronal activity when mutant Ataxin-1 is expressed in the cerebellum.

Presenter: Abdi Farah
Poster Number: 18
Home Institution: University of Minnesota - Twin Cities
Program: LSSURP
Faculty Mentor: Dr. Li-Na Wei
Research Advisor: Yu-Lung Lin
Poster Title: **Glioma-Associated Oncogene 1 (Gli1) and Specificity Protein 1 (SP1) Transcription Factors Recognize and Regulate the Expression of Cellular Retinoic Acid Binding-Protein 1 (CRABP1) Promotor in a Motor Neuron Cell Line**

Abstract: Cellular Retinoic Acid Binding-Protein One (CRABP1) is a known Vitamin A derivative that is important for many cellular functions such as cell growth and differentiation. It has been shown that CRABP1 is highly expressed in patients with Amyotrophic Lateral Sclerosis (ALS) which is a neurodegenerative disease that affects nerve cells in the brain and the spinal cord. However, little is known about the reason why CRABP1 overexpression is more prevalent in ALS patients than non-ALS patients. Based on this observation, CRABP1 overexpression could be exploited for ALS diagnosis and efficient treatment. In our experiment, we will determine protein & DNA interactions using Chromatin Immunoassay (CHIP) in neuronal cell lines. This is meant to determine how well the DNA and protein interact, while other simpler tests are meant to analyze gene regulation. Additionally, a thorough analysis of various research articles indicated that CRABP1 could have alternative intercellular functions that contribute to malignancies. The overarching goal of this project is to determine one of the regulations pathways of CRABP1 and to exploit this to help patients with ALS.

Presenter: Carolina Fernandez
Poster Number: 19
Home Institution: Florida International University
Program: LSSURP
Faculty Mentor: Dr. Laurie Parker
Research Advisor: Monica Johnson
Poster Title: **Determining Drug Efficacy in a Model System for Chronic Myelogenous Leukemia by Using a Biosensor Assay to Detect Phosphorylation**

Abstract: The underlying cause of Chronic Myelogenous Leukemia is the translocation of chromosomes 9 and 22, and this produces an abnormal fusion protein known as the BCR-ABL1 oncogene. This oncogene causes the ABL1 kinase to remain constantly active, signaling cells to divide beyond necessary means. Inhibitors such as Imatinib bind to the ATP binding site of the kinase to inhibit phosphorylation and cell proliferation. Although this has been effective, Leukemia patients have developed resistance due to the signaling mechanisms that cells utilize to adapt to different environments. In this experiment, biosensor was administered to different treatments of blood, which converts a biological response into an electrical signal. Once this was done, an ELISA was performed to detect levels of phosphorylation between healthy human blood, blood with low burden CML, and blood with high burden CML. Two replicates for each treatment were used, one replicate contained Imatinib while the other did not have any treatment. Healthy blood exhibited the least amount of phosphorylation, and the samples with inhibitor present exhibited less phosphorylation than the ones without treatment. These results provide clinical applications for the revolutionary treatment that CML patients can acquire once an inhibitor drug can target individuals' specific cancer morphology.

Presenter: Julian Gonzalez Amortegui
Poster Number: 20
Home Institution: Florida International University
Program: LSSURP
Faculty Mentor: Dr. Donald Simone
Research Advisor: Victoria Rogness, Rebecca Speltz, Malcom Johns, Sergey Khasabov
Poster Title: **Analgesic Effect of Resolvin D1 on Bone Cancer Pain and the Role of the Rostral Ventromedial Medulla**

Abstract: Bone cancer causes severe pain that is difficult to treat. Although opioids are used to treat this pain, they are associated with serious side effects. Thus, new, effective, and safe analgesics are needed. The rostral ventromedial medulla (RVM) is an area of the brainstem that is involved in modulation of nociceptive transmission in the spinal cord through inhibitory (OFF-cells) or facilitatory (ON-cells) descending projections. We hypothesized that Resolvin D1 (RvD1) decreased cancer pain by reducing RVM-induced nociceptive facilitation. We used a mouse model of cancer pain (fibrosarcoma growth in the heel bone) to test our hypothesis. Analgesic effect of (RvD1) on bone cancer pain has been evaluated by giving seven consecutive subcutaneous daily injections of RvD1 (200ng/50µl). RvD1, but not vehicle, decreased mechanical hyperalgesia in the tumor-bearing paw. Absence of addictive properties of RvD1 was demonstrated using the Conditional Place Preference test. In electrophysiological studies in anesthetized mice, RvD1 given directly into the RVM decreased responses of ON- and OFF-cells to noxious stimulation applied on the tumor-bearing paw. Therefore, RvD1 produces analgesia in part by reducing descending facilitation and enhancing descending inhibition. In conclusion, RvD1 could be used to treat cancer pain as it lacks addictive properties and produces analgesia.

Presenter: Gladys Gonzalez Matias
Poster Number: 21
Home Institution: California State University - San Marcos
Program: LSSURP
Faculty Mentor: Dr. Brian Betts
Poster Title: **The Role of Human Beta-defensin-3 in Graft-versus-Host Disease Prevention**
Abstract: Graft-versus-host disease (GVHD) is a life threatening complication that affects over 30% of patients treated with allogeneic hematopoietic cell transplantation (allo-HCT). Beyond conventional, broadly suppressive, pharmacologic immunosuppression, cell therapy with regulatory T cells (Treg) can prevent GVHD and spare anti-tumor benefits of allo-HCT. Beta-Defensins are antimicrobial peptides that have anti-inflammatory properties, in part due to their effects on Treg function. Specifically, human beta-defensin-3 (hBD3) is produced by activated keratinocytes and protects the epithelial-barrier from pathogenic bacteria. Using allogeneic mixed lymphocyte reactions, we show that hBD3 fully polarizes Treg generation, eliminates alloreactive conventional T cells (Tconv), and significantly increases the Treg:Tconv ratio; which is a clinically relevant metric in controlling GVHD. Additionally, hBD3 significantly suppresses the proliferation of allo-stimulated T cells, deleting critical mediators of GVHD. As such, we are able to rapidly produce pure Tregs in less than 7 days. Thus, hBD3 presents a promising compound to selectively target alloreactive Tconv and preserve Treg populations in GVHD prevention.

Presenter: Harywilliam Gonzalez Vidal
Poster Number: 22
Home Institution: University of Puerto Rico - Utuado
Program: LSSURP
Faculty Mentor: Dr. Julie Grossman
Poster Title: **Nitrogen Fixation by Summer and Winter Legume Cover Crops in High Tunnels**
Abstract: High tunnels are unheated, plastic-film covered, protected environments with a unique warmer microclimate that extend crop production in temperate regions. Since high tunnels allow farmers to produce crops for longer periods of the year, soils are intensively cultivated, reducing soil health and fertility. Legume cover crops are non-harvested crops intentionally planted to improve soils. We studied cover crop treatments consisting of legumes alone or legume-grass mixtures in two seasons, summer and winter. The summer cover crops were cowpea (legume) and cowpea + sorghum-sudangrass (mixture) and winter cover crops were vetch (legume) and vetch + rye (mixture). We studied how treatments (season and presence or absence of a grass) affected the amount of (1) nitrogen fixed from the atmosphere by the legumes (15N natural abundance method) and (2) mineral nitrogen in the soil at 3 timepoints 0 to 11 weeks after termination (KCl extraction followed by colorimetric measurement of nitrate concentration). We expect to find that legumes will fix a higher quantity of nitrogen when grown alone than when in a mixture, and cowpea will fix a higher quantity of nitrogen than vetch; grass mixtures will have less mineral N in the soil than legumes grown alone.

Presenter: Jazmine Grant
Poster Number: 23
Home Institution: Howard University
Program: LSSURP
Faculty Mentor: Dr. Carolyn Fairbanks
Poster Title: **Using Non Reflexive Assays to Evaluate Oxymorphindole-Loperamide Combination Efficacy**

Abstract: Reflexive assays classically have been used in preclinical pain models to assess pain and analgesic efficacy. There are concerns that reflexive assays do not correlate with aspects of human pain, including quality of life. Therefore, in this project we studied an inflammatory pain model with non-reflexive behavioral assays to test the efficacy of the loperamide-oxymorphindole drug combination (OMI-LO). Animals (C57BL6 mice) received a bilateral intraplantar injection with Complete Freund's Adjuvant (CFA) to induce peripheral inflammatory pain. Non-reflexive assays including the running wheel test and the open field activity box system were used to test for CFA-induced behavioral deficits as well as antihyperalgesic effects of morphine and OMI-LO. In the inflammatory model, injured animals demonstrated a significant decrease in distance traveled in the running wheel ($p<0.05$, ordinary two-way ANOVA). Distance traveled and number of ambulatory events in the open field activity assay decreased as well. The results correlated with decreased paw withdrawal latency from reflexive stimuli including heat and touch. In the running wheel assay, the deficit following inflammation was significantly reversed with morphine and OMI-LO. These results suggest that OMI-LO shows analgesic efficacy in reflexive and non-reflexive assays.

Presenter: Brianna Greiskalns
Poster Number: 24
Home Institution: Wartburg College
Program: LSSURP
Faculty Mentor: Dr. Ling Li
Research Advisor: AWenfeng Liu, Rui Zhong
Poster Title: **The Impact of Diabetic Hyperglycemia on Neuropathology in a Transgenic Mouse Model of Alzheimer's Disease**

Abstract: Alzheimer's disease (AD) is a leading cause of dementia that affects more than 5 million Americans and their families. The cause of AD is not fully understood, and to date there is no effective prevention or treatment for AD. Recently, compelling evidence suggests that type 2 diabetes increases the risk of developing AD. Type 2 diabetes is a chronic disease that occurs when the body stops producing enough insulin, or stops responding to insulin sufficiently enough to process glucose in the blood. Nearly 1 in 10 Americans are living with diabetes, and 95% of these cases are type 2 diabetes. This statistic is projected to increase by another 50% in the next decade. Type 2 diabetes has been correlated with complications such as cardiovascular disease, heart attack and stroke; however, the connections between diabetes and AD are yet to be supported by experimentally sound evidence. The objective of this study was to assess the impact of diabetes-induced hyperglycemia on neuropathology in a transgenic mouse model of AD, APP/PS1 mice. These particular mice overexpress AD mutant forms of amyloid-β precursor protein (APP) and presenilin 1 (PS1) and develop AD-like amyloid-β (Aβ) plaques and associated neuroinflammation in the brain. In this study four pairs of these APP/PS1 mice were examined, both with and without diabetic hyperglycemia. The primary method used in this study was immunohistochemistry (IHC). The Aβ buildup was quantified by IHC using the 6E10 antibody; neuroinflammation was evaluated by IHC using antibodies specific to glial fibrillary acidic protein (GFAP), a marker for activated astrocytes, and ionized calcium binding adaptor molecule-1 (IBA1), a marker for activated microglia. It was found that the pattern of amyloid- buildup in the brains of AD-model mice with type 2 diabetes does not significantly differ from that of AD-model mice without type 2 diabetes. These particular results do not provide substantial evidence to support the use of insulin in slowing the progression of Alzheimer's disease.

Presenter: Yashira Gutierrez Cardona
Poster Number: 25
Home Institution: University of Puerto Rico - Utuado
Program: LSSURP
Faculty Mentor: Dr. Mary Rogers
Poster Title: **Evaluating Biodiversity of Beneficial and Pest Arthropods in Urban Community Garden in Twin Cities, Minnesota**

Abstract: Urban gardens are a tool to educate and take care about the green spaces, conservation of resources and share food whit community. This study is aimed at measuring arthropod biodiversity in four urban gardens in Minneapolis and St. Paul, MN, during summer 2019. Two methods were used to capture, count and identify arthropods. Pitfall traps were used for underground insects and sticky cards for flying insects were collected every two weeks. A total of 464 arthropods have been counted in general with pitfall traps and sticky cards. On sticky cards, a total of 316 were counted, 111 beneficial and 205 pests. In the pitfall traps a total of 148 arthropods were identified from in two different Orders: Coleoptera (beetles), a total of 21, and Arachnida (spiders), a total of 127. In the order Coleoptera four different families were found: Carabidae, Lucanidae, Passalidae, Elateriadae. At Frogtown farm, there was a total of 51 beneficial arthropods and 62 pests. At Pilgrim Baptist garden, we identified 33 beneficial and 91 pests, at Growing Lots, we identified 9 beneficials and 14 pest, and at Waite house 18 beneficial and 38 pests. Frogtown farm is the urban garden with the most beneficial arthropods.

Presenter: Caroline Hanson
Poster Number: 26
Home Institution: University of Wisconsin - Madison
Program: LSSURP
Faculty Mentor: Dr. Jill Siegfried
Poster Title: **Mechanism of Cellular Uptake of Cyclic STAT3 Decoy in Non-Small Cell Lung Cancer**

Abstract: Lung cancer is difficult to treat effectively and has the highest mortality rate among cancers world-wide. To improve treatments for this illness, targeted therapies are developed to inhibit pathways that are altered in cancerous cells. This includes the JAK/STAT3 signaling pathway, which activates genes to promote cell proliferation. The STAT3 transcription factor is hyperactive in cancer cells, causing uncontrolled growth. Previous studies in the Siegfried lab have found cyclic STAT3 decoy (CS3D) oligos to be an effective therapeutic for inhibiting STAT3. The CS3D mimics the binding element of STAT3 target genes, sequestering active STAT3 in the cytoplasm to inhibit cell proliferation. While the mechanism of inhibition for CS3D is understood, the method of cellular uptake for this decoy oligo is still under investigation. In this study, cells were transfected with fluorescent CS3D and examined with confocal microscopy to determine if CS3D enters the cell via endocytic trafficking. Images of the transfected cells showed colocalization of fluorescent CS3D with the Rab7 (mid-phase endosomal), Rab11 (late-phase endosomal) and LAMP1 (lysosomal) fluorescently-tagged markers, supporting the hypothesis that CS3D enters the cell via endocytosis. Research into mechanisms of CS3D uptake is important for predicting how this therapeutic will act during clinical trials.

Presenter: Emely Henriquez Pilier
Poster Number: 27
Home Institution: University of Virgin Islands
Program: LSSURP
Faculty Mentor: Dr. Alonso Guedes
Research Advisor: Ruth Quintana
Poster Title: **Astroglial CD38 is Involved in Opioid-mediated Anti-nociception in a Neuropathic Pain Model**

Abstract: Understanding chronic pain mechanisms would allow for better drugs and treatment. Calcium is a very important signaling molecule and CD38, a transmembrane protein, is involved in the regulation of calcium homeostasis. Using the spared nerve injury model of chronic neuropathic pain in 6-12 month-old wild type (WT) and CD38-deficient (CD38KO) mice, we found that both mice developed similar magnitudes and significant mechanical hypersensitivity. Next, we found that a centrally (15 mg/kg) but not a peripherally (1.5 mg/kg) acting dose of the mu-opioid receptor agonist, loperamide, completely normalized mechanical hypersensitivity in the WT mice but had no effect in the CD38KO mice. Together, these results suggest that CD38 is not involved in the development and maintenance of neuropathic pain, but its presence in the central nervous system is required for the pain-relieving action of mu-opioid receptor agonists. To further understand how CD38 might mediate opioid-induced anti-nociception, we performed in-situ hybridization and immunohistochemistry in spinal cord and dorsal root ganglion (DRG) tissue from WT mice and found that CD38 is localized in astrocytes in spinal cord and satellite glial cells in DRG. Altogether, our results suggest that spinal cord astrocytes expressing CD38 are required for effective opioid therapy of neuropathic pain.

Presenter: Mia Hoffman
Poster Number: 28
Home Institution: University of Notre Dame
Program: LSSURP
Faculty Mentor: Dr. Andrew Oxenham
Research Advisor: Dr. Anahita Mehta, Dr. Emily Allen
Poster Title: **Locating Pitch in the Brain Using Harmonic and Inharmonic Tones**

Abstract: Pitch is a perceptual quantity relating to the periodicity of a sound, but the mechanisms behind this perception are unclear. Harmonic tones are tones that share a common fundamental frequency. When these tones are combined they form a harmonic complex tone with the pitch of the fundamental. Previous fMRI studies reported possible “pitch-sensitive” regions in the human auditory cortex located near the antero-lateral portion of Heschl’s gyrus. However, few studies have compared this to neural activation of inharmonic tones, which have an indiscernible or weak pitch percept. The present work covers the design and behavioral testing of a task for use in future fMRI work. The aim of this project is to determine whether there are differences in neural activation for harmonic and inharmonic sounds and whether these differences exist in the previously reported “pitch-sensitive” regions. The test presents harmonic and inharmonic tones of either high- or low-frequency harmonics to subjects while measuring neural activation using fMRI. We hypothesize that harmonic tones will have stronger representation in these “pitch-sensitive regions” of the brain compared to inharmonic tones. The present study uses several methods to verify the location of the primary auditory cortex, including tonotopy, macro anatomical landmarks, and myelin mapping.

Presenter: Robyn Huber
Poster Number: 29
Home Institution: Bemidji State University
Program: LSSURP
Faculty Mentor: Dr. Rita Perlingeiro
Research Advisor: Karim Azzag
Poster Title: **Satellite Cell Engraftment of Pluripotent Stem Cell-Derived Myogenic Progenitors in a Dystrophic Mouse Model Associated with FKRP Mutations**

Abstract: Mutations in Fukutin Related Protein (FKRP) lead to a large spectrum of muscular dystrophies, from severe forms like Walker-Warburg Syndrome and congenital muscular dystrophy 1C to mild phenotypes, such as limb girdle muscular dystrophy 2I (LGMD2I). FKRP is an enzyme involved in the glycosylation process of alpha-dystroglycan. When FKRP is mutated, impaired alpha-dystroglycan glycosylation results in reduced binding of alpha-dystroglycan with the extracellular matrix. To study the feasibility of cell therapy for LGMD2I, we transplanted PSC-derived mouse myogenic progenitors, labeled with H2B fused to RFP to facilitate *in vivo* tracking of donor cells, in FKRP mutant mice. Four weeks following intra-muscular transplantation, we detected significant myofiber engraftment. Since satellite cells are critical for long-term regeneration, the goal of my project was to determine whether PSC-derived myogenic progenitors would be able to seed the satellite cell compartment in FKRP mutant mice. To detect donor-derived satellite cell engraftment, I established a triple staining protocol for Pax7, RFP and laminin on tissue sections. Using fluorescent microscopy, I acquired images of several transplanted muscles and quantified the ratio of RFP+Pax 7+ satellite cells (PSC-derived) versus endogenous satellite cells (RFP-Pax 7+). After quantification, I determined that 20% of the satellite cell pool were donor-derived. These results indicate that transplantation of PSC-derived myogenic progenitors in FKRP mutant mice results in extensive satellite cell engraftment, which is critical for future therapeutic applications.

Presenter: Rebecca Jirik
Poster Number: 30
Home Institution: St. Olaf College
Program: LSSURP
Faculty Mentor: Dr. Aaron Goldstrohm
Poster Title: **The Affect of Codon Optimality on PUM Mediated Repression**

Abstract: Gene expression is controlled by a multitude of different mechanisms. One such mechanism involves RNA binding proteins (RBPs) that bind RNA resulting in translational inhibition or RNA decay. Human Pumilio proteins, PUM1 and PUM2, belong to the PUF family of RBPs. PUM proteins bind, and potently repress RNA targets via a consensus sequence known as the Pumilio response element (PRE). Once bound, PUM proteins promote translational repression primarily through recruitment of the CNOT deadenylase complex resulting in decreased mRNA stability. In addition, codon optimality affects mRNA stability such that the most frequently used codons in an mRNA sequence lead to more efficient and more stable translation. Specifically, codon optimality is the differences in decoding rates that each of the 61 amino-acid encoding codons by the ribosome. In this study, we seek to address one key question: Does codon optimality affect PUM mediated repression? In order to analyze the relationship between codon optimality and PUM repression we designed 4 luciferase reporters with varied codon optimality, with either 3 wild type PREs or 3 mutant PREs, that PUM cannot bind to, in the 3' UTR (0% rare codons, 50% rare codons, 100% rare codons, and wild type codons). We hypothesized that PUM mediated repression would negatively correlate with codon optimality, with the most optimally coded reporter being least susceptible to repression by PUMs. We performed luciferase assays normalizing luciferase signal of each wild type reporter to its respective mutant reporter.

Presenter: Guerldyn Joanem
Poster Number: 31
Home Institution: Loyola University
Program: LSSURP
Faculty Mentor: Dr. Cindy Tong
Poster Title: **Perceptions of "Soil Health" by Twin Cities Gardeners and Farmers**
Abstract: Soil Health is a term with many different definitions. According to the United States Department of Agriculture Natural Resources Conservation Service, soil health is the quality of soil and its ability to continue functioning as a system that "sustains plants, animals and humans". The term however varies depending on the scale and type of agriculture which can make it difficult to maintain healthy soils. Maintaining healthy soils can be difficult anywhere but is uniquely difficult in urban settings where soil quality is impacted by pollution and little access to educational resources. Despite this, urban agriculture has become an important system that has positively impacted many communities. My research focused on soil health, examined how peopled defined it and how to further develop materials that could educate urban agriculturalists.

Presenter: Beminet Kassaye
Poster Number: 32
Home Institution: Macalester College
Program: LSSURP
Faculty Mentor: Dr. Anna Lee
Research Advisor: Jenna Robinson
Poster Title: **Investigating the Role of GRK4 in Modulation of Nicotine Reward-Motivation Behavior**
Abstract: *Rationale:* Nicotine is the primary addictive substance found in tobacco that binds and activates the nicotinic acetylcholine receptors (nAChRs). Nicotine, acting as an agonist, exerts similar function as the endogenous neurotransmitter acetylcholine. Dopamine receptors are G protein-coupled receptors (GPCRs) that are important in reward behaviors, and the receptors can be regulated by G protein-coupled receptor kinases (GRK), specifically subfamily GRK4. *Objective:* The purpose of this study was to analyze the role GRK4 plays in nicotine consumption. *Method:* A two-bottle choice study was used to investigate nicotine consumption and preference in GRK4 wild type and knock out mice. 16 mice (males and females) were single-housed with a bottle of water and a bottle of diluted nicotine over a period of 4 weeks. The nicotine concentration increased weekly: 30µg/mL, 50µg/mL, 75µg/mL, & 100µg/mL. Over the course of four weeks, the bottles were weighted to gauge consumption of nicotine and water. The position of the bottles was altered after each bottle measurement to account for side preference. We controlled for fluid leakage with a control cage with both bottles that contained no mouse. Average weekly consumption (mg/kg/day) and preference was calculated using the weights of the bottle and weight of individual mouse. *Result:* Knockout mice showed increased average weekly consumption of nicotine as the concentration escalated in comparison to wild-type mice. It was also observed that knockout mice had preference for nicotine was greater than wild-type mice. These data show that GRK4 plays a role in mediating nicotine consumption.

Presenter: Kamran Kelly
Poster Number: 33
Home Institution: Carleton College
Program: LSSURP
Faculty Mentor: Dr. Bryce Binstadt
Poster Title: **Investigating the Role of Interleukin 33 in Mitral Valve Disease**
Abstract: Valvular heart disease (VHD) is a common disease that requires costly surgical valve repair or replacement and costs an estimated 23.4 billion dollars annually worldwide. This disease primarily confines itself to valves on the left side of the heart for reasons that are not understood. Interleukin-33 (IL-33) is a cytokine in the IL-1 family of cytokines. IL-33 is rarely expressed in healthy mouse tissue, but is commonly expressed in inflamed mouse tissue. Immunohistochemistry (IHC) was used to detect levels of IL-33 in B6 (non-arthritic) mice. Flow cytometry was used to track the secretion of IL-33 in K/B.g7 (arthritic) and B6 mice. It was hypothesized that IL-33 is secreted by endothelial cells and acts on type II innate lymphoid cells (ILC2), leading to a type II inflammatory immune response. There were significantly higher levels of IL-33 in the mitral valve than the tricuspid valve in non-arthritic B6 mice. Macrophage, ILC2, endothelial cell, T-cell, B-cell, neutrophil, and red blood cell populations were identified in the mitral valves and secondary lymphoid organs of K/B.g7 and B6 mice. Both IL-33 and IL-33 receptor knockout experiments will be conducted in the future with the hypothesis that inflammation will be decreased in knockout samples.

Presenter: Aaron Khaimraj
Poster Number: 34
Home Institution: Augsburg University
Program: LSSURP
Faculty Mentor: Dr. Marco Pravetoni
Research Advisor: Carly Baehr
Poster Title: **Exploration of Fentanyl-Specific Monoclonal Antibodies Against Opioid Use Disorder**
Abstract: Fentanyl, a synthetic opioid about 100 times more potent than morphine, was one of the leading causes of death from opioid-related overdoses in 2018, and illicit street drugs such as heroin and cocaine are frequently laced with fentanyl. Vaccines and antibodies offer a promising strategy to combat opioid use disorder by preventing drug distribution across the blood-brain barrier. The goal of this study was to produce fentanyl-specific monoclonal antibodies (mAb) that bind to fentanyl derivatives with high affinity. C57BL/6 mice were immunized with a vaccine containing a fentanyl-based hapten conjugated to an immunogenic carrier protein. Cells from lymph nodes and spleen were enriched for antibody expressing cells and then fused with Sp2/0 myeloma cells. Hybridomas were screened for mAb expression using ELISA. Previously harvested opioid-specific mAb were assessed for binding affinity with fentanyl and its derivatives. The anti-fentanyl mAb showed high affinity for fentanyl but relatively low cross-reactivity for fentanyl derivatives, suggesting the need to explore more structurally diverse haptens. Overall, the ability of fentanyl-specific antibodies to bind to fentanyl and its derivatives helps predict the clinical efficacy of immunotherapy for opioid use disorder, including vaccines and mAb for passive immunization.

Presenter: Rachel Kirchner
Poster Number: 35
Home Institution: Ohio State University
Program: LSSURP
Faculty Mentor: Dr. Gregory Vercellotti
Research Advisor: Dormarie E. Rivera Rodriguez, John D. Belcher, Ping Zhang
Poster Title: **Characterizing Toll-like Receptor 4 (TLR4) as a Target for Treatment in Sickle Cell Disease**

Abstract: Our lab has shown that hemin, a damage-associated molecular pattern (DAMP), is released from hemolyzed sickled RBCs and activates TLR4 signaling. The downstream effects of this signaling pathway triggers an inflammatory response mediated by the transcription factor NF-kB. Cytokines, cell adhesion molecules, and coagulation factors are released which can result in a vaso-occlusive (VO) crisis. This restriction of blood flow leads to ischemic injury and gives rise to many of the symptoms associated with SCD. We hypothesize that TLR4 deficiency will limit inflammation, coagulation, and VO in SCD. Transgenic Townes SCD mice that express human α-globin and βS-globin (HbS) were crossed with TLR4 +/+ or TLR4-/- mice to produce TLR4-/- and TLR4+/+ mice expressing human HbS. Using these mice, we characterized their phenotypes using RNA, protein, immunohistochemical, and serological analyses following hemin injection. Townes SS TLR4 -/- mice have lower expression of cytokines and cell adhesion molecules compared to the Townes SS TLR4+/+, most notably Vascular Cell Adhesion Molecule 1 (VCAM1; $p<0.05$). In conclusion, we have shown that TLR4 and the innate immune system play a critical role in inflammation in SCD. We speculate that modulation of TLR4 with targeted inhibitors would be beneficial in SCD patients.

Presenter: Britta Koenen
Poster Number: 36
Home Institution: St. Olaf College
Program: LSSURP
Faculty Mentor: Dr. David Largaespada
Research Advisor: Bryant Keller, Dr. Kyle Williams
Poster Title: **Combination Chemotherapies for Malignant Peripheral Nerve Sheath Tumors**

Abstract: Neurofibromatosis type 1 is a common, autosomal dominant tumor predisposition syndrome that can cause benign and malignant tumors of peripheral nerves. Patients carry one nonfunctional mutant of the Nf1 tumor suppressor gene; tumors develop after loss of the remaining allele in Schwann cells or their precursors. With subsequent mutations, these progress to malignant peripheral nerve sheath tumors (MPNSTs), occurring in 10-15% of patients. The 5-year survival rate for MPNST diagnosis is <40%, highlighting inadequate treatment options that currently consist of nonspecific chemotherapy and surgical resection. In seeking effective alternatives, our lab performed a drug screen using cells deficient of Nf1 and other tumor suppressor genes to expose possible drug vulnerabilities in MPNSTs. The drug screen yielded 6 targeted chemotherapies that effectively lengthened survival and slowed tumor growth as mono-treatments in murine models. Based on mono-treatment data, we tested for potentially synergistic drug interactions that amplified effects on tumor size and survival. We enrolled a murine model in two combination regimens. The first incorporated selumetinib and digoxin, and the second incorporated vorinostat, selumetinib, and digoxin. Both combination treatments reduced tumor size between 18.5-99.8% compared to no shrinkage in mono-treatments, and are projected to further increase median survival upon cohort completion.

Presenter: Sophie Kowaliczko
Poster Number: 37
Home Institution: University of Minnesota - Twin Cities
Program: LSSURP
Faculty Mentor: Dr. Satoshi Ishii
Poster Title: **Determining Oxygen Tolerance of Nitrous Oxide Reductase for Atmospheric Bioremediation**

Abstract: Nitrous oxide (N2O) is a potent greenhouse gas with ozone-destroying capabilities and was named the most critical anthropogenic substance emitted in the 21st century. The traditional method of atmospheric N2O removal depends on the use of noble metal catalysts that are costly and inhibited by water and oxygen, thus reducing their practicality. The bacterial enzyme, nitrous oxide reductase (N2OR), is involved in converting nitrous oxide to nitrogen gas in the last step of denitrification, and has promising potential as an alternative to these ineffective noble metal catalysts. It is known that N2OR has varying efficiencies between different bacterial strains and oxygen concentrations. The goal of this study is to screen several N2O-reducing bacterial strains for the presence of an oxygen-tolerant N2OR. Bacterial strains were cultured for N2OR screening across a broad range of taxa. Aerobic N2O reduction was measured over time in a double chamber system using microsensor analysis to determine the efficiency of N2OR in the presence of oxygen. Based on the microsensor results, *Azospirillum* was not identified as oxygen-tolerant. Oxygen-tolerant N2ORs require further study to elucidate both the enzyme structure and mechanism of oxygen-tolerance before bioengineering and bioremediation efforts can begin.

Presenter: Christian Lagares Linares
Poster Number: 38
Home Institution: University of Puerto Rico - Cayey
Program: LSSURP
Faculty Mentor: Dr. Subree Subramanian
Poster Title: **Hypoxic Modulation of miR-424 Expression and HIF-1a Stabilization in Colorectal Cancer**

Abstract: Hypoxia is a common feature of developing tumors in which proliferating cells demand more oxygen than the available supply, creating an imbalance. Adaptation to oxygen deprivation plays a critical role in cell survival and tumor progression. Some Hypoxamirs—a family of microRNAs expressed under hypoxia—stabilize the Hypoxia Inducible Factor 1 (HIF1). HIF1 is a transcription factor involved in the induction of genes for angiogenesis, metastasis and glucose metabolism. In this study we further analyzed the relationship between miR-424 expression and HIF-1 stabilization in mouse and human colon adenocarcinoma cell lines. By using the AnaeroPack System and Cobalt Chloride II treatments we created various hypoxic environments for cells to grow in for twenty-four hours. miR-424 and HIF-1a were both overexpressed under hypoxia in comparison to normal oxygen levels, as shown by RT-qPCR and Western Blot analysis. To investigate whether HIF1a regulates miR-424 expression in a positive feedback loop, chromatin immunoprecipitation assays were performed. HIF1 is expected to bind at the Hypoxia Response Elements (HRE) region of the miR-424 promoter, stabilizing its expression. While further investigation of miR-424 expression is still needed, this hypoxia and hypoxia regulated miR-424 could be a molecular target for cancer therapy.

Presenter: Gabriella Mabayyed
Poster Number: 39
Home Institution: Tennessee State University
Program: LSSURP
Faculty Mentor: Dr. Lucy Vulchanova-Hart
Poster Title: **Histological Differences in the Dorsal Funiculus Following Contusion Injury at the T9 Spinal Cord in Male Mice**

Abstract: Every year roughly 17,700 people in the United States are affected with spinal cord injuries (SCI). By the time they are discharged from the hospital less than one percent of people are left with complete neurological recovery. A number of sensory changes following SCI, including pain and loss of sensation. Prior work in the lab examined a number of behaviors following SCI in mice. My work examined the quality of responses to light touch and histological changes that are present in the spinal cord after SCI. To view the intensity of the possible damage to each spinal cord, I first conducted immunohistochemistry staining with a primary antibody of Iba1. To view the possible differences of myelination on each spinal cord, I used luxol fast blue staining. Quantification of immunohistochemical markers was done in fiji/image j. I began analyzing behavioral studies regarding light touch sensitivity with cotton swab testing by measuring their reactions which included jerking, fluttering or no response. If trends hold during the remainder of analysis we expect to see less luxol fast blue staining in SCI mice than in naive mice. Continued analysis is occurring for the staining and quantification of the spinal cords.

Presenter: Ibrahim Mahamed
Poster Number: 40
Home Institution: North Hennepin Community College
Program: LSSURP
Faculty Mentor: Dr. Bonnie Klimes-Dougan
Poster Title: **HPA Axis Regulation and Amygdala-Frontal Connectivity in Mood Disorder Patients**

Abstract: Dysregulation of the stress system is a hallmark of adolescent depression and mood disorders (MD). MD neurobiology is poorly understood leading to limited treatment options. Current research associates elevated levels of cortisol and greater amygdala activation/volume in patients with major depressive disorder (MDD). In addition, BOLD signal fluctuations during rest has shown increased functional connectivity between the amygdala and ROI within healthy control (HC). The purpose of this study was to further investigate these findings in adolescent populations. There were 31 patients with MD (major depressive disorder or bipolar disorder) and 20 HC participants (N = 51; age M = 16.28; SD = 1.61; 68.6% female). Key measurements included estimates of brain structural volume, activation in the context of an emotion task, and functional connectivity. Cortisol response was measured in the context of the Trier Social Stress Test(TSST) and cortisol awakening response (CAR). Contrary to predictions, results showed no significant difference in cortisol levels between patient groups on cortisol or brain indexes. Associations between systems and across systems showed some interesting results. For example, group moderated the association between TSST and CAR cortisol. Increased plasticity during adolescence makes treatment possible but further study is necessary to better understand mood disorders.

Presenter: Josue Martes Villalobos
Poster Number: 41
Home Institution: University of Southern Florida
Program: LSSURP
Faculty Mentor: Dr. Alexander Khoruts
Poster Title: **Evaluating the Efficiency of Secondary Bile Acid (SBA) Derivatives as Germination Suppressors of Clostridioides difficile; Compared to Naturally Occurring SBAs**

Abstract: Infections caused by *Clostridioides difficile* average to half a million cases each year, with over 30,000 deaths in the US alone. The infection is typically acquired from the environment in the form of spores, which germinate in the host and produce toxins cause epithelial damage, inflammation, and patient's symptoms. Fecal microbiota transplantation, a very effective treatment of recurrent *C. difficile* infections, has been found to work at least partially through restoration of secondary bile acid metabolism in the host. Therefore, we focused our efforts on development of bile acid derivative drugs that are more potent than natural bile acids in inhibiting *C. difficile* spore germination and have more favorable pharmacokinetics. Specifically, the ideal compounds are more potent and have minimal absorption into the enterohepatic circulation; achieving optimal concentrations in the colon. This project focused on investigating the germination inhibition efficiency of lithocholic acid (LCA), a natural secondary bile acid versus "21b", a bile acid derivative. Optical density measurements were taken with spectrophotometry throughout the initial germination period in anaerobic conditions to measure spore germination. Direct counts using phase contrast microscopy were employed to verify spectrophotometric measurements. Results indicated a greater germination inhibition achieved by 21b compared to LCA.

Presenter: Kenneth Martínez Algarín
Poster Number: 42
Home Institution: University of Puerto Rico - Cayey
Program: LSSURP
Faculty Mentor: Dr. Kurt Prins
Poster Title: **Influences of Sex Hormones on the Microtubule Cytoskeleton in the RV in PAH**

Abstract: Background: Pulmonary arterial hypertension (PAH) is a lethal disorder characterized by pathological remodeling of the pulmonary arteries. In PAH, right ventricular function (RVF) is the strongest predictor of symptom burden and survival. Despite PAH occurring in women more than men, women have better RVF and live longer. We previously showed microtubule (MT) remodeling in RV cardiomyocytes promotes RV dysfunction, but the effects of the sex hormones on MT regulation in the RV hasn't been explored. Methods: We studied how estrogen and testosterone altered MT dynamics in vitro. We also examined differences in microtubule remodeling in the RV in male and female PAH rats. Finally, we examined RV function using echocardiography in PAH patients. Results: In vitro, estrogen significantly blunted MT polymerization. Conversely, testosterone stabilized microtubules depolymerization. In male MCT RV extracts, α- and β-tubulin, and detyrosinated α-tubulin had elevated expression. However, in female MCT RV extracts, there were no significant differences in α- or β-tubulin expression. In PAH patients, females had better RVF despite having more severe pulmonary vascular disease. Conclusions: Sex hormones directly modulate MT dynamics which may explain the differences in sexes in RVF.

Presenter: Asha McElroy
Poster Number: 43
Home Institution: North Carolina A & T State University
Program: LSSURP
Faculty Mentor: Dr. Eric Watkins
Research Advisor: Dr. Dominic Petrella
Poster Title: **The Impact of Stress Response on Anthocyanin Production in Creeping Bentgrass**
Abstract:

Purple/red anthocyanin pigments can be found constitutively in foliage, or production can increase due to stress, especially due to phosphorus deficiency or in response to high light. Creeping bentgrass (*Agrostis stolonifera*) is a turfgrass that is primarily used on golf courses, and many times can be found with excessive amounts of anthocyanin. My objective was to determine if both phosphorus deficiency and high light impacted anthocyanin production in 16 genotypes of creeping bentgrass to help better understand why this grass may turn purple on golf courses. Two experiments were conducted under three levels of light. Condition 1 had 900 µmol m-2 s-1 of light; Condition 2 had 450 µmol m-2 s-1 of light; and plants in Condition 3 were kept in the greenhouse as a control. In Experiment 1, the fertilizer applied did not contain phosphorus, and in Experiment 2, 1000 µM phosphorus was added. Results showed that genotypes SP L93 A and LP L93 D produced significantly greater amounts of anthocyanin in both experiments, and under all conditions. Additionally, certain genotypes produced anthocyanins no matter the condition or phosphorus amount. Lastly, when subjected to phosphorus deficiency, most genotypes did not produce the high levels of anthocyanins that were expected.

Presenter: Leroy Medrano
Poster Number: 44
Home Institution: Purdue University
Program: LSSURP
Faculty Mentor: Dr. Colin DeYoung
Research Advisor: Scott D. Blain, Aisha Udochi
Poster Title: **Personality Correlates of Neural Activation During a Social Perception Task**
Abstract:

Social cognition relies heavily on mentalization, which refers to our ability to decipher the mental states of others. Social cognition and mentalization are essential for explaining and predicting behaviors. Different personality traits can affect one's ability to successfully mentalize, particularly traits related to Agreeableness, which references to tendencies toward compassion and cooperation. A substantial amount of research has also related mentalization to specific brain systems, often by using functional imaging. The present study assessed whether individual differences in Agreeableness and social cognitive ability predict neural activation in response to animations demonstrating mental states. While in a 3T fMRI scanner, participants completed a theory of mind task, in which they observed triangles that displayed either random or human-like behavior. Prior to this, participants completed self-report measures of Agreeableness, antagonism, and social network quality. Average blood oxygen level dependent responses were calculated for regions of interest associated with social processing, and structural equation modeling was used to look at associations of personality and task performance with activation in those brain regions. We hypothesize Agreeableness will positively predict neural activation in areas across the Default Network, during the theory of mind task.

Presenter: Warda Mohamed
Poster Number: 45
Home Institution: University of Minnesota - Rochester
Program: LSSURP
Faculty Mentor: Dr. Gordon Smith
Poster Title: **Understanding the Role of Inhibitory Neurons in the Development of Neuronal Networks in the Primary Visual Cortex**

Abstract: Prior to visual experience, spontaneous neuronal activity in the ferret visual cortex forms large-scale correlated patterns that are predictive of the organization of mature functionally specific networks, such as orientation selectivity. Previous experiments only examined large-scale correlations of spontaneous activity in excitatory cells. Thus, the role inhibitory cells play in large-scale networks is unknown. In mature ferret cortexes, inhibitory neurons participate in functionally specific networks. We hypothesized that spontaneous activity of inhibitory neurons form large-scale correlated networks in the early cortex. We tested this by using two-photon microscopy to image the spontaneous activity of inhibitory neurons expressing GCaMP6s *in vivo*, and then used immunohistochemistry to identify specific inhibitory cell types such as parvalbumin (PV) and somatostatin (SOM). Preliminary data suggests that inhibitory neurons form large-scale correlated networks, providing new insights into how inhibitory interneurons contribute to early network organization. Further research is needed to examine and compare the functional roles of different inhibitory cell types in network development through the targeted activation or inhibition of GABAergic interneurons using optogenetics.

Presenter: Julissa Molina-Vega
Poster Number: 46
Home Institution: Macalester College
Program: LSSURP
Faculty Mentor: Dr. David Potter
Research Advisor: Zhijun Guo
Poster Title: **Biguanide Sensitivity of the Nuclear Pore Complex in Breast Cancer: A Potential Therapeutic Strategy**

Abstract: Cancer cell-intrinsic enzyme cytochrome P450 3A4 (CYP3A4) promotes tumor progression through epoxyeicosatrienoic acid biosynthesis. CYP3A4 localizes to mitochondria in estrogen receptor positive (ER+) breast cancer cells where it is required for tumor growth. Structure-based design led to the discovery of N1-hexyl-N5-benzyl-biguanide (HBB), which binds to CYP3A4 with high affinity and inhibits CYP3A4 arachidonic acid epoxygenase activity. HBB was discovered to inhibit nuclear localization of RagC, an important component of the mTORC1 complex, which is required for biomass assembly in cancer. Since HBB restrains nuclear transport of regulatory proteins, we hypothesized that HBB modulates the nuclear pore complex (NPC) to influence nuclear transit of transcription factors, including estrogen receptor alpha (ERα). ER+ breast cancer cells (MCF-7 and ZR-75) were seeded on chamber slides and treated with vehicle or HBB for varied periods of time. Using immunofluorescence and western blotting, it was determined that HBB reduced nuclear translocation of ERα in both cell lines, correlating with reduced cell proliferation. This suggests that HBB can be utilized to inhibit the growth of ER+ breast cancer cells by inhibiting nuclear transit of regulatory proteins through the NPC and may provide a new strategy for combined ERα and mTORC1 inhibition in breast cancer therapy.

Presenter: David Moreno
Poster Number: 47
Home Institution: University of Texas - Brownsville
Program: LSSURP
Faculty Mentor: Dr. Rocio Gomez-Pastor
Research Advisor: Nicole Zarate
Poster Title: **The Role of HSF1 in the Transcriptional Dysregulation of PSD-95 in Huntington's Disease**

Abstract: Huntington's Disease (HD) is a devastating neurological disorder characterized by progressive motor and cognitive decline. The disease is caused by a CAG expansion within the Huntington gene, leading to a mutated form of the Htt protein that is prone to misfolding and aggregation. The mutant Htt (mHtt) preferentially affects medium spiny neurons (MSN's) in the striatum. Our lab and others have shown that glutamatergic excitatory synapses in the striatum are dysfunctional in HD; however, the mechanism behind this dysfunction is unknown. The postsynaptic density protein (PSD-95) is a scaffold protein involved in anchoring AMPAR and NMDA receptors to the postsynaptic membrane. We and others have shown that PSD-95 expression is reduced in HD, correlating with the loss of excitatory synapses however the mechanism is still unclear. Our preliminary data shows Heat Shock Transcription Factor 1 (HSF1) binds to the mouse promoter of PSD-95 and regulates its transcription. Using Chromatin Immunoprecipitation, we show that HSF1 also binds to the human PSD-95 promoter and that this binding is reduced in HD patients. Colocalization experiments revealed that excitatory synapse density loss occurs in 3 months mice, consistent with previous results, and that increasing HSF1 levels in HD mice rescues this.

Presenter: Sierra Nelson
Poster Number: 48
Home Institution: University of Missouri - Columbia
Program: LSSURP
Faculty Mentor: Dr. Mark Masino
Research Advisor: Dr. Jacob E Montgomery
Poster Title: **Chemogenetic Ablation of Serotonergic Neurons in the Larval Zebrafish Spinal Cord**

Abstract: Spinal cord injury (SCI) leads to significant loss of function below the point of injury and the chances of recovery are low since the human nervous system lacks the ability to self-regenerate. Signals that influence recovery from SCI can be studied using regenerative animal models such as zebrafish. The neurotransmitter serotonin influences neurogenesis and neurite growth; therefore, serotonin may influence spinal cord (SC) recovery following injury. The main objective of this project is to test the efficacy of a chemogenetic approach for ablating cellular sources of spinal serotonin to test its role in SC regeneration. We compared the effects of metronidazole (MTZ) treatment in two transgenic zebrafish lines, Tg(pet1:Gal4-EGFP);Tg(UAS:nfsB-mCherry) and Tg(tph2:nfsB-mCherry), that expressed the bacterial "suicide gene" nitroreductase in serotonergic cells in the raphe and SC. Nitroreductase-mCherry was more consistently expressed in serotonergic cells in Tg(tph2:nfsB-mCherry) than in Tg(pet1:Gal4-EGFP);Tg(UAS:nfsB-mCherry) which had stochastic expression pattern. Forty-eight hours of MTZ treatment effectively caused a loss of nitroreductase-expressing cells and serotonin antibody labeling in the SC. Finally, SC transections were performed to test if serotonergic cell ablation affects spinal motor neuron regeneration.

Presenter: Tianna Nepean
Poster Number: 49
Home Institution: University of Wisconsin - Whitewater
Program: LSSURP
Faculty Mentor: Dr. Colin Campbell
Poster Title: **Determining the Role of the Non-homologous End-Joining Mechanism in the Repair of DNA-Protein Cross-links**

Abstract: DNA-Protein Cross-links (DPCs) are a common DNA lesion induced by many chemotherapeutics. Many cancer cells develop an enhanced ability to repair these lesions, however, little is known about the mechanisms used. This repair allows cells to become resistant thus rendering chemotherapeutics ineffective. The Nucleotide Excision Repair (NER) pathway is known to play a role in DPC repair, but data suggests that a secondary method, Non-Homologous End-Joining (NHEJ), is also involved. We hypothesize that NHEJ is a secondary mechanism involved in the repair of DPCs. To test this, we compared mutated mammalian cells lacking the NER pathway and mutated cells lacking the NER and NHEJ pathways to WT. All cells were transfected with plasmids containing DPCs. DNA was then extracted, and percent repair was calculated using a novel qPCR technique entitled Single Strand Primer Extension qPCR (SSPE-qPCR). We expect to observe a high amount of repair in WT cells, lesser amounts of repair in NER deficient cells, and little to no repair in NER and NHEJ deficient cells. That data would support our hypothesis that NHEJ is involved in DPC repair. If data obtained refutes our hypothesis, alternative mechanisms may be considered regarding DPC repair.

Presenter: Malcolm Nzuwah
Poster Number: 50
Home Institution: Morehouse College
Program: LSSURP
Faculty Mentor: Dr. Alfonso Araque
Poster Title: **C-Fos Expression in Nucleus Accumbens Astrocytes in Amphetamine-Treated Mice**

Abstract: Astrocytes are a known regulator of synaptic transmission, as they influence specific transmission and the uptake of certain neurotransmitters. Drugs of abuse alter the synaptic activity, but little is known about astrocyte activity. Therefore, we investigated astrocyte activity in the nucleus accumbens, a key brain region involved in reward and addiction, in mice under the influence of amphetamine using immunohistochemistry. Using 2 groups, an amphetamine treatment group and a saline treatment group, we stained for a combination of c-Fos and sox9 or c-Fos and NeuN. C-Fos is an immediate early gene that has been used as a cell activity marker, which in the striatum is expressed in astrocytes. Astrocytes were identified using sox9 and neurons were identified with NeuN. Confocal microscopy revealed the specific activity of astrocytes to researchers. Previous data suggested no significant difference between activity in astrocytes under the influence of amphetamine compared to a control treatment group 30 minutes after treatment. We investigated astrocyte activity 2 hours after treatment. There is colocalization between sox9 and c-Fos and between NeuN and c-Fos in the nucleus accumbens. Preliminary analysis suggests that amphetamine increases the number of c-Fos positive astrocytes. Ongoing experiments and quantifications will confirm or discard this idea.

Presenter: Oluwateniayo Ogunsan
Poster Number: 51
Home Institution: University of Maryland - Baltimore County
Program: LSSURP
Faculty Mentor: Dr. Zohar Sachs
Research Advisor: Klara-Noble Orcutt, Marie Lue Antony
Poster Title: **Therapeutic Vulnerabilities in AML with TP53 Alterations**
Abstract:

Acute myeloid leukemia (AML) is a cancer of the blood and bone marrow with a low two-year survival rate. Standard chemotherapy achieves complete remission in 60-80% of patients, but only 20-30% survive two years due to relapse. This is a result of leukemia stem cells (LSCs) that can self-renew and recapitulate disease. AML with *p53* alterations has a particularly poor prognosis with lower survival rates of 0-10% at one year. Broad, *in vitro* drug screens have identified drugs which have some activity in AML with p53 alterations. These therapies include Crizotinib, Elesclomol, AZD1480, GW2580, and Venetoclax, which are signaling pathway inhibitors. The overall goal of this research is to understand the molecular mechanisms of self-renewal and therapeutic vulnerabilities in LSCs of AML with *TP53* alterations. Specifically, we investigate whether these agents target LSCs from AML with *TP53* alterations. In this study, we treated primary human AML samples with *TP53* alterations with this panel of drugs *in vitro* to assess the effects of these drugs on cell viability. We then performed colony forming assays (CFAs) as a surrogate for stem cell self-renewal in these samples. Crizotinib reduced viability while no change in viability was observed in AZD1480 and GW2580-treated samples. Based on these results, we titered Crizotinib, Venetoclax, and Elesclomol doses in order to define better working concentrations for the drugs and confirm our findings.

Presenter: Kelsey Person
Poster Number: 52
Home Institution: University of Maryland - Baltimore County
Program: LSSURP
Faculty Mentor: Dr. Sarah Heilbronner
Poster Title: **Viral Tract Tracers in Non-Human Primates**
Abstract:

Designer Receptors Exclusively Activated by Designer Drugs (DREADDs) are a chemogenetic tool that can be used to directly manipulate neuronal activity. This chemogenetic tool is a synthetic variant of G-Protein Coupled Receptors, meaning that they do not respond to endogenous ligands within the brain. DREADDs have been extensively used in rodent models, however, their functionality in Non–Human Primates (NHPs) is not well-explored. Our goal was to validate the use of DREADDs as a viral tract tracer in NHPs by assessing the rate of transduction and transport at the injection site and in projection areas. Using adeno-associated viruses (AAVs) to introduce the receptors into the brain, we successfully injected DREADDs into specific regions of the brain in seven NHPs and performed immunohistochemistry. Using light microscopy and Neurolucida software, we were able to visualize the transport of the DREADDs along axon terminals and transduction in cells at the injection site and in terminal fields. We also saw dramatic differences in transport across the various AAV constructs we used. This project demonstrated that DREADDs can be used in NHPs as viral tract tracers, and will eventually allow us to effectively study the reversible manipulation of neuronal activity within large scale brain networks.

Presenter: Kennedy Person
Poster Number: 53
Home Institution: University of Maryland - Baltimore County
Program: LSSURP
Faculty Mentor: Dr. Maxim Cheeran and Dr. Walter Low
Poster Title: **Immunohistochemical Analysis of Infiltrating Immune Cells After a Traumatic Brain Injury**

Abstract: Traumatic brain injury (TBI) is an acquired brain injury leading to dysfunction of normal brain activity due to an external force or blow to the head. Inflammation is a key player in this type of injury. When inflammation occurs in the brain, immune cells such macrophages rush into the brain and resident cells like astrocytes and microglia become activated. However, the precise roles of these cells in the development of clinical disease is still unknown. We used immunohistochemistry to understand the role of these cells in the brain post-injury. The free-floating method was used to stain 30 microns thick coronal brain sections of wild-type C57BL/6J female mice. Brain tissue was collected three and thirty days after injury or after no injury was given (sham). Sections were stained with primary antibodies and fluorescent secondary antibodies to identify neurons, astrocytes, and macrophages. These cells in the injured (or sham) brains were marked and imaged on the fluorescent microscope to determine their response levels post-injury. The cellular response will be used to explain behavioral changes in an ongoing investigation of TBI and inflammation.

Presenter: Heidi Pipkin
Poster Number: 54
Home Institution: Bemidji State University
Program: LSSURP
Faculty Mentor: Dr. Margaret Titus
Poster Title: **Class V Myosin Motor Protein Impact on the Development of the Social Amoeba**

Abstract: Class V myosins are intracellular transport proteins found in many eukaryotes, such as humans and the soil-dwelling *Dictyostelium* amoeba. In humans, these motor proteins transport organelles and influence cellular activities, such as melanosomes transportation during pigmentation (albinism). *Dictyostelium* were used as a model to investigate the function of a developmentally regulated class V myosin, MyoH. The MyoH gene encodes the Myo5A protein. Transcription of MyoH is highly upregulated towards the end of *Dictyostelium* development, with highest levels of expression during the final stages when spore formation occurs. The role of Myo5A during this process is unknown. A MyoH gene targeting cassette containing a hygromycin resistance gene was generated using golden gate assembly and introduced into *Dictyostelium* by electroporation. Selected Clones were screened for knockout mutants using genomic PCR. The characterization of knockout clones and their phenotype(s) is currently in progress. The analysis will focus on the fruiting body morphology and spore formation. Characterization of MyoH may provide new insights into the role of class V myosins in organelle transport during multicellular development of a simple organism.

Presenter: Paola Pou Acosta
Poster Number: 55
Home Institution: University of Puerto Rico - Cayey
Program: LSSURP
Faculty Mentor: Dr. Emilyn Alejandro
Research Advisor: Brian Akhaphong, Seokwon Jo
Poster Title: **Genetic Loss of Placental mTOR Protein Promotes Obesity - Induced Insulin Resistance in Part by Impairment of the Insulin Signaling Pathway in Peripheral Tissues**

Abstract: Type 2 diabetes develops when pancreatic β-cells do not produce enough insulin and/or peripheral tissues (i.e. visceral fat and liver) become insulin resistant, causing higher blood glucose levels. Suboptimal intrauterine environment during pregnancy, which is shown to affect offspring metabolic health, induces permanent changes in glucose homeostasis but remains unclear how. Mammalian target of rapamycin complex (mTOR) is a protein kinase that controls cell growth and metabolism in response to nutrients and growth factors. In pervious human studies, babies with lower placental mTOR levels are more susceptible to metabolic diseases later in life. We generated mouse models with placental Cyp19-cre genetic loss ($mTORKO^{Placenta}$) and gain-of-function ($TSC2KO^{Placenta}$) of mTOR protein, predisposing female mTORKO offspring to obesity-induced insulin resistance under High-Fat Diet. Our aim is to study the downstream of the insulin signaling pathway by examining how the liver and fat affect insulin resistance, and what changes our models demonstrate in the pathway. To study the insulin signaling pathway, we performed immunoblots on liver and visceral fats by probing for phospho-S6 and phospho-AKT. Finally, genetic loss of mTOR protein function was observed in mTORKO males as reduction in phosphorylated S6 at Ser240 in liver and fat tissues suggesting that mTORC1 activity was decreased. Meanwhile, the opposite was obtained in TSC2KO model.

Presenter: Lucia Ray
Poster Number: 56
Home Institution: Carleton College
Program: LSSURP
Faculty Mentor: Dr. Andrew Oxenham
Research Advisor: Juraj Mesik, Magdalena Wojtczak
Poster Title: **Electrophysiological Correlates of Semantic Speech Information in Normal-hearing and Hearing-impaired Populations**

Abstract: People without clinical hearing loss frequently report having difficulty comprehending speech in noisy environments. However, behavioral correlates of these sub-clinical hearing deficits, and their neural underpinnings, are presently unknown. Recent work using a new computational approach to map stimulus characteristics onto evoked neural activity has shown that neural responses to semantic information are modulated by speech intelligibility. The overarching aim of this project is to explore whether this method can be used to measure deficits in speech perception by comparing semantics-evoked responses in individuals with normal, sub-clinically impaired, and clinically impaired hearing. As a first step, the present study used a regression technique to estimate semantics-evoked responses in normal-hearing participants only. EEG data were recorded while participants attended to one of two audiobooks that were presented simultaneously. A measure of the semantic dissimilarity of stimulus words, derived using natural language processing algorithms, was regressed against the EEG data. Consistent with previous research, a prominent negative potential at a latency of 200-600 ms was found for the attended story only. These results demonstrate that this approach is sensitive to neural signatures of semantic comprehension, and may thus be a promising tool for studying how people with undiagnosed hearing impairments process speech.

Presenter: David Reynolds
Poster Number: 57
Home Institution: Iowa State University
Program: LSSURP
Faculty Mentor: Dr. Joan Beckman
Research Advisor: Geneva Doak
Poster Title: **Evaluation of Whole Blood and Endothelial Adhesion in JAK 2 V617F Positive Myeloproliferative Neoplasms Using Microfluidics**

Abstract: Myeloproliferative neoplasms (MPNs) are a group of blood cancers characterized by the excess production of red blood cells (polycythemia vera) and platelets (essential thrombocythemia). A majority of MPNs carry the JAK2 V617F mutation. Patients with MPNs develop arterial and venous thrombosis, which can lead to significant morbidity and mortality. Current therapies for MPNs are targeted toward preventing thrombosis; however, due to a lack of understanding of the pathophysiology, these strategies fail. Mouse models of JAK2 V617F+ shear flow and endothelial cell-cell interactions exhibit a bleeding rather than a thrombotic phenotype. Our goal is to design an endothelized in vitro model of the human vasculature system to study the shear flow and physiological effects JAK2 V617F+. Our methodology consists of the following steps: fabricating a vasculature-on-a-chip with soft lithography techniques, culturing and seeding human umbilical vein endothelial cells or patient-derived blood outgrowth endothelial cells in the microchip's microchannels and culturing underflow. Staining of devices demonstrates cell alignment with flow direction. Next, to establish controls, normal donor whole blood was perfused over endothelialized devices with/without TNF-α. The endothelialized devices exposed to TNF-α resulted in a lower displacement of leukocytes and platelets, indicating increased adhesion. Studies using JAK2 V617F+ human blood are forthcoming.

Presenter: Dormarie Rivera Rodriguez
Poster Number: 58
Home Institution: University of Puerto Rico - Ponce
Program: LSSURP
Faculty Mentor: Dr. Gregory Vercellotti
Research Advisor: Rachel Kirchner, Ping Zhang, John D. Belcher
Poster Title: **Characterizing Toll-like Receptor 4 (TLR4) as a Target for Treatment in Sickle Cell Disease**

Abstract: Our lab has shown that hemin, a damage-associated molecular pattern (DAMP), is released from hemolyzed sickled RBCs and activates TLR4 signaling. The downstream effects of this signaling pathway triggers an inflammatory response mediated by the transcription factor NF-kB. Cytokines, cell adhesion molecules, and coagulation factors are released which can result in a vaso-occlusive (VO) crisis. This restriction of blood flow leads to ischemic injury and gives rise to many of the symptoms associated with SCD. We hypothesize that TLR4 deficiency will limit inflammation, coagulation, and VO in SCD. Transgenic Townes SCD mice that express human α-globin and βS-globin (HbS) were crossed with TLR4 +/+ or TLR4-/- mice to produce TLR4-/- and TLR4+/+ mice expressing human HbS. Using these mice, we characterized their phenotypes using RNA, protein, immunohistochemical, and serological analyses following hemin injection. Townes SS TLR4 -/- mice have lower expression of cytokines and cell adhesion molecules compared to the Townes SS TLR4+/+, most notably Vascular Cell Adhesion Molecule 1 (VCAM1; $p<0.05$). In conclusion, we have shown that TLR4 and the innate immune system play a critical role in inflammation in SCD. We speculate that modulation of TLR4 with targeted inhibitors would be beneficial in SCD patients.

Presenter: Nathan Roberts
Poster Number: 59
Home Institution: University of Minnesota - Twin Cities
Program: LSSURP
Faculty Mentor: Dr. Chun Wang
Research Advisor: Samuel Hanson
Poster Title: **The Combination of Doxorubicin and a Cytotoxic Polymer in the Treatment of Multicellular Tumor Spheroids**

Abstract: In the field of cancer therapy, novel therapeutic compounds with alternative mechanisms of action could be coadministered with traditional chemotherapeutic drugs to treat cancers more effectively and improve patient outcomes. Compounds with mechanisms that complement those of traditional chemotherapeutics could prove to be synergistic, and this synergy would result in greater efficacy of treatment, and could also reduce the dosage of the individual drugs, thus reducing adverse effects in the patient. The purpose of this study was to observe the effects of the combination of the cytotoxic polymer, PAHM, and doxorubicin in the treatment of multicellular tumor spheroids. It is reasoned that the cytotoxicity of PAHM is due to it disrupting the cell membrane, evidenced by inducing rapid cell death upon administration and the morphology of individual cells post treatment. It was predicted that these compounds would show synergistic effects, with the membrane disruption of the PAHM allowing for more doxorubicin to enter the cells. Tumor spheroids were grown from the EMT6 mouse mammary carcinoma cell line in 96 well plates with agarose lining the well bottoms. Doxorubicin and PAHM were administered separately and in combination after 4 days of growth. At low dosages the treatments were effective in slowing the growth rate of the spheroids compared to the control. At high dosages, the treatments reduced the size of the spheroid, with the spheroids adopting a morphology indicating large amounts of cell death at the surface of the spheroid and internally. The combination treatments were shown to be more effective than the individual compounds, indicating the possibility of synergy between the two compounds. Fluorescent imaging of doxorubicin in the spheroids showed a higher fluorescence in the combination treated spheroids, suggesting that the PAHM increased the penetration of doxorubicin into the spheroids. The results of this study demonstrate the potential of PAHM to be used on its own and in combination with chemotherapy agents in the treatment of cancer.

Presenter: Derick Rodríguez Reyes
Poster Number: 60
Home Institution: University of Puerto Rico - Cayey
Program: LSSURP
Faculty Mentor: Dr. Colin Campbell
Poster Title: **The Role of Non-Homologous End Joining and Homologous Recombination on the Repair of Double-Strand Breaks of DNA in the Mitochondria**

Abstract: Mitochondrial DNA (mtDNA) damage is believed to drive a variety of human pathologies, including many disorders associated with aging. In contrast to the situation in the nucleus, there is limited information available about the mechanisms through which mammalian cells recognize and repair mtDNA damage. Evidence from our lab and from others suggests that homologous recombination (HR) and non-homologous end-joining (NHEJ) repair pathways in mammalian mitochondria. To confirm these earlier findings plasmid DNA harboring a double-strand break was introduced via electroporation into isolated mammalian mitochondria, and the efficiency of repair will be assessed. In one series of experiments, the strand break is present within a region of homology to the mtDNA genome, whereas in the other the strand break is in a region of the plasmid that lacks homology to mtDNA. In the former case repair could occur via either the HR and NHEJ pathways, whereas in the latter instance, only the NHEJ pathway could repair the damage. In addition to measuring the efficiency of repair, we will measure repair fidelity. We hypothesize that mitochondria repair DNA double-strand breaks predominantly via HR and that the recombinational repair pathway is more accurate than the NHEJ pathway.

Presenter: Gabriel Romero Agosto
Poster Number: 61
Home Institution: University of Puerto Rico - Cayey
Program: LSSURP
Faculty Mentor: Dr. Dana Davis
Poster Title: **Identifying Genetic Regulators in *Candida albicans* that Lead to Phenotypic Switching through Mutant Screening**

Abstract: *Candida albicans*, a commensal fungus, causes life-threatening infections in immunocompromised individuals. Colony morphology phenotypic switching (CMPS) is employed by *C. albicans* to generate phenotypic diversity, potentially promoting pathogenicity and resistance to anti-fungal treatments. A clear role for the target of rapamycin complex 1 (TORC1) growth control pathway in CMPS has been established, but the specific TORC1-dependent processes that contribute to CMPS are unknown. The main objective of this research is to identify mutants that regulate CMPS to determine how TORC1 governs CMPS. CMPS occurs after prolonged growth in strains defective for TORC1, we screened our collection of mutants that were incubated for >10 days on solid medium and liquid medium. Mutants on solid medium that led to changes in CMPS are possible inhibitors of CMPS. Mutants in liquid medium that did not exhibit CMPS are possible inducers of CMPS. We previously showed that CMPS isolates showed altered sensitivity to the TORC1 inhibitor, rapamycin. To determine if new mutants may affect the TORC1 pathway we screened them for rapamycin sensitivity. Here we identified mutants for two genes that affect CMPS on solid medium, vac7 and tor11. The vac7 mutants also showed heightened sensitivity to rapamycin.

Presenter: Anthony Ruiz
Poster Number: 62
Home Institution: Bemidji State University
Program: LSSURP
Faculty Mentor: Dr. Michael O'Connor
Poster Title: **Exploring The Effects of Low Carbohydrate Levels In Activin Beta Mutants**

Abstract: Organismal survival and homeostasis is dependent on multiple organ systems and the mode through which they communicate, cell signaling pathways. One of the cell signaling pathways that is crucial for maintaining energy homeostasis is the TGF-β/Activin pathway. We have recently found that a ligand in TGF-ß, Actβ is required to maintain glycogen levels as well as levels of circulating carbohydrates. We are interested in answering two questions over the summer. Is locomotor activity affected in Activin beta mutants? Do lower levels of carbohydrates protect against effects of a high sugar diet delayed developmental timing, developmental lethality, increased circulatory sugars and fat. First instar larvae were moved into vials containing a regular diet or a high sugar diet. Developmental timing and lethality were tracked by keeping count of the amount of pupariation in the vials. Wandering first instar larvae were recorded using ImageJ to calculate the differences in locomotor activity. It was found that loss of Actß leads to developmental delay and higher lethality but not a significant change in locomotor activity.

Presenter: Gustavo Serrano Berrios
Poster Number: 63
Home Institution: University of Puerto Rico - Cayey
Program: LSSURP
Faculty Mentor: Dr. Xavier Revelo
Research Advisor: Saad Khan, Fanta Barrow, Gavin Fredrickson, Katrina Dietsche
Poster Title: **B cells Promote Inflammation in Non-Alcoholic Fatty Liver Disease**
Abstract:

Non-Alcoholic fatty liver disease (NAFLD) is a progressive liver disease that affects approximately 70 million people in the United States. NAFLD is characterized by liver steatosis, inflammation, hepatocellular injury, and fibrosis. NAFLD is estimated to become the leading cause of liver failure leading to hepatic transplants. Despite ongoing clinical trials, there are no current FDA-approved therapies for its treatment. Our preliminary data indicates that pro-inflammatory B cells accumulate in the liver of mice fed with a high-fat high-carbohydrate diet (HFHC), a dietary model of NAFLD that resembles the human condition. To assess the role of these pro-inflammatory B cells in NAFLD, we fed B cell-deficient (μMT) mice a HFHC for approximately 20 weeks, followed by determination of their metabolic, fibrotic and inflammatory status. We hypothesized that μMT mice would show ameliorated metabolic, inflammatory, and fibrotic parameters, compared with wild type littermate control. HFHC-fed μMT mice showed improvements in glucose, insulin and pyruvate sensitivity, assessed by tolerance tests, and decreased gene expression of the inflammatory and fibrotic markers TNFA, ICAM1, COL1A1, and a trending decrease of IL1B, MMP2 and ACTA2. These data show that B cells promote inflammation and glucose intolerance during NAFLD and highlight these cells as potential therapeutic targets.

Presenter: Sabra Sisler
Poster Number: 64
Home Institution: Northeastern University
Program: LSSURP
Faculty Mentor: Dr. David Redish
Research Advisor: Daniel Min
Poster Title: **Spatial Delay Discounting Task with Flavored Pellets**
Abstract:

Animals, including humans, discount rewards that are delayed in their delivery. To understand the mechanisms of delay discounting, we assessed rat behavior on the spatial delayed-discounting task. In this figure-8 maze, rats are given a choice between a smaller reward with a fixed delay of 1 second and a larger reward with a variable delay. Rats titrate the delay to the larger reward based on their behavior (increasing with delayed choices, decreasing with non-delayed choices). Rats typically perform the delay-discounting task in three distinct behavioral phases; investigation, alternation of sides to determine the delayed side and the given reward of each side; titration, adjustment of the variable delay by preferring one side; and exploitation, alternation of laps to hold the chosen delay. The delay in which the rat consistently alternates indicates the delay that makes the values of the two sides equal. In this new variant of the task, the sides have differently flavored pellets. Using the flavor differences in the final titrated-to delays, we calculated the subjective value and discounting rate of the two flavors. We found that as pellet ratio increased, rats adjusted to longer final delays, but showed a preference for one flavor over the other.

Presenter: Devin Smith
Poster Number: 65
Home Institution: Tennessee State University
Program: LSSURP
Faculty Mentor: Dr. Cheuk Leung
Poster Title: **Live-Cell Fluorescence Guided Investigation of the Effect of Anti-Estrogens on Cell-Cycle Dynamics in ER+ Breast Cancer**

Abstract: Tumor cells that are quiescent, a cell cycle state of reversible growth-arrest, are less sensitive to standard cancer therapies. Quiescent tumor cells are a challenge to breast cancer treatment and are implicated as a source that persists in patients and drives cancer relapses, a major cause of breast cancer mortality. My research seeks to better understand the cell cycle dynamics of breast tumor cells when they enter cellular quiescence under drug treatments. 60% of breast cancers are positive for estrogen receptors (ER) and often depend on estrogen to proliferate & divide. Tamoxifen is an anti-estrogen agent used in the clinics to stop tumor cell growth and progression of the disease. The current project will investigate the cell cycle dynamics of ER+ breast tumor cells under anti-estrogen treatment in vitro. We used two ER+ human breast cancer cell lines (T47D and MCF7) that express a previously established quiescent state reporter (mVenus-p27K-) and monitored their entrance into cellular quiescence over seven days. We compared the response between the two different ER+ breast cancer cell lines and between treatments with tamoxifen and another cytostatic drug.

Presenter: Xochitl Smola
Poster Number: 66
Home Institution: Arizona State University
Program: LSSURP
Faculty Mentor: Dr. Kathleen Thomas
Poster Title: **Effects of Adolescent Peer-and Parent-Related Stress on Adult Brain Function**

Abstract: Exposure to chronic stress is associated with poor mental and physical health outcomes throughout the lifespan. Early life stress is known to shape cognitive and emotional systems in the brain. Little is known, however, of whether these health outcomes are a result of general stress accumulation or are related to specific domains of stress. Stress during adolescence may be particularly important as this developmental period is characterized by significant shifts in social relationships and the emergence of psychopathology. We predicted that peer-related stress would be more relevant in adolescence than at earlier ages, and that peer-related stress in adolescence would have a greater impact than parent-related stress. Using data from a longitudinal sample, we examined whether peer-related and parent-related stress at ages 12 and 15 uniquely predicted emotion-related brain functioning at age 25. Stress composite scores at ages 12 and 15 were created from the Life Events Index. Participants completed the Hariri emotion and shape matching task in the scanner at age 25. Higher levels of both parent and peer-related stress in adolescence were associated with stronger brain activation to emotional faces. Peer-related stress at age 15 was a stronger predictor of brain function than peer-related stress at age 12.

Presenter: Ignacio Sosa
Poster Number: 67
Home Institution: Florida International University
Program: LSSURP
Faculty Mentor: Dr. Justin Drake
Poster Title: **Molecular Cloning of gRNA Constructs Targeting RET Regulatory Elements to Define Transcription Factor Profiles in Neuroendocrine Prostate Cancer Tumors**

Abstract: Neuroendocrine prostate cancer (NEPC) is one of the most aggressive variants of prostate cancer and currently can only be treated with broadly acting chemotherapies. NEPC is characterized by metastatic tumors that are resistant to androgen deprivation therapies and express genes normally limited to neuroendocrine cell types. Our lab has shown that inhibiting a receptor tyrosine kinase, known as RET, can reduce NEPC tumor growth and viability. The transcriptional changes that lead to RET overexpression are unknown. We are utilizing a modified CRISPR technology (enChIP) to define the transcription factors that regulate RET in NEPC versus androgen sensitive prostate cancer. Specifically, we are designing guide RNAs that will bind to the RET promoter and enhancers, which are then subsequently bound by catalytically inactive Cas9 protein. The Cas9/gRNA/chromatin-protein complex can be immunoprecipitated and analyzed by mass spectrometry to define the transcription factors regulating the RET gene. With the identification of these transcription factors, we could create screening markers to identify patients with tumors that could progress to NEPC or drug treatments to block the transcription factors that upregulate RET. The use of enCHIP can also be translated into different neuroendocrine cancer subtypes, leading to the development of more targeted therapies.

Presenter: Brittany Stokes
Poster Number: 68
Home Institution: Augsburg University
Program: LSSURP
Faculty Mentor: Dr. Laura Shannon
Research Advisor: Husain Agha
Poster Title: **Diploid Induction of Tetraploid Potatoes**

Abstract: Breeding new varieties of potato, *Solanum tuberosum L.,* has proved difficult due to their tetraploid nature. Over the years, projects have been successful in producing diploid potatoes, but they lack self-compatibility (SC). It is a goal of this project to produce diploid potatoes and introduce SC. To do this, we employed IVP 101, a diploid variety, as the father and pollinated flowers from five tetraploid varieties (Chieftain, Dark Red Norland, Modoc, Red LaSota, Red Norland). The data on the competency of these crosses is forthcoming; however, preliminary fruiting provides some evidence for increased viability of pollen dried in a window sill over pollen dried in a dehydrator.

Presenter: William Stump
Poster Number: 69
Home Institution: University of Alabama - Huntsville
Program: LSSURP
Faculty Mentor: Dr. Timothy Starr
Poster Title: **Characterization of the Wac Gene and its Effect on Tumorigenesis in Colorectal Cancer**
Abstract: Colorectal Cancer (CRC) is the third leading cause of cancer related deaths per year in the US and 145,600 new diagnoses are estimated for 2019. There is a need for new targeted therapies through the discovery of novel genes related to CRC. Forward genetic screens were performed in mice, identifying the Wac gene as a candidate CRC gene due to its association with high rates of tumor development. The Wac gene encodes an adaptor protein which regulates gene transcription. However, the mechanism of Wac dependent tumorigenesis is unknown. We hypothesize that Wac acts as a tumor suppressor in CRC based on patterns of insertional mutagenesis. To test this hypothesis, Wac overexpression and knockout cell lines were used to perform Soft Agar, Hard Agar, MTT, and Scratch Assays to quantify effects of these mutations compared to control cell lines. Overexpression of Wac increased proliferation and anchorage independent growth rates while knockout of Wac lowered proliferation and anchorage independent growth rates. These results contradict our hypothesis, suggesting Wac functions as an oncogene. Wac suppression, therefore, has the potential to be used as a treatment of CRC.

Presenter: Nia Sweatt
Poster Number: 70
Home Institution: Howard University
Program: LSSURP
Faculty Mentor: Dr. Mark LeSage
Poster Title: **The Role of Non-Nicotine Constituents in Tobacco Addiction**
Abstract: Tobacco addiction is the leading cause of preventable death in the US. Tobacco is addictive mainly due to nicotine. Monoamine Oxidase Inhibitors (MAOI) are present in cigarette smoke and can enhance the addiction-related effects of nicotine. However, previous preclinical work has used MAOIs that are not in smoke. To address this issue, three MAOI's, Harmine, Harmane, and Norharmane, specific to cigarette smoke were examined in an intracranial self-simulation (ICSS) model to determine how MAOI's affect the abuse potential of nicotine. We hypothesized that MAOI's would mimic nicotine's effects on ICSS when administered alone and increase nicotine's addiction-related effects when combined with nicotine. Each MAOI was tested individually twice/week. Also tested combinations of Norharmane with nicotine. All three MAOI's produced aversive effects, indicated by increased ICSS thresholds at higher dosages. MAOI's at lower dosages had no effect when administered alone, suggesting a lack of abuse potential. There was a trend for Norharmane to reduce nicotine's aversive effects. Because behavioral effects were only seen at dosages above the intake of an average smoker, these MAOI's are likely not contributing to tobacco addiction. Future work should further evaluate the effects of nicotine combined with several MAO inhibitors to better understand their potential interactions.

Presenter: Vy Tran
Poster Number: 71
Home Institution: Normandale Community College
Program: LSSURP
Faculty Mentor: Dr. Kirsten Nielsen
Poster Title: **The Contribution of Titan Cell Formation on Fluconazole Resistance in *Cryptococcus neoformans***

Abstract: The human fungal pathogen, *Cryptococcus neoformans*, contributes to a significant portion of fungal-related deaths and causes life-threatening meningitis primarily in immunocompromised individuals. In resource-limited areas, fluconazole (FLC) is the only available treatment. FLC resistance has led to a high rate of treatment failure resulting in over 50% mortality in patients receiving FLC monotherapy. FLC resistance in *C. neoformans* has been shown to be due to formation of aneuploids that are able to evade the stress of the drug. A recent *in vitro* study from our lab showed enlarged, polyploid cells known as titan cells are more resistant to FLC and can produce aneuploid daughter cells that are also more resistant to FLC. In order to better assess the contribution of titan cells to FLC drug resistance, we performed antifungal susceptibility testing to determine the minimal inhibitory concentration of FLC and the level of FLC heteroresistance of a wild-type strain that produces titan cells and a mutant strain, *gpr4Δgpr5Δ* that exhibits decreased titan cell formation. Our results show that the wild-type strain and mutant strain have similar FLC susceptibilities under normal *in vitro* conditions that do not induce titan cells and under *in vitro* titan cell inducing conditions.

Presenter: Angeline Utomo
Poster Number: 72
Home Institution: Tufts University
Program: LSSURP
Faculty Mentor: Dr. Geoffrey Hart
Poster Title: **Investigating Natural Killer Cells in Antibody-Mediated Immunity Against Placental Malaria**

Abstract: Adaptive natural killer cells (NK) correlate with protection against malaria. Shown to kill *Plasmodium falciparum*-infected red blood cells (iRBCs) through antibody-dependent cellular cytotoxicity (ADCC), we hypothesize NK's ADCC as one underlying mechanism in adaptive immunity against malaria. One way we are investigating this hypothesis is through placental malaria – a malaria complication in pregnancy that causes miscarriages and low birth weights. Antibodies and protection against placental malaria increase with subsequent pregnancies, but the mechanism of the antibody-mediated protection is unknown. To test ADCC as a possible underlying mechanism, we will compare ADCC levels elicited by antibodies in the blood sera of *falciparum*-exposed Ghanaian women in their 1st pregnancy (primigravid) and subsequent pregnancies (multigravid), using men as a negative control. Furthermore, given that adherence to the placenta is mediated by the Var2CSA protein on iRBCs, we will test ADCC elicited by a monoclonal antibody against Var2CSA, called PAM1.4. These antibodies will be tested against recombinant Var2CSA and multiple Var2CSA+ & Var2CSA- iRBCs in our *in vitro* ADCC assay. We will then examine if correlation between ADCC levels and protection against placental malaria exists. Here, our data shows the preliminary experiments to optimize our ADCC assay. In the future, studying ADCC's role in malaria protection may contribute to the development of an effective malaria vaccine and new therapeutics.

Presenter: Adriana Vélez Aviles
Poster Number: 73
Home Institution: University of Puerto Rico - Rio Piedres
Program: LSSURP
Faculty Mentor: Dr. Michael Georgieff
Poster Title: **Effect of Cellular Iron Deficiency on Epigenetic Modifications at the BDNF Locus**
Abstract: Iron deficiency (ID) is the most common micronutrient deficiency worldwide, affecting approximately 30% of pregnant women and preschool-age children. Early-life ID causes cognitive and behavioral abnormalities associated with long-term gene dysregulation in preclinical models. However, the mechanism behind the long-term gene dysregulation is not well understood. Lysine Demethylase 5B (JARID1B) is an iron-dependent histone modifier, important for neural development by regulating brain-derived neurotrophic factor (Bdnf) gene, important for neuronal survival, differentiation, and plasticity. Previous studies show that early-life ID reduces JARID1B expression and alters histone H3K4-methylation at the Bdnf locus. We used chromatin immunoprecipitation (ChIP) assay to analyze the effect of ID on the interaction between JARID1B and Bdnf. Neuronal cell line derived from embryonic mouse hippocampus (HT-22) was treated with deferoxamine (DFO), an iron chelator, to induce ID. Results showed that 24-hr after DFO exposure, cells showed upregulation of both genes. However, ChIP assays showed lower enrichment of H3K4me3, a histone modification associated with active transcription. Furthermore, enrichment of JARID1B at the Bdnf promoter, but not at its own promoter. Collectively, findings suggest that iron-deficient neurons acutely alter gene regulation contrary to our expectation, raising the possibility of differential responses between acute and chronic ID at a molecular level.

Presenter: Erik Velez Perez
Poster Number: 74
Home Institution: University of Puerto Rico - Mayaguez
Program: LSSURP
Faculty Mentor: Dr. Kathryn Cullen
Research Advisor: Anna Parenteau, Dr. Bonnie Klimes-Dougan
Poster Title: **A Study of Self-Perception, Cortical Thickness, and Cortisol Stress Response in Female Adolescents with Non-Suicidal Self-Injury**
Abstract: Non-suicidal self-injury (NSSI), the act of purposefully harming one's own body without the intent of suicide, commonly starts in adolescence. Research is needed to understand the neurobiology underlying NSSI. Adolescents commonly struggle with sense of identity and stress adaptation. Self-related processes are mediated by the medial cortical network (MCN), which includes the anterior-cingulate (AC) and posterior-cingulate (PC). The biological stress response system, i.e. the hypothalamic-pituitary-adrenal axis, is regulated by frontal regions such as the orbitofrontal (OF) cortex. Adolescent NSSI might involve abnormal development of these systems. In this study, female participants (N=71, 12-17 years) completed the Self-Perception Profile, structural MRI scans, and the Trier Social Stress Test (TSST), a protocol designed to elicit cortisol stress response. Relationships between NSSI frequency (based on number of lifetime episodes), self-perception, cortical thickness in the MCN and OF, and cortisol reactivity were examined. NSSI frequency was inversely related to self-perception and cortical thickness in the left-lateral OF, left-caudal AC, and left PC. Additionally, NSSI frequency was associated with flattened cortisol stress responses. Low self-worth and cortical thinning in AC, PC and OF may set the stage for vulnerability to NSSI, while flattened cortisol responses may reflect allostatic shifts to accommodate chronic stress.

Presenter: Precious Wells
Poster Number: 75
Home Institution: Howard University
Program: LSSURP
Faculty Mentor: Dr. DeWayne Townsend
Poster Title: **Visualizing the Organization of Microtubules in Cardiac Mouse Tissues**
Abstract: Duchenne muscular dystrophy is a fatal X-linked disease characterized by the progressive deterioration of skeletal and cardiac muscle as a result of mutations in the DMD gene and subsequent loss of the protein dystrophin. Dystrophin is a large cytoskeletal protein that binds to the sarcolemma through interactions with multiple components of the cellular cytoskeletal. Studies have revealed that dystrophin binds to microtubules, and in the absence of dystrophin, the organization of microtubules become disordered. However, visualizing and studying this organization in the heart is difficult due to the ~10% survival rate of live dystrophic myocytes following isolation. In this study, we aim to develop a method that allows us to better visualize microtubules in the cardiac muscle using immunofluorescence staining of frozen fixed or perfused tissues.

Presenter: Eden Woldermariam
Poster Number: 76
Home Institution: Minneapolis Community College
Program: LSSURP
Faculty Mentor: Dr. Jonathan Sachs
Research Advisor: Chi Hung Lo, Anthony Braun
Poster Title: **Finding Aminoacids in Alpha-synuclein that are Critical to Oligomer Formation**
Abstract: Alpha-Synuclein, the causative protein of Parkinson's diseases, is a 140-amino acid soluble protein of unknown function that is abundant in neurons and especially concentrated in presynaptic terminals. Early aggregation of α-synuclein into small aggregates known as oligomers is thought to be toxic to dopaminergic neurons. In this research we mainly focused on how α-synuclein aggregation could be affected by changing the tyrosine residues through mutations created at each site. Although there was a total of 11 constructs, in the time span of this project, we were able to analyze two: Y125A and Y136A. After mutating the tyrosine residues, we used FRET and two cytotoxicity assays to examine the difference between the wild type and the mutant α-synuclein protein. We were able to show that the two constructs differ in cell viability and FRET where Y125A showed FRET differences and Y136A, cell viability differences. Based on these preliminary findings for the mutations we were able to study in the given timeframe, we conclude that these mutations appear to alter alpha-synuclein conformational behavior and cytotoxicity. This information could help guide the development of new medications to prevent and/or cure Parkinson's disease.

Presenter: Danielle Zwanziger
Poster Number: 77
Home Institution: Cornell College
Program: LSSURP
Faculty Mentor: Dr. Branden Moriarity
Poster Title: **Optimization of DNA Delivery to Human B Cells using the Amaxa 4D Nucleofector System**

Abstract: B lymphocytes are the only immune cells that can differentiate into long-lived plasma cells that produce large amounts of antibody. This unique ability makes B cells a potential candidate to express a synthetic transgene for treating genetic disorders such as enzymopathies. Recently, B cell engineering utilizing CRISPR/Cas9 together with adeno-associated viral (AAV) vector was shown to mediate high efficiency, site-specific integration of transgenes into the B cell genome. However, AAV vector cannot carry therapeutic transgene cassettes exceeding 4.7 kb in size, which is unsuitable for larger or multiple gene cassettes. Electroporating CRISPR/Cas9 and a DNA template into B cells thus allows more flexibility of the transgene size. However, our lab has found that using the Neon Transfection System to deliver DNA to B cells resulted in low cell viability and low transfection efficiency. Thus, my aim is to optimize a transfection protocol to address this issue. I found that stimulation of B cells 36 hours prior delivery of DNA using Amaxa 4D Nucleofector System resulted in the highest cell viability and the highest transfection efficiency of the DNA plasmid when compared to 24 or 48 hours. This protocol will be further optimized for B cell genome engineering.