UNIVERSITY OF MINNESOTA

2017 SUMMER UNDERGRADUATE RESEARCH SYMPOSIUM

Life Sciences Summer Undergraduate Research Program (LSSURP)

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Presenter: Noha Abdelrahman
Poster Number: 1
Home Institution: North Dakota State University
Program: LSSURP
Faculty Mentor: Dr. Louis Mansky
Research Advisor: Luiza M. Mendonça, Ruth Blower, José O. Maldonado, Sheng Cao, Wei Zhang
Poster Title: **Investigation Of The Acidic Carboxyl-Terminal Region Of The HTLV-1 Nucleocapsid (NC) Domain Of Gag On Virus Particle Size And Cellular Distribution**

Abstract: Human T-cell leukemia virus type 1 (HTLV-1) is a cancer-causing human retrovirus that infects about 15 million individuals worldwide. Many of the aspects of HTLV-1 replication, including virus particle structure and assembly, are poorly understood. Group-specific antigen (Gag) protein is the major retroviral structural protein that drives virus particle assembly. Preliminary studies by the Mansky research group have suggested a potential role of the carboxy (C)-terminal region (which is enriched in acidic amino acids) in the nucleocapsid domain of Gag on HTLV-1 assembly. Based upon these observations, I tested the hypothesis that deletion of this region would influence HTLV-1 particle assembly. Specifically, I analyzed several Gag expression constructs, when introduced into human cells in culture result in the production of HTLV-1-like particles. First, I analyzed the cellular distribution of the Gag proteins by laser scanning confocal microscopy. Second, I analyzed the size and morphology of particles by cryo-transmission electron microscopy. My analyses have suggested that the Gag C-terminus does not significantly impact the formation of Gag puncta but does impact particle size and morphology. These observations help to lay the foundation for subsequent studies, and contribute to the long-term objective of understanding how particle size and morphology impacts virus infectivity.

Presenter: Saad Abdulkadir
Poster Number: 2
Home Institution: Normandale Community College
Program: LSSURP
Faculty Mentor: Dr. Wensheng Lin
Poster Title: **The Effects of Activation Transcription Factor 4 on the Lower Motor Neuron and Axons loss in Patient with Multiple Sclerosis**

Abstract: Unfolding Protein Response (UPR) occurs in response to Endoplasmic Reticulum (ER) stress caused by a buildup of unfolded or misfolded proteins in the ER. Recent studies have shown upregulated components of UPR in Multiple Sclerosis (MS) lesions. Pancreatic Endoplasmic Reticulum Kinase (PERK) is ER transmembrane proteins that's been identified as transducers of UPR. Previous research has shown Oligodendrocyte-Specific Activation of PERK signaling attenuates Oligodendrocyte death and demyelination. In this experiment we hoped to determine the significance of Activation Transcription Protein 4 (ATF4), one of the three major downstream pathways of PERK. To test the significance of ATF4, we bred our mice to create an AFT4 knockout mice and wild type mice with AFT4. We observed both groups to establish there is no significant difference. After establish the removal of AFT4 does not affect the healthy mice initiate the Experimental Autoimmune Encephalomyelitis (EAE) mouse model to simulate MS in the mice. The mice are closely observed for the next twenty days. We documented the behavior of mice and clinical scores of the mice. On the twenty first day the mice are scarified and perfused for us to collect tissue samples and gray matter from the brain and spinal cord. Using immunohistochemistry, we compare the number of upper and lower motor neurons, Purkinje cells, oligodendrocytes, and axons. Although not conclusive, our initial results are showing ATF4 is not significant in the attenuation of Oligodendrocyte death and demyelination. When we conclude the insignificance of AFT4, we plan to move onto the next downstream pathway of PERK and test its significance.

Presenter: Paige Akins
Poster Number: 3
Home Institution: University of Arkansas - Pine Bluff
Program: LSSURP
Faculty Mentor: Dr. Mary Rogers
Poster Title: **Effects of Low Tunnel Plastic Type on Early Development of Day-Neutral Strawberries**

Abstract: Strawberry consumption in the U.S. is steadily increasing, and demand is strong for locally produced and organic fruit. Protected culture systems, including low tunnels, modify the microclimate and allow for season extension and higher quality fruit. In this project, we investigated the effects of UV blocking and UV transmitting plastic on early growth of day-neutral strawberries in low tunnels. This research project is being conducted within the context of a longer-term project looking at how low tunnel coverings affect strawberry fruit yield, quality and insect pest management. In this project, we assessed vegetative and reproductive growth and leaf chlorophyll content of day neutral 'Albion' strawberry plants during eight weeks of production under the three different treatments: UV transmitting, UV blocking, and open plots. The transmitting and blocking plastic treatments saw significantly higher numbers of flowers and leaves compared to the open control plots. Vegetative growth was not distinctly correlated with leaf chlorophyll content in any treatments. These research efforts contribute to our understanding of strawberry production in Minnesota to help meet the growing demands for local, organic strawberries.

Presenter: Jacqeline Aldaco
Poster Number: 4
Home Institution: Bryn Mawr College
Program: LSSURP
Faculty Mentor: Dr. Sylvain Lesné
Poster Title: **Quantitation of Glial Cells in the Proximity of Amyloid Plaques**

Abstract: The neurodegenerative disorder Alzheimer's disease (AD) is characterized by amyloid plaques, neurofibrillary tangles, and neuronal loss. Amyloid plaques originate from the amyloidogenic processing of its precursor protein, APP, which leads to the accumulation of beta-amyloid (Aβ) peptides. The close proximity of these plaques are associated with increased levels of synaptic loss and dystrophic neurites. We recently observed that overexpressing alpha-synuclein in APP mice lowered amyloid burden in these animals but surprisingly also worsened cognition. In this study, we were interested in determining whether the density of glial cells (i.e. astrocytes and microglia) changes differentially between the immediate vicinity of the plaque core, the surrounding toxic halo .

Presenter: Maria Anaya
Poster Number: 5
Home Institution: Stony Brook State University
Program: LSSURP
Faculty Mentor: Dr. Michael Georgieff
Research Advisor: Amanda Barks, Phu Tran
Poster Title: **In Vitro Assessment Of Iron-Deficiency Induced Epigenetic Modifications At The BDNF Promoter In Neuronal Cells**

Abstract: Iron deficiency (ID) is the most common nutritional deficiency throughout the world. Early-life ID has long term effects, including reduced cognitive function and increased risk of depression, schizophrenia and autism in adulthood. Brain-derived neurotrophic factor (BDNF) is broadly expressed in developing and adult mammalian brains and is essential in neuronal differentiation, proliferation, and synaptic plasticity. In animal models of early-life ID, Bdnf gene expression is downregulated during and beyond the ID period. Bdnf is epigenetically modifiable. JARID-mediated histone demethylation is a known iron-dependent epigenetic modification that may explain the long-term effects of ID on BDNF expression. We hypothesize that altered JARID-mediated histone methylation is a mechanism by which ID induces long-term Bdnf dysregulation. ID will be induced in immortalized hippocampal neurons (HT-22) using deferoxamine (DFO), an iron chelator. Expression of Bdnf and transferrin receptor (TfRc) will be quantified by qPCR. Levels of histone methylation (K4me3) and JARID1b (K4me3 demethylase) binding at the Bdnf-IV promoter will be quantified by ChIP-qPCR. In addition, HT-22 cells will be treated with PBIT, a JARID1B inhibitor, to determine whether JARID1B mediate the decrease in Bdnf expression following ID. Preliminary data showed a 3-fold increase in TfRc expression, indicating that ID was induced, accompanied by a 50% decrease in Bdnf expression, when cells are treated with 25uM DFO for 24 hours.

Presenter: Michael Anderson
Poster Number: 6
Home Institution: University of Notre Dame
Program: LSSURP
Faculty Mentor: Dr. Bryce Binstadt
Research Advisor: Nathan Schuldt
Poster Title: **Generation of a Mouse to Track Dual TCR T Cells**

Abstract: Thymic selection shapes the T cell receptor (TCR) repertoire by deleting potentially harmful TCRs. Despite this essential role in immunity, thymic selection remains incompletely understood. Leading theories on thymic selection assume that a T cell expresses only one TCR specificity. However, current evidence estimates between 10 and 30 percent of T cells express a functionally recombined TCR from both alleles. Advancements in this area of research have been limited by the lack of available reagents to reliably detect these dual TCR T cells. In order to address this gap in knowledge, we are engineering a dual TCR T cell reporter mouse that will allow us to detect, enumerate, and track dual TCR T cells. We generated two different strains of TCR reporter mice, each with a unique small epitope tag attached to the TCRα constant region shared by all TCRs recombined from that allele. Once bred together, we will be able to detect cells that express TCRs recombined from both allele (i.e. dual TCR T cells) using flow cytometric analysis with fluorescently labeled antibodies specific for the two small epitope tags. This exciting new tool will allow us to design novel experiments to study the effect of dual TCR T cells on thymic selection and immunity. Here I focus on optimizing detection of the reporter tag in these mice.

Presenter: William Anderson
Poster Number: 7
Home Institution: Macalester College
Program: LSSURP
Faculty Mentor: Dr. Mark Schleiss
Poster Title: **Determining Antibody Response To Sections Of GP129, GP 133, And gL (GP115) Of The Pentameric Complex In Guinea Pig Cytomegalovirus**

Abstract: Cytomegalovirus (CMV) is the leading viral cause of birth defects in the world. The pentameric complex is a 5-protein complex that is necessary for virus entry into epithelial and endothelial cells and has become a point of interest in vaccination efforts. Guinea Pigs are a useful model of human CMV (HCMV) infection since the mode of trans-placental transmission is similar to that in humans. Using Guinea Pig CMV (GPCMV) as a model, we selected sections of the pentameric proteins GP129, GP133 and gL (GP115) to be conjugated into a carrier protein and then these conjugates were introduced into rabbits to elicit a polyclonal antibody response. Using the generated antibodies, we performed ELISAs to determine the antibody's titer against the both the peptide it was made to and to viral particles of GPCMV. We also completed western blotting assays to determine antibody specificity to viral particles. We aim to determine which areas of these proteins can be targeted effectively by generated antibodies. Our results will further understanding of the natural antibody response to CMV and possibly aid in the development of a vaccine or better screening for HCMV.

Presenter: Evan Banks
Poster Number: 8
Home Institution: University of Minnesota - Twin Cities
Program: LSSURP
Faculty Mentor: Dr. Jonathan Gewirtz
Research Advisor: Xin Song
Poster Title: **Classical Conditioning of an Odor Preference in Mice**

Abstract: Conditioned Odor Preference (COP) is a recently developed classical conditioning technique that can measure addictive behavior in rodents by testing. The purpose of this study was to use COP as a new paradigm to test whether mice develop a positive association between a drug state and a neutral odor. In the present study, wild-type were first subjected to a pretest that measured whether they prefer vanilla or almonds scents. During the conditioning phase, they were weighed and injected with 0.2-0.35ml of either saline or morphine on alternate days for 8 days. After injection, the mice's odor preference was measured in the COP paradigm. Odor preference was quantified using Animaze, to measure the mouse's time investigating each scent. Longer investigation indicated higher preference. We found that mice on morphine do not investigate either scent to a significantly higher degree than the saline group, indicating that they did not develop a positive association between a drug state and a neutral odor. These results do not support previous studies that indicate that mice in a morphine-induced state develop a classically conditioned preference for previously neutral odor.

Presenter: Socrates Bassuk
Poster Number: 9
Home Institution: Oberlin College
Program: LSSURP
Faculty Mentor: Dr. Changbin Chen
Poster Title: **A Search for an ATM Gene Mutation in Maize**
Abstract: The Ataxia telangiectasia mutated (ATM) is a highly conserved eukaryotic gene crucial for DNA double-strand breaks that occur during meiosis as well as those induced by DNA damaging agents. It has been well-characterized in mammals due to its role in cancer. In plants however, understanding of ATM is virtually limited to *Arabidopsis* radiation response. We conducted a search for an ATM mutation in maize, an economically important crop with a bigger genome and more repetitive DNA content than *Arabidopsis*. Based on the *Arabidopsis* ATM gene, we identified the homolog in maize and searched for available mutants. Using polymerase chain reaction (PCR), we identified one putative mutant with a Mu transposon insertion in a predicted intron-exon boundary. Plants homozygous for the Mu transposon insertion did not show any obvious vegetative growth phenotypes. Plants that are either heterozygous or homozygous for the Mu insertion were found less than expected based on Mendelian segregation, indicating that reproductive cell development might be affected. Pollen fertility tests will be conducted to determine the fertility status of the different genotypes. The understanding of ATM's role in maize meiosis will extend our knowledge of the function of this gene in plants.

Presenter: Danny Baumann
Poster Number: 10
Home Institution: Macalester College
Program: LSSURP
Faculty Mentor: Dr. Robert Kratzke
Poster Title: **Immunogenic cell death induced via virotherapy and ruxolitinib treatment in non-small cell lung cancer**
Abstract: Non-small cell lung carcinoma (NSCLC) is a form of epithelial lung cancer that accounts for 85% of all lung cancers. NSCLC is resistant to chemotherapy, but immunotherapy has been shown to be an effective treatment. Previous studies have shown that the vesicular stomatitis virus (VSV), that produces interferonβ (VSV-IFNβ) can enhance the body's immune response to NSCLC therefore it is hypothesized that the mechanism involves immunogenic cell death (ICD). ICD is characterized by the secretion of DAMPs (danger associated molecular patterns) that operate on a series of receptors expressed by the dendritic cells. Once activated by the DAMPs the dendritic cell delivers the antigen to the T-cell in order to kill cancer. LM2 and LLC mouse cell lines were treated with various concentrations of VSV-IFNβ and Ruxolitinib in order to visualize the route that induces ICD. Kill curves were generated after a 72 hour treatment and DAMP expression was measured employing ELISA to quantify the ICD response caused by VSV-IFNβ treatment. To assess the integrity of the JAK/STAT pathway as part of the interferon response, immunoblots were run on STAT1, P-STAT1, STAT3, P-STAT3, PDL-1 and β-actin. The combination treatment of virus and Ruxolitinib shows promise as a NSCLC treatment.

Presenter: Qierra Brockman
Poster Number: 11
Home Institution: Coe College
Program: LSSURP
Faculty Mentor: Dr. Michael Olin
Research Advisor: Elisabet Ampudia Mesias
Poster Title: **Identification of the CD200 Activation Receptor Signaling Pathway**
Abstract: Glioblastoma multiforme is an incurable primary brain tumor. The standard of care consists of resection followed by radiation and chemotherapy, and is associated with a median overall survival of 14.6 months. To address this dismal outcome, the FDA approved immune checkpoint inhibitor therapy for solid tumors that are otherwise refractory to standard therapy heralding a new era for effectively treating cancer. Many immune checkpoint inhibitors yield poor responses for patients with glioblastoma, calling into question whether cancer immunotherapy can be applied to glioblastoma. We are targeting an alternative checkpoint blockade (CD200 blockade). The CD200 checkpoint blockade is a paired receptor complex of inhibitory and activation receptors. Targeting these receptors activate antigen presenting cells enhancing dendritic cell maturation, cytokine production and antigen specific T cell activation, which significantly extend survival in two murine glioma models. Although the CD200 checkpoint is the most studied of all immune checkpoints, the signaling pathway surmounting the inhibitory signals remains unknown. This study is designed to determine the signaling pathway of the CD200 activation receptor. Using transcription analysis, we determined pulsing murine CD11b cells with a peptide designed to activate the activation receptor elicited the transcript fold increase of molecules associated with immune activation.

Presenter: Caroline Buchholz
Poster Number: 12
Home Institution: Iowa State University
Program: LSSURP
Faculty Mentor: Dr. Nicholas Levinson
Poster Title: **Building an Aurora A Kinase Förster Resonance Energy Transfer (FRET) Biosensor for Investigating Conformational Preferences of Kinase Inhibitors**
Abstract: Disruption of allosteric regulation mechanisms in the kinase Aurora A (AurA) is linked to multiple types of cancer. This project's main focus was to build an AurA FRET biosensor in order to investigate the conformational preferences of potential inhibitors. To construct the biosensor, AurA was labeled with two fluorophores, the donor dye (Alexa 488) and the acceptor dye (Alexa 568). We then used an advanced high-throughput Time-resolved (TR-) FRET platform, which is concentration independent, to measure the effects of six known kinase inhibitors on AurA. First, a new FRET pair (K227C-S284C) was compared to a previously tested pair (L225C-S284C). The data showed the same conformational preferences, demonstrating the robustness of the results. The next goal was to resolve donor only effects observed with the previously used donor site (L225C), due to proximity to the inhibitor binding site. We measured the D350C site and found it had little to no quenching, and so is a superior donor site. The next step would be to develop a way to site specifically place the donor dye using nonsense suppression and click chemistry. In the future, when the biosensor is built, a high-throughput screen of inhibitors can be performed without confounding effects of direct quenching from inhibitors.

Presenter: Karina Bursch
Poster Number: 13
Home Institution: Catholic University of America
Program: LSSURP
Faculty Mentor: Dr. Gregory Vercellotti
Poster Title: **A Characterization of the Heme Binding Site on MD-2/TLR4**
Abstract: In sickle cell disease (SCD), free heme released by chronic hemolysis binds to MD-2/TLR4 and activates inflammatory signaling cascades that produce many components of SCD pathophysiology. LPS, the canonical TLR4 ligand, binds to MD-2/TLR4 at a site separate from that of heme to initiate the same inflammatory pathways. This lab is working to characterize the unique heme binding site on MD-2/TLR4 in order to mitigate heme-induced inflammation, while preserving the innate immune response to LPS. Based on the HemeBind algorithm, site-directed mutagenesis of MD-2 and NF-κB reporter assays have indicated that MD-2 mutants W23A and Y34A significantly inhibit heme-induced NF-κB activation in HEK293 cells, but variably affect LPS-induced NF-κB activation. The cellular concentration of IL-8, a chemokine whose promoter contains an NF-κB binding site necessary for transcription/translation, was examined in an attempt to confirm the results of the reporter assays. HEK293 cells were transfected with a plasmid cocktail containing TLR4, wt MD-2, CD14, and NF-κB reporters to measure IL-8 production in response to LPS, TNF, and/or hemin stimulation. The cellular concentration of IL-8 was determined by ELISA and qRT-PCR after lysis. Although initial results demonstrate that heme and LPS/heme-mediated MD-2/TLR4 signaling produces more IL-8 in HEK293 cells than LPS alone, this difference is not significant, due to low transfection efficiencies in the cells. Therefore, the concentration of another cytokine or an alternative method may need to be used to confirm the results of the past NF-kB reporter assays in this working model.

Presenter: Peter Christenson
Poster Number: 14
Home Institution: Bethel College
Program: LSSURP
Faculty Mentor: Carrie Wilmot
Poster Title: **Protein Pathways for the Synthesis of β-Lactones**
Abstract: Beta lactone molecules are promising antibiotics and anti-obesity drugs. All beta lactones contain a constrained, reactive four membered ring. In recent publications, our group has shown the first pathway for the creation of beta lactones using Ole proteins. Ole enzymes form large 2.0 MDa complexes making Cryo-EM an ideal technique to gain structural insight. By using His-tag purification methods and size exclusion columns, progress has been made toward purifying homogeneous complexes. Homogeneity is critical for Cryo-EM. In addition to progress on structures, our group has successfully purified and is testing another protein currently known as Orf 1. This enzyme is suspected of to play a key role in the creation of ebelactone A.

Presenter: Daphne Cobbs
Poster Number: 15
Home Institution: Norfolk State University
Program: LSSURP
Faculty Mentor: Dr. Matthew Clark
Poster Title: **Optimization of SRAP Markers for Mapping of Variegation in Grapevines**
Abstract:

The purpose of this research is to identify the molecular markers linked to the trait, that is, variegation. One issue that has been observed in grape breeding is the widespread presence of variegated seedlings. Variegation is the appearance of different colored zones in the leaves, and sometimes the stems, of plants. Variegation is not a desired trait because the plants that have this are less efficient at photosynthesis and often suffer from other diseases, which make them candidates for culling at the greenhouse stage. This recessive trait is inherited from the parents and occurs in about 25% of seedlings. The genetic markers that were used in this experiment were Sequence Related Amplified Polymorphism (SRAP) markers. These markers were chosen because they are affordable and they are an effective way to identify dominant markers linked. There were 176 individuals tested from the population GE1642, which was derived from an MN1220 x MN1326 cross. The GE1642 population was pollinated in 2016 and grown in the greenhouse. The anticipated goal of this study is to develop a methodology for this marker system and find notable differences in the genome of the seedlings in order to find out exactly what gene/allele is responsible for variegation in the grape seedlings.

Presenter: Camila Colón-Alfonzo
Poster Number: 16
Home Institution: University of Puerto Rico - Arecibo
Program: LSSURP
Faculty Mentor: Dr. Li-Na Wei
Research Advisor: Sung Wook Park
Poster Title: **Retinoic Acid And Compound 4 Bound Cellular Retinoic Acid Binding Protein 1 Regulates CaMKII Activation**
Abstract:

Calcium-calmodulin protein kinase II (CaMKII) is one of the key enzymes for the regulation of normal heart physiology. It is involved in various heart diseases such as ischemic cardiac cell death and heart failure. Our lab has previously found that cellular retinoic acid binding protein 1 (Crabp1) modulates CaMKII activation. Here we present evidence that this regulation may occur by direct interaction between Crabp1 and CaMKII in the kinase and regulatory domain. Retinoic acid (RA) can dampen CaMKII phosphorylation through Crabp1 and further phospholamban (PLN) phosphorylation at Threonine 17 (T17), a CaMKII substrate, in H9C2 rat neonatal cardiomyocytes. Furthermore, compound screening for possible Crabp1 ligands shows that compound 4 (C4) reduces phosphorylation of CaMKII and PLN at T17 induced by ouabain. In vitro competition assay suggests that RA and C4 dampen CaMKII activation via Crabp1 binding to CaMKII and competing out calmodulin from this enzyme. These results suggest that RA and C4 may protect heart from pathological remodeling by suppressing CaMKII activation through Crabp1.

Presenter: Soniya Coutinho
Poster Number: 17
Home Institution: Macalester College
Program: LSSURP
Faculty Mentor: Dr. Anna Lee
Poster Title: **The Involvement of Protein Kinase C Epsilon (PKCε) in Modulation of Nicotine Addiction**

Abstract: Alcohol and nicotine addiction are highly prevalent and often co-morbid. There are currently no pharmaceutical agents that can treat both addictions simultaneously. Protein kinase C epsilon (PKCε) is a kinase involved in both alcohol and nicotine addiction mechanisms. Previous studies show that male PKCε knockout ($PKC\varepsilon^{-/-}$) mice have decreased alcohol consumption and reward, and male $PKC\varepsilon^{-/-}$ mice show decreased nicotine consumption compared to wild-type males. If PKCε also influences alcohol and nicotine consumption in females, it could be a potential target for a drug to treat co-morbid alcohol and nicotine addiction. We examined whether female $PKC\varepsilon^{-/-}$ mice show similar nicotine consumption patterns to male $PKC\varepsilon^{-/-}$ mice. Female $PKC\varepsilon^{-/-}$ and wild-type mice were given 4 weeks of continuous access to 15µg/mL nicotine with 2% saccharin solution and water with 2% saccharin solution in a voluntary consumption two-bottle choice model. Consumption of nicotine and water were measured. Preliminary data (n=5 per group) shows no significant difference in nicotine consumption between wild-type and knockout mice (P=0.81). If our finding remains the same in future studies with larger sample sizes, this would suggest a sex difference in PKCε modulation of nicotine consumption in mice. Specifically, PKCε influences nicotine consumption in males but not females. If so, future research should investigate mechanisms underlying this difference. Sex differences are also observed in human substance abuse, but their molecular causes are still not fully known. Thus, our experiment has important implications for the role of sex-influenced factors in addiction mechanisms.

Presenter: Shelby Davis
Poster Number: 18
Home Institution: Tennessee State University
Program: LSSURP
Faculty Mentor: Dr. Robert Meisel
Poster Title: **Exploring Novel Brain Regions In Female Sex Behavior**

Abstract: Different brain regions are connected anatomically and functionally involved in various social behaviors. Our lab is interested in determining which brain regions are specifically activated by sexual behavior. We know that there are separate circuits regulating the expression or the rewarding/ pleasurable consequences of sex behavior. Our lab has previously demonstrated that sexual behavior increases activity in the nucleus accumbens (NAc) and the medial prefrontal cortex (mPFC), areas traditionally involved in sexual reward, but we want to further elucidate other key regions activated in this evolutionarily important behavior. We did a broad screen of the brain and selected four brain regions implicated in reward or the expression of social behaviors. Four female hamsters were given hormone priming followed by ten minutes of sexual experience, and four were used as controls. Perfusions followed an hour after the sex experience, a time period that would produce maximal expression of c-Fos, which is our marker of cellular activity. Their brains were sliced and underwent immunohistochemistry to stain for c-Fos activation so that we could image, count and analyze cells in the different brain regions. Our preliminary results suggest that out of all the brain regions studied we found the interpeduncular nucleus, lateral habenula, superior colliculus and the paraventricular thalamus were activated during sex. In this study we have identified novel brain regions that were activated during female sex experience in hamsters. Following experiments would be done to figure out what functional components of sex behavior are related to each of these brain regions we studied. Further experiments can control the environment and selectively inhibit regions of interest to inform us of their functional role in sexual behavior.

Presenter: Angel Dixon
Poster Number: 19
Home Institution: Xavier University of Louisiana
Program: LSSURP
Faculty Mentor: Dr. Mark Masino
Poster Title: **Testing the Localization of Various Dopamine Receptors within the Zebrafish Nervous System**

Abstract: Dopamine is one of the many modulatory neurotransmitters studied due to its implication in several neural functions which include: neuroendocrine regulation, locomotion, motivational behaviors, learning and memory. We have chosen to focus on one of its functions, locomotion. In zebrafish, dopamine is released into the nervous system by a subset of dopaminergic neurons within the brain. Since there are four distinct dopamine receptors within zebrafish, it is important to understand which dopamine receptors are expressed in locomotor cell types. Thus, leading to the question, what cell types respond to the signals sent from dopaminergic cell bodies within the brain and are these cells apart of either the spinal neurons that control locomotion or dopaminergic neurons within zebrafish? Using immunohistochemistry in larval zebrafish, we tested antibodies against dopamine receptors 1-4 within the spinal cord and brain. The results from these individual experiments have determined that the dopamine-2 antibody has expressed the most signaling within the diencephalon in both glutamatergic and dopaminergic transgenic lines of zebrafish. In conclusion, dopamine receptors 1,3, and 4 have illustrated minimal expression in both the spinal cord and brain in comparison to the high level of expression illustrated by the dopamine 2 receptor.

Presenter: Giovanna Dorvelus
Poster Number: 20
Home Institution: Howard University
Program: LSSURP
Faculty Mentor: Dr. Alfonso Araque
Poster Title: **Hippocampal Astrocyte Responsiveness To Glucocorticoids**

Abstract: Stress is a physiological animal response to challenging stimuli from the environment. Chronic and acute stress may lead to pathological disorders such as anxiety, depression, and post-traumatic stress disorder (PTSD). Glucocorticoids, a type of corticosteroid and steroid hormone released in the adrenal cortex, are key signaling molecules involved in the stress response. While mechanisms of action of glucocorticoids have been widely focused on neurons in various brain regions, whether astrocytes sense and respond to these stress hormones is largely unknown. Since astrocytes are emerging as key cellular elements actively involved in the regulation of the synaptic function in tripartite synapse, we aimed to investigate whether they respond to glucocorticoids, as an initial approach to test the hypothesis that astrocytes contribute to the effects of stress in the brain. Using calcium imaging techniques, fluorescent dyes and confocal microscopy in mouse hippocampal slices, we monitored the intracellular calcium levels of hippocampal astrocytes located in the stratum radiatum of the CA1 region. We quantified the astrocyte activity before and after application of pregnenolone (XX μM). Our preliminary results indicate that pregnenolone increases the calcium-based activity of hippocampal astrocytes. Further studies will test whether these effects may influence synaptic transmission. If that is the case, astrocytes would play an active role in the pathophysiology of stress, and would be identified as novel cellular targets for the treatment of stress-related pathologies.

Presenter: Morgan Evenson
Poster Number: 21
Home Institution: Gustavus Adolphus College
Program: LSSURP
Faculty Mentor: Dr. Martina Bazzaro
Poster Title: **UNC-45A expression changes during development of the nervous system**
Abstract: UNC-45A is a member of the evolutionarily conserved UCS (UNC-45/Cro1/She4p) protein family that has been associated with many regulatory functions. Various studies have implicated UNC-45A in non-muscle myosin II (NMII)-mediated functions including cytokinesis, cancer cell proliferation and motility, adhesion, and vessel formation. Our lab has recently shown that UNC-45A is necessary for neuronal differentiation and elongation by regulating phosphorylation of NMII. Given the necessity for UNC-45A in neuronal cytoskeletal functions, we sought to investigate how UNC-45A expression levels and localization change during development using immunohistochemistry (IHC) and staining techniques in mice embryos and post-natal day 1 (PND1) mouse brains. We found that UNC-45A is widely expressed in cortical regions, eye, vibrissae follicles, and skin in embryos. This is contrasting to PND1 as the expression is found primarily along the dorsal pallium. Thus, we conclude that UNC-45A expression declines throughout mammalian neural development. Further work is needed to establish how localization of UNC-45A changes in the body beyond the embryonic stage.

Presenter: Jazz Fields
Poster Number: 22
Home Institution: Tennessee State University
Program: LSSURP
Faculty Mentor: Dr. Robert Meisel
Poster Title: **Probing the Role of the Medial Prefrontal Cortex in Female Sex Behavior**
Abstract: It is typically thought that animals engage in sex primarily for means of reproduction. However, all animals, including humans, actually perform this motivated behavior for its rewarding consequences. Indeed, studies in our lab have demonstrated increased activity from sex in the nucleus accumbens (NAc), a key region of reward circuity, as well as in the medial prefrontal cortex (mPFC), an area known for its involvement in goal-directed behavior. Because the mPFC provides glutamatergic afferents to the NAc, our lab wanted to determine if activation that is seen in mPFC and NAc are related in the same circuitry, acting independently, or working together as an integrated unit. To do this we examined the expression of c-Fos in inhibitory (GABA) and excitatory (glutamate) neurons in the mPFC to elucidate which cell type is activated during sex to determine whether the mPFC is driving the NAc activity. The mPFC neurons were labeled for both c-Fos, a marker of activation, as well as markers for GABA (GAD) or glutamate (CAMKII). Preliminary results suggests that sex activates c-Fos primarily in the CaMKII neurons of the mPFC. These results implicate the mPFC and NAc as integrated structures in reward circuitry in female sex behavior. Future studies may help refine therapeutic treatment in sexual desire disorders in women, which is a prevalent concern affecting 10% of the population. Understanding sex and reward circuitry is critical in developing therapies for pathological conditions and further understanding sexual pleasure in both men and women.

Presenter: Roshanak Gonzalez
Poster Number: 23
Home Institution: Florida Gulf Coast University
Program: LSSURP
Faculty Mentor: Dr. Greg Molnar
Poster Title: **Analyzing Sleep in Parkinson's disease Patients Undergoing Deep Brain Stimulation**

Abstract: Over 1 million people in the U.S. have Parkinson's disease (PD), most whom have an additional accompanying sleep disorder. One of the most promising treatments for PD is deep brain stimulation (DBS) - implanted electrically stimulating leads in the subthalamic nucleus and globus pallidus that decrease motor symptoms - most notably tremors. Despite DBS' success, the issue of sleep disorders in PD patients is unaddressed. Traditional methods of analyzing sleep include polysomnography using scalp-placed electroencephography (EEG) electrodes and analyzing recordings in reference to established sleep-stage profiles. The goal of this study is to compare the sleep activity signals from EEG polysomnography signals to subcortical local field potential (LFP) recordings from an implanted DBS lead. This was done by using scalp-placed EEG and DBS leads to take both cortical and subcortical readings in a preclinical model of PD and to analyze the neural oscillations of sleep. EEG and LFP data were transmitted wirelessly to a Matlab computer interface using Triangles Biosystems International System (TBSI) . We hypothesize that classic sleep-stage recording will be similar from the EEG and LFP sites. Modern DBS systems offer the ability to record LFPs thus, could offer clinicians more regular insight into how sleep disturbances might be affected by their current treatment regimen.

Presenter: Isabelle Gonzalez-Montalvo
Poster Number: 24
Home Institution: University of Puerto Rico - Rio Piedres
Program: LSSURP
Faculty Mentor: Dr. Donald Simone
Research Advisor: Iryna Khasabova
Poster Title: **Contribution Of Exosomes Isolated From The Sciatic Nerve Of Cisplatin-Treated Mice To Cisplatin-Induced Hyperalgesia**

Abstract: Cisplatin is a commonly used chemotherapeutic agent that treats tumors. However, the usage of the drug is limited by the development of dose-dependent painful peripheral neuropathy. It has been shown that both dorsal root ganglion (DRG) neurons and Schwann cells are affected by cisplatin. Schwann cells play an essential role in maintenance of neuronal health. Exosomes, intraluminal vesicles that contain mRNA, miRNA, proteins, and lipids, are a possible mechanism of Schwann cell-DRG neuron communication. The aim of the present investigation is to determine if exosomes isolated from the sciatic nerve of cisplatin-treated mice contribute to cisplatin-evoked hyperalgesia. Behavioral tests were conducted to evaluate the effect of exosomes on mechanical hyperalgesia and cold sensitivity. Our results demonstrate the development of cisplatin-induced mechanical hyperalgesia after the fourth injection. Exosomes isolated from the sciatic nerves of cisplatin-treated mice evoked hyperalgesia after the second injection. In contrast to cisplatin, no increased cold sensitivity was determined in mice treated with exosomes. Taken together, our results support the contribution of Schwann cell-derived exosomes to mechanical hyperalgesia.

Presenter: Kathryn Hagen
Poster Number: 25
Home Institution: Gustavus Adolphus College
Program: LSSURP
Faculty Mentor: Dr. Geoffrey Ghose
Research Advisor: Elisabeth Moore
Poster Title: **Neural Changes in Early Visual Areas due to Perceptual Learning**
Abstract: Visual perceptual learning (VPL) is the ability to improve the perception of a visual stimulus over time. Line orientations and shapes are encoded in the earliest visual regions, starting at V1 and progressing through V4, before the more complicated regions that encode entire objects. Study of early processing VPL is necessary to understand more complex regions. In this study, human subjects are trained on a learning task that tests their ability to distinguish a circle from a noisy background. Prior to and after training on this learning task, subjects perform a second magnet task during fMRI scanning. In the magnet, subjects discern a glitch within dynamically morphing shapes. We hypothesize that behavioral performance on detecting the glitch in circles will be comparable to other, non-circular shapes prior to training on the learning task. Following training, performance is expected to improve for the circle, but not for other shapes. In the fMRI signal, voxels that are responsive to shapes in early visual processing areas are expected to show altered activity when the circle appears, compared to voxels responsive to non-circular shapes, following training. This will provide valuable physiological knowledge concerning how neural populations process information to reflect visual perceptual learning.

Presenter: Syed Ali Hassan
Poster Number: 26
Home Institution: CUNY - Howard College
Program: LSSURP
Faculty Mentor: Dr. Zhi Yang
Research Advisor: Wenfeng Zhao
Poster Title: **Bandwidth Pursuit: Comparative Analysis of Binary Sensing Matrices in Quantized Compressed Sensing for Neural Spike Data Compression**
Abstract: Wireless transmission of neural spike data in real time is power consuming. Implanted stimulators and sensors have an upper limit on size and power consumption placed by biological constraints. It is therefore required to lower the amount of data to be wirelessly transmitted. Quantized-Compressive sensing is one such method that lowers the amount of data to be transferred by projecting the quantized signals into a lower dimensional space. This data can then be recovered off-chip. The performance of quantized compressive sensing depends on the sensing matrix used, the ratio of bits to measurements in bandwidth, and the recovery algorithm used. Traditionally a random binary matrix (RBM) is used as a sensing matrix but is computationally expensive. Here, we compared the performance of 1-Sparse Random Binary Matrix (1-SRBM) and Quasi Cyclic Array Code Matrix (QCAC) vs RBM. We performed a sweep of different bits to measurements ratios for fixed bandwidths to maximize the signal to noise ratio for each sensing matrix used. Consistent Basis Pursuit (CoBP) recovery algorithm provided the best results for all sensing matrices. We concluded that the performance of QCAC and SRBM is comparable to RBM and that the ideal ratio of bits to measurements depends on the sensing matrix used.

Presenter: Aishwarya Iyer
Poster Number: 27
Home Institution: University of MD - Baltimore County
Program: LSSURP
Faculty Mentor: Dr. Zohar Sachs
Poster Title: **Identifying Genes Pertinent in Transformation from Myelodysplastic syndromes to Acute Myeloid Leukemia in Murine Models**

Abstract: Myelodysplastic syndromes (MDS) are clonal malignancies that are characterized by ineffective hematopoiesis. Patients often progress to bone marrow failure or secondary acute myeloid leukemia (sAML), which tends to have poor prognosis. Identifying the genes that instigate transformation to sAML will aid in understanding the mechanisms that drive this process. Previous work was done to develop a transgenic mouse model that established MDS using sleeping beauty (SB) mutagenesis among other mutations. SB mutagenesis is a technique used to knockout genes in mice. We extracted RNA and DNA from mice harvested tissues after optimizing extraction protocol. After assessing the quality of nucleic acids, we will then perform ligation-mediated polymerase chain reaction (LM-PCR) to determine the insertion sites of the sleeping beauty transposon. Understanding the genetic makeup of these mice with SB mutagenesis induced AML will allow for better understanding regarding to what genes harbor the potential for MDS patients to develop secondary AML.

Presenter: Adrienne Jo
Poster Number: 28
Home Institution: Claremot McKenna College
Program: LSSURP
Faculty Mentor: Dr. Stanley Thayer
Research Advisor: Matthew Green
Poster Title: **The Effects of HIV-1 GP120 on the Expression and Puncta Count of α5-Containing GABAA Receptors in Cultured Rat Hippocampal Neurons**

Abstract: Approximately 50% of the >30 million people worldwide affected by human immunodeficiency virus-1 (HIV-1) suffer from cognitive impairments known as HIV-1-associated neurocognitive disorders (HAND). HIV-1 can infect microglia, leading to the release of toxic proteins, such as envelope glycoprotein 120 (gp120IIIB), which causes neurotoxicity and synaptodendritic damage. Gp120IIIB is known to induce the release of interleukin-1β (IL-1β), a cytokine released by microglia. Previous work shows that IL-1β increases the function of α5-containing GABAA receptors (α5-GABAA-Rs), which lowers cell excitability and may contribute to cognitive impairments. Thus, we tested whether gp120IIIB would increase the expression of protein clusters of α5-GABAA-Rs in primary hippocampal cultures derived from embryonic day 17 Sprague Dawley® rats. Immunocytochemistry was performed to examine the localization of α5-GABAA-Rs relative to microtubule-associated protein 2 (MAP2) immunoreactivity. Based on previous electrophysiology experiments on α5-GABAA-Rs, we hypothesize that expression and puncta count of α5-subunit protein clusters will increase after exposure to gp120IIIB. Higher expression of α5-GABAA-Rs on neuronal membrane might explain the increased neuronal inhibition and decreased cell excitability seen in vitro. Altered excitability may lead to the cognitive impairments found in HAND patients. Thus, inhibition of α5-GABAA-R activity may serve as a novel therapy for HAND patients.

Presenter: Eun Kim
Poster Number: 29
Home Institution: Dominican University
Program: LSSURP
Faculty Mentor: Dr. Timothy Ebner
Poster Title: **Characterizing Inhibitory Interneurons and Glia from SCA8 Models**
Abstract: Spinocerebellar Ataxia Type 8 (SCA8) is a neurodegenerative disease caused by the trinucleotide (CTG) repeat expansion mutation of the ataxia gene ATXN8. Phenotypes of SCA8 include cerebellar and cortical abnormalities. Recently, we have observed increased cortical excitability to direct electrical stimulation in SCA8 mice. One potential mechanism for this dysfunction could be due to the alterations of inhibitory interneurons, either in structure or function. Immunohistochemistry is a prime method towards studying potential alteration in inhibitory interneurons in SCA8 mouse models. To understand the effects on the motor cortex and cerebellum, we looked at interneurons, microglia, and astrocytes by staining for parvalbumin (PV), Iba1, and GFAP, respectively. After imaging the immunostained tissue with confocal microscopes, the cell densities of PV+ and activated microglia among astrocytes were observed. Analysis showed that the PV+ cell density proved to be in favor of the irregular excitability. The phenotypes of the glia in relation to the disease were noted as well. With these results, the knowledge gained from this project could help with the advancement of new therapeutic strategies for testing SCA8.

Presenter: Adam Kornberg
Poster Number: 30
Home Institution: University of Wisconsin - Madison
Program: LSSURP
Faculty Mentor: Dr. Jill Siegfried
Research Advisor: Christian Njatcha, Mariya Farooqui
Poster Title: **Short-Term Effects of Targeting STAT3 in NSCLC Using an Oligonucleotide-Based Decoy**
Abstract: This study intends to explore the effects of an oligodeoxynucleotide decoy to selectively inhibit the activated phosphorylated dimer of transcription factor STAT3 in Non-Small Cell Lung Cancer (NSCLC) tumors after just five days in a mouse model. It has previously been observed that treatment with the decoy for 29 days in mice with human NSCLC tumor cell xenografts led to significant reduction in tumor area and extensive necrosis. To explore the events that preceded the necrosis and tumor area reduction, the effect of the decoy was observed after five days of treatment. It was hypothesized that after five days, there would be a reduction in tumor cell proliferation and an increase in apoptosis in tumor tissue due to the inhibition of pSTAT3. Using immunohistochemistry (IHC), variations in protein expression between oligodeoxynucleotide decoy and mutant control treatments were imaged and analyzed with a grading scale. IHC analysis of the activated transcription factor pSTAT3 and cell proliferation marker Ki-67 showed decreased staining in the presence of the oligodeoxynucleotide decoy. There was no significant difference in staining intensity between decoy and mutant control treatments for apoptosis marker Cleaved Caspase-3. This allows us to conclude that cellular proliferation and activated STAT3 decrease in tumor tissue after just five days, while apoptosis is unaffected.

Presenter: Thomas Krug
Poster Number: 31
Home Institution: Minnesota State University - Mankato
Program: LSSURP
Faculty Mentor: Dr. Daniel Schmidt
Poster Title: **Modeling Neural Network in Aid to Developing Optogenetic Reagents**
Abstract: Controlling neural activity with high specificity using principles of optogenetics—high precision and genetically encoded—is crucial for understanding how cellular components contribute to neural dynamics. We apply these principles by harnessing the diversity of peptide toxins to target specific cellular components such as ionic conductances and synaptic connections with chemical reagents called lumitoxins. To better understand how lumitoxins affect neuronal activity, we modelled a neural network of rat hippocampal cells in MATLAB and compared the effects of sodium and potassium conductances and synaptic connections to neuron spiking frequency. Our simulations suggest that potassium channel manipulation causes significant changes in spike frequency and overall network dynamics indicating the utility of potassium targeted lumitoxins. Our next step is to record and compare experimental lumitoxin results to our simulated results.

Presenter: Edene Shirley Lakpa
Poster Number: 32
Home Institution: Howard University
Program: LSSURP
Faculty Mentor: Dr. Harry Orr
Poster Title: **Characterization of Spinocerebellar Ataxia Type 1 Mouse Model Pcp2 [82Q]W775R**
Abstract: Spinocerebellar Ataxia Type I (SCA1) is an autosomal dominant neurodegenerative disorder caused by the expansion of CAG repeats encoding a polyglutamine (polyQ) tract in the ATXN1 protein. Primarily affecting Purkinje cells of the cerebellum, pathology in SCA1 is caused by the enhanced interaction between ATXN1 and splicing factor RBM17, altering expression of other genes. Previous experiments conducted by the lab developed Pcp2[82Q], a mouse model with overexpression of the polyQ tract in the ATXN1 gene. In this study, Pcp2[82Q]W775R, a transgenic mouse model, was generated. It is an overexpression model with an 82 polyQ tract in the ATXN1 protein as well as the replacement of tryptophan with arginine at amino acid 775 of the ATXN1 gene. We propose this substitution that disrupts the ability of ATXN1 to bind to RBM17 will result in the dampening of SCA1. To characterize W775R, RNA expression was determined by qPCR, protein distribution and expression by immunofluorescence and western blotting. Results indicate that two W775R lines express the polyQ tract comparable to the Pcp2[82Q] mouse model. RNA sequence of these mice will be used to look at the effects ATXN1[82Q]W775R has on RNA splicing. This may elucidate pathways that can be utilized for disease therapy.

Presenter: Philip Leung
Poster Number: 33
Home Institution: University of Minnesota - Twin Cities
Program: LSSURP
Faculty Mentor: Dr. Burckhard Seelig
Poster Title: **Discovery Of Activity Improvements In A RNA Ligase Mutant Library Via A High Throughput Malachite Green Screening Protocol**

Abstract: A common approach in the discipline of protein engineering is the application of directed evolution. Directed evolution experiments are used to select in vitro or in vivo for improved enzymatic function, resulting in very large libraries of mutants with potential improvements. Therefore, the demand for specific high throughput screening protocols to detect improvements is continuously escalating, as the variety of proteins undergoing engineering expands. Here, we show a protocol used to detect catalytic rate increases in a mutant library derived from a novel RNA ligase enzyme. The enzyme catalyzes a reaction not found in nature, whereby a 5' triphosphorylated RNA oligonucleotide is covalently linked in standard biological configuration to another RNA oligonucleotide in the presence of a complementary DNA splint, and releasing pyrophosphate as a leaving group. The assay detects phosphate levels in solution after a pyrophosphatase liberates phosphate from the free pyrophosphate. The protocol has high sensitivity and uses cheap, easily available reagents, and requires only equipment, which is standard to most laboratories equipped to research molecular biology. In addition, the workflow process can differentiate between up to 96 unique mutants in a single assay. A final advantage of the protocol is that it can be used to detect rate enhancements in any reaction which releases phosphate or pyrophosphate. The assay repeatedly detected RNA ligase mutants with higher activities with low error, demonstrating its efficacy in narrowing the pool of enzyme candidates with which to continue engineering projects.

Presenter: Quang Ly
Poster Number: 34
Home Institution: California State University - Long Beach
Program: LSSURP
Faculty Mentor: Dr. Bin He
Poster Title: **Implementation of Foot Motor Imagination in Brain-Computer Interface**

Abstract: Brain-computer interfaces (BCI), based on data extracted and analyzed from electroencephalographic (EEG) signals while distinct mental tasks are performed, are effective tools in assisting people with serious motor impairments ranging from partial paralysis to full locked-in syndrome. Conventional BCI feedback systems, however, require extensive training times in order for subjects to perform motor imagery tasks proficiently. In our experimental protocol, each subject completed an offline training and online feedback test, in which subjects moved a cursor on the computer monitor with the only input being brain signals. Offline training determined the user-specific frequency band that corresponded to foot motor imagination. During the online sessions raw neurological data was processed in real time to correlate to 4 out of 5 mental states: left hand imagery, right hand imagery, imagining both hands, and either foot imagery or the rest condition. Preliminary results suggest an improvement when incorporating foot motor imagination relative to a resting task. Future iterations of this experimental protocol will involve virtual reality (VR) to potentially reduce the training time. It is our hypothesis that the inclusion of foot motor imagery will result in a greater degree of control for BCI tasks.

Presenter: Allen Lynch
Poster Number: 35
Home Institution: University of Minnesota - Twin Cities
Program: LSSURP
Faculty Mentor: Dr. Jeffrey Gralnick
Poster Title: **The Better Twin: Finding the Component of *Shewanella Oneidensis* UshA that Promotes Flavin Synthesis**

Abstract: *Shewanella oneidensis* is a metabolically-diverse marine bacterium that possesses the ability to respire using a remote final electron acceptor in anoxic conditions. In conditions necessitating the use of this extracellular electron transport, *Shewanella* primarily utilizes the molecule flavin mononucleotide (FMN) as a shuttle to carry electrons and reduce molecules in the environment. Electron exporter FMN is synthesized by cleavage of flavin dinucleotide (FAD) by the periplasmic protein ushA. Additionally, *Shewanella* UshA performs the dephosphorylation of adenosine monophosphate (AMP). *E. coli* also produces an ushA protein that shares 50.5% amino acid identity with the *Shewanella* protein that also cleaves AMP, however, the *E. coli* enzyme is vastly less reactive with FAD. This paper explores the differences between the Shewanella and E. coli UshA variants that, despite having a great degree of amino acid commonality, have starkly different catalytic efficiencies regarding FAD cleavage. The first approach to determining the differences was amplifying expression of Shewanella UshA using a plasmid containing a promoter for T7 high-efficiency RNA polymerase. Increased expression was utilized for purification, followed by analysis using cyro-electron microscopy. A second approach involved constructing a plasmid containing the Shewanella ushA gene with select amino acids in the active site changed to resemble the active site of E. coli UshA. This edited UshA allele was transformed into Shewanella, then its catalytic activity with respect to FAD was observed using an FAD cleavage assay.

Presenter: Elizabeth MacDonald
Poster Number: 36
Home Institution: University of Minnesota - Twin Cities
Program: LSSURP
Faculty Mentor: Dr. Cara Santelli
Poster Title: **Identification of Cultivable Selenium Tolerant Microorganisms Isolated from Selenium Contaminated Mine Soil**

Abstract: Selenium pollution is a global environmental problem impacting both human and environmental health. Selenium is an essential nutrient but has a small margin between deficiency and toxicity and biomagnifies in the food chain. Microorganisms play a crucial role in redox transformations of selenium in the environment, which influence its solubility and bioavailability. The more oxidized forms, Se(IV) and Se(VI), are soluble, toxic, and bioavailable. Microorganisms can reduce these to Se(0) and Se(-II), which are insoluble and less toxic. Though they are essential for many environmental Se transformations, current understanding of organisms are capable of tolerating and transforming Se is limited. Identifying organisms that are capable of living in high-selenium environments and performing these transformations is important for understanding selenium cycling and identifying organisms that could be used in bioremediation. Bacteria and fungi were isolated from selenium-contaminated soil from two reclaimed phosphate mines in Southeastern Idaho. Organisms were isolated using three different media types amended with either 100 uM Se(IV) [as Na2SeO3] or Se(VI) [as Na2SeO4]. To identify the organisms, the 16S ribosomal RNA (rRNA) gene region from bacteria and the internal transcribed spacer (ITS) rRNA gene region from fungi were amplified and sequenced using Sanger Sequencing. Isolate DNA sequences were aligned using Benchling then put into phylogenetic trees using Arb to determine the most closely related previously characterized species.The organisms were also grown in media containing Se(IV) and Se(VI) to determine if they are able to reduce selenium. Out of 80 bacterial isolates, 14 unique strains have been identified and phylogenetically characterized. The most abundant bacterial genera in the sequenced isolates were Arthrobacter and Pseudomonas, with four species identified each.

Presenter: Delfina Mancebo
Poster Number: 37
Home Institution: Providence College
Program: LSSURP
Faculty Mentor: Dr. Mark Thomas
Poster Title: **Characterizing Plasticity Changes In Corticostriatal Ensembles**

Abstract: The nucleus accumbens (NAc) has been shown to signal reward information and undergo maladaptive changes related to addiction. Until recently, directly measuring changes in strength of synaptic transmission between the NAc and its various upstream inputs could not be fully discerned. To study this, we introduced channelrhodopsin-2 (ChR2, a light-sensitive ion channel) to one of the NAc inputs, the infralimbic (IL) sub-region of the prefrontal cortex, in C57bl6j mice. The ChR2 gene was driven by a calcium-calmodulin-kinase-2 promoter in an adeno-associated viral construct (AAV8) to target expression to pyramidal neurons in the IL cortex, which are known to send excitatory projections to the shell (Sh) of the NAc. To interrogate functional connectivity of the IL-NAcSh circuit, local field potentials (LFPs) of the NAcSh were recorded in acute ex vivo slice preparations and evoked by shining a blue light directed at IL afferents. Light stimulation evoked a negative, bimodal waveform in LFPs, consistent with an IL pre-synaptic depolarization response followed by a second NAcSh post-synaptic depolarization response, the latter of which is both calcium- and glutamate-dependent. We then delivered a pattern of stimulation known to induce a form of long-term depression (LTD, 4ms pulses-10hz-10min) and validated that we could reduce the amplitude of the second peak in IL-NAcSh opto-evoked-LFPs. Lastly, we developed an ex vivo assay to compare functional connectivity measures between subjects by normalizing post-synaptic responses to afferent recruitment size in efforts to capture in vivo experience-dependent plasticity changes in specific striatal circuits measured at the population ensemble level.

Presenter: Audre May
Poster Number: 38
Home Institution: Lewis and Clark College
Program: LSSURP
Faculty Mentor: Dr. Subree Subramanian
Research Advisor: Xianda Zhao
Poster Title: **MicroRNA-552 Regulates Atypical Chemokine Receptor 4 And Chemokine Receptor CCR7-Dependent Dendritic Cell Chemotaxis In Colorectal Cancer**

Abstract: Antigen Loading dendritic cells (DCs) are critical for an effective adaptive immune response, as naive T cells are activated once their T cell receptors recognize antigens presented by major histocompatibility complex (MHC) class II peptides. In order for T cell activation to occur, DCs migrate from tumor tissue to tumor draining lymph nodes. DC chemotaxis is regulated by CC-chemokine receptor 7 (CCR7) activation, which is driven by its ligands, chemokines CCL19 and CCL21. However in colorectal cancer (CRC), expression of these chemokines is dysregulated. A potential factor contributing to this irregularity is atypical chemokine receptor 4 (ACKR4) expression. ACKR4 sequesters CCL19 and CCL21 in peripheral tissue, helping to maintain the chemokine gradient. In CRC tumor tissue, research suggests ACKR4 expression is down regulated, while microRNA-552 expression is upregulated in colorectal cancer tumor tissue. Here we demonstrate low expression of ACKR4 at both transcript and protein levels. We also explore the potential silencing capabilities of microRNA-552 targeting ACKR4 expression in CRC tumor tissue. Correlating expression patterns suggest that microRNA 552 is targeting ACKR4, further elucidating mechanistic disruptions to CCR7-dependent dendritic cell chemotaxis.

Presenter: Sarah Meier
Poster Number: 39
Home Institution: University of New Hampshire
Program: LSSURP
Faculty Mentor: Dr. David Redish
Poster Title: **Infralimbic Versus Prelimbic Cortices In Deliberative Learning And Procedural Learning Systems**
Abstract: Differing decision-making systems can be found in several regions of the brain. Of particular interest to this project are two regions of the medial prefrontal cortex: the prelimbic and infralimbic cortices. The prelimbic region is believed to be involved in a deliberate-planning system which can be evidenced by the vicarious trial and error phenomenon, whereas the infralimbic region is believed to be involved in a habit-forming system, evidenced by the path stereotypy phenomenon. Conflict between these regions arises when faced with a single decision. Therefore, the goal of the current project was to determine how that conflict is resolved. This was done by activating DREADDs within either the prelimbic or infralimbic region of two rats and analyzing for these behavioral phenomena when put through a Contingency Switch maze task. If we find an increase in path stereotypy when the prelimbic region is disrupted, or an increase in vicarious trial and error when the infralimbic region is disrupted, this would imply that the region not disrupted gains control over resultant behavior given system conflict.

Presenter: Brianna Morales
Poster Number: 40
Home Institution: University of Texas - San Antonio
Program: LSSURP
Faculty Mentor: Dr. Victor Barocas
Poster Title: **Understanding Vibrotactile Sensing Of Simple And Complex Waveforms**
Abstract: Psychophysical experiments were conducted to characterize human response to vibratory stimuli at various frequencies. The aim of this study was to understand the Pacinian corpuscle, a touch mechanoreceptor within the hand responsible for detecting high frequencies. We investigated the discriminability of five different frequencies (160, 230, 310, 400, and 500 Hz) and determined whether playing an underlying frequency would improve the subjects' ability to differentiate the stimuli. In the first study, subjects were presented with 40 pairs of consecutive frequencies within the reported receptive range of the Pacinian corpuscle (the consecutive frequencies are 160, 230, 310, 400, and 500 Hz). Subjects were asked to differentiate between two frequencies in same-different tests, responding to a graphical user interface developed in MATLAB. Then, the study was repeated, except that 100Hz oscillation was applied in conjunction with each individual frequency to produce complex waveforms. The participants were able to discriminate between the simple waveform frequencies more easily in the first experiment compared to the second setup with the complex waveform. The next step in this study is to analyze the d' values for the subjects, in order to determine their sensitivity.

Presenter: Davis Nossaman
Poster Number: 41
Home Institution: Harding University
Program: LSSURP
Faculty Mentor: Dr. Matthew Johnson
Poster Title: **A Glove Design for Quantifiable Rigidity Testing in Parkinson's Disease**
Abstract:

Cogwheel muscle rigidity is one of the prominent motor signs in Parkinson's disease patients. To quantify parkinsonian rigidity, a well-trained movement disorders specialist slowly articulates a patient's joints and rates the perceived level of resistance to the movement on an integer-based scale from 0 (no rigidity) to 4 (severe rigidity) for each joint. The subjectivity of this motor exam leads to intra- and inter- rater variance of rigidity scoring and low scoring resolution, which combine to yield unreliable results regarding the effectiveness of a patient's treatment regime. To address this clinical challenge, we developed a multi-modal sensor glove that integrates an inertial measurement unit and two force sensors attached to the thumb and index fingers. Signals detected from these three sensors were measured through an Arduino system. The glove was evaluated using (1) a phantom elbow joint with variable resistance and (2) a parkinsonian research animal both off and on deep brain stimulation therapy. The device is lightweight, user-friendly, and capable of examining rigidity across multiple joints, making it a reasonable candidate for implementation in a clinical setting.

Presenter: Jaime Pérez Lizardi
Poster Number: 42
Home Institution: University of Puerto Rico - Rio Piedres
Program: LSSURP
Faculty Mentor: Dr. David A. Potter
Research Advisor: Zhijun Guo
Poster Title: **Cytochrome P450 Regulation of Breast Cancer Mitochondria**
Abstract:

Cytochrome P450 (CYP) enzymes with arachidonic acid (AA) epoxygenase activity promote breast tumors, in part, through epoxyeicosatrienoic acids (EETs) biosynthesis and are potential therapeutic targets. Immunocompetent mouse mammary tumor models that are dependent on murine Cyp AA epoxygenase activity may advance our understanding of this novel pathway. However, it is unknown which mammary tumor models may be dependent on Cyp AA epoxygenase activity and which murine Cyps are expressed in mouse breast tumor cells. To answer these questions, several mouse breast cancer cell lines were surveyed for sensitivity to a highly potent chemical probe inhibitor of Cyp AA epoxygenase activity, hexyl-benzyl-biguanide (HBB). We found that there were 2 estrogen receptor positive (ER+HER2-) cell lines $SSM2^{ucd}$ and 67NR, as well as 2 basal cell lines, (ER-HER2-), which were sensitive to HBB with IC_{50} values of less than 25µM. We then conducted a survey of mouse Cyp enzymes which are candidate AA epoxygenases. First total mRNAs of the respective cell lines were extracted, then using RT-PCR, a cDNA library was created. Different Cyp gene primers were used to probe the cDNA library, to determine which Cyp mRNA species are present. Western blot analysis will be used to confirm the protein expression of the Cyps. Finally, using immunofluorescent microscopy, the localization of these proteins within the cell will be assessed. It is expected that Cyp epoxygenase enzymes will be localized within mammary carcinoma mitochondria, similar to the localization of CYP3A4 in the human MCF-7 breast cancer cell line.

Presenter: Elliott Peterson
Poster Number: 43
Home Institution: Pacific Lutheran University
Program: LSSURP
Faculty Mentor: Dr. Douglas Yee
Poster Title: **Examining the Effects of Gp2 Protein Scaffolds on IGF1R/InsR Signaling in Triple-Negative Breast Tumor Cell Lines**

Abstract: The type I insulin-like growth factor receptor (IGF1R) and insulin receptor (InsR) signaling pathway in breast tumors is well understood, and has led to the development of numerous drugs targeting this system. Unfortunately, clinical trials testing anti-IGF1R monoclonal antibodies were not successful. InsR, a closely related receptor to IGF1R has purposely been avoided as a potential cancer target due to unwanted metabolic side effects. Small protein scaffolds based on the T7 phage gene 2 protein (Gp2) have been developed to target InsR and have been shown to be effective in inhibiting endocrine-resistant breast cancer growth. However, the efficacy of these Gp2 in triple-negative breast cancer cells is still elusive. Here, we examine the inhibitory effects of Gp2 in a triple-negative (MDA-MB-435) LCC6 cell line by measuring the downstream activation of AKT, which is a major oncoprotein in cell proliferation and malignant phenotype. LCC6 cells were plated, serum-starved and treated individually with Gp2 variants #1, #5, and #10 overnight, and then exposed to either insulin, IGF-I, or IGF-II for 15 minutes. These cells were collected and lysed for Western blot analysis. Preliminary analysis of these blots demonstrated that Gp2 #1 fully blocked insulin-stimulated, but only partially inhibited IGF-I and IGF-II stimulated AKT signaling in LCC6 cells compared to untreated cells. Gp2 #5 and #10 results were not complete due to some technical issues; however, we anticipate an inhibitory effect of Gp2 #5 and #10 in insulin signaling. Thus, InsR is an effective target for treating triple-negative breast tumors.

Presenter: Stephanie Ponce-Robles
Poster Number: 44
Home Institution: University of Puerto Rico - Aguadilla
Program: LSSURP
Faculty Mentor: Dr. Tanya Freedman
Poster Title: **Inflammation Upregulates LynA Expression and β-glucan Sensitivity in Macrophages**

Abstract: Juvenile Idiopathic Arthritis (JIA) is an autoimmune disease in which macrophage cells help to drive chronic inflammation. Current antirheumatic drugs block inflammatory macrophages, but also suppress macrophage immune function. Large- scale clustering of immunoreceptor tyrosine-based activation motif (ITAM)-coupled receptors initiates antimicrobial responses in macrophages. Exposure to inflammatory cytokines (e.g. IFN-γ) can lower the threshold for mouse macrophage activation by upregulating the Src-family kinase LynA, causing hypersensitive signaling. IFN-γ is elevated in JIA patients, which may induce LynA-mediated hypersensitive macrophage signaling. Therefore, inhibiting LynA signaling may be an efficient treatment to target inflammatory macrophages in JIA without suppressing antimicrobial immunity. I stimulated mouse bone marrow-derived macrophages (BMDMs) with β-glucan ITAM-receptor ligands to determine if LynA signaling is required for macrophage sensitivity to physiological “weak” (non-clustering) stimuli. I also cultured human monocyte-derived macrophages and stimulated them with IFN-γ to test LynA upregulation. My immunoblot data supported previous studies demonstrating that macrophage downstream signaling through Dectin-1 pathway is a Lyn- and priming-dependent process. Our long-term goal is to inhibit the LynA pathway to block hypersensitive macrophage signaling in JIA patients without suppressing the immune system.

Presenter: Sidharth Ramesh
Poster Number: 45
Home Institution: University of Pennsylvania
Program: LSSURP
Faculty Mentor: Dr. Timothy Starr
Poster Title: **Single Cell Sequencing As A Prognostic And Predictive Tool For Ovarian Cancer Therapy**

Abstract: Technological advances allow genomic analyses to be conducted at the single cell level. Analysis of gene expression at this detailed level could lead to prognostic and predictive biomarkers along with enhanced understanding of stromal and cancer cell subpopulations including stem cells and chemotherapy resistant populations. This project prospectively studies the transcriptomes of high grade serous ovarian cancer solid tumor samples at the single cell level. We have enrolled 8 patients and begun single cell RNA sequencing the transcriptomes using the 10X Genomics platform. These patients are receiving carboplatin/paclitaxel treatment and will be followed prospectively; their clinical responses will be incorporated into our analyses. Using the platform, we have completed RNA sequencing of five patients. We quantified gene expression on an average of 8,707 cells/patient and 1,723 genes/cell. Using graph-based clustering combined with the t-Distributed Stochastic Neighbor Embedding technique for dimensionality reduction, we identified approximately 9 to 15 subsets of cells within these cancer samples based on analysis of their gene expression patterns. Using bioinformatic tools including CellRanger, Seurat, and Ingenuity Pathway Analysis, we defined several subsets including immune cells, stromal cells and cancer epithelial cells based on known functional markers. We can estimate the frequency of each subset and subdivide the groups using cell-type specific markers. Ultimately, we will correlate presence and percentage of cell subpopulations with clinical outcomes of the patients. Our long-term goal is to use single cell data as a prognostic biomarker for chemotherapy resistance as well as a tool for predicting effective therapeutic options.

Presenter: Emily Reeves
Poster Number: 46
Home Institution: Oberlin College
Program: LSSURP
Faculty Mentor: Dr. Lucy Vulchanova
Research Advisor: Jennifer Cook, Reshma Gore, Maureen Riedl
Poster Title: **Effects of Peripheral Nerve Injury on C3aR1 Expression in the Spinal Cord**

Abstract: Chronic pain is a problem affecting 100 million adults in the U.S., and acute pain due to injury can transition into a chronic state after neuroplasticity has taken place in the spinal cord. VGF is a neuropeptide precursor protein that is upregulated following injury, and our lab has previously found that VGF is involved in neuroplasticity associated with chronic pain. The mechanism of VGF contribution to hypersensitivity after nerve injury is less understood. The VGF-derived peptide TLQP-21 has been found by our lab to contribute to the development and maintenance of neuropathic pain following peripheral nerve injury, and its receptor C3aR1 is a complement receptor associated with the innate immune system. We aimed to investigate C3aR1 in the spinal cord in order to probe how its expression changes following peripheral nerve injury. We hypothesized that C3aR1 expression would increase after injury and change over time. Spared nerve injury (SNI) was performed, and tissue was collected at 3, 14, and 28 days post-SNI. Through immunohistochemistry the C3aR1 receptor was stained, and expression was measured in the dorsal horn of the lumbar spinal cord. All three time points showed an increase of C3aR1 expression in the injured mice compared to the sham controls. The peak increase of C3aR1 expression occurred at 14 days post-SNI. These results indicate that there was an overall increase in C3aR1 signaling post-injury and that this peaks at 14 days post-SNI. Further studies will be focused on how the involvement of C3aR1 signaling changes over time after injury, in addition to probing the mechanism of the receptor's involvement in hypersensitivity following SNI.

Presenter: Isabel Ricke
Poster Number: 47
Home Institution: University of Minnesota - Twin Cities
Program: LSSURP
Faculty Mentor: Dr. Satoshi Ishii
Poster Title: **Impact of Migratory Birds on Water Quality**
Abstract: Geese are known to harbor many bacterial pathogens such as Campylobacter and Arcobacter that are hazardous to human health. As aquatic birds that congregate in large numbers and produce large quantities of fecal material, geese are of great concern to water safety. This study sought to define the impact that migratory geese have on water safety and human health by studying migratory geese at Silver Lake in Rochester, MN. Both culture-dependent and -independent methods were used to analyze genotypes of Campylobacter from water and goose fecal samples collected at Silver Lake. Isolates positive for the Campylobacter flaA gene were sequenced, and a phylogenetic tree was assembled in order to determine how the Campylobacter changed with time. The flaA fragments were also amplified from DNA directly extracted from water and goose fecal samples. These flaA fragments will be sequenced using Next Generation Sequencing in the near future.

Presenter: Esther Rodman
Poster Number: 48
Home Institution: Macalester College
Program: LSSURP
Faculty Mentor: Dr. Lisa Peterson
Research Advisor: Rashi Arora
Poster Title: **Expression Analysis of GSTT1 and EPHX1 in HapMap Cells**
Abstract: 1,3-butadiene (BD) is classified as a known human carcinogen by the National Toxicology Program, based on its link to leukemia in exposed workers and laboratory animal studies. Human exposure occurs through tobacco smoke, car exhaust, and manufacturing of styrene-butadiene rubber. In the body, P450 catalyzes the oxidation of BD into reactive epoxides. These epoxides react with DNA to create DNA adducts, which can lead to mutations and cancer. Detoxification of the epoxide metabolites occurs through conjugation with glutathione, catalyzed by glutathione-S-transferase theta 1 (GSTT1) or through hydrolysis, catalyzed by epoxide hydrolase 1 (EPHX1). The focus of this study is to characterize the role of GSTT1 and EPHX1 in preventing the mutagenicity and toxicity of BD. To accomplish this, 40 human HapMap cell lines from two populations, from Nigeria and Utah, will be selected for high and low expression of each gene. This classification has been done in silico by finding data on GSTT1 expression from the 1000 Genome Database and on EPHX1 expression from work done by Zhang et al (AJHD, 2008). The GSTT1 genotype and gene expression of GSTT1 and EPHX1 will be experimentally determined via PCR and RT-qPCR, respectively, on each of the 40 cell lines. These results will lead to the identification of the role and interaction of GSTT1 and EPHX1 in the metabolism, detoxification, and sensitivity of BD within and between human populations.

Presenter: Yanitza Rodriguez-Gonzalez
Poster Number: 49
Home Institution: University of Puerto Rico - Mayaguez
Program: LSSURP
Faculty Mentor: Dr. Theoden Netoff
Research Advisor: Brenda Ogle
Poster Title: **Studying the Cellular Mechanisms of Epilepsy and Characterization of Neural Stem Organoids**

Abstract: Genetic analyses have discovered many mutations associated with epilepsy, the majority of which are known to be related to synaptic function. However, a mutation in the X-linked gene, protocadherin 19 (PCDH19), is thought to be a calcium-dependent cell-adhesion protein. How this mutation results in epilepsy is not known. The ultimate goal of this study is to understand how PCDH19 affects neuronal activity. The specific goal of the study was to identify differences in neural activity and anatomy between neuronal organoids cultured from normal controls and epileptic patients with PCDH19 mutations. We hypothesized that expression of PCDH19 will be decreased in organoids grown from patients with this mutation and that the activity of the organoids with PCHD19 will be hyper-excitable in response to stimulation with potassium and glutamate. Cells were taken from human subjects, made into pluripotent stem cells and then differentiated and cultured into cerebral organoids. Anatomical changes were studied using histological slices of the organoids labeled with immunohistological staining of PCDH19, PCDH11, and PFAK. The neural activity was measured using calcium imaging. Neural organoids were stimulated using high potassium and glutamate. Results show that PCDH19 has a decrease in activity in patient slides rather than wild type, and PCDH11 remained the same. Glutamate signals were possibly found in calcium transients, future studies will be conducted.

Presenter: Edaris Rodriguez-Izquierdo
Poster Number: 50
Home Institution: University of Puerto Rico - Mayaguez
Program: LSSURP
Faculty Mentor: Dr. Margaret Titus
Poster Title: **A Unique Dictyostelium discoideum Myosin Is Required For Chemotaxis Signaling**

Abstract: Mitogen-activated protein kinases (MAPKs), better known as extracellular-signal regulated kinases (ERKs) and (cAMP) signaling pathways are involved in a variety of cellular processes such as proliferation, and chemotaxis. The activation of adenylyl cyclase is the most complex, involving G-proteins and components of the MAP kinase pathway. A unique Dictyostelium discoideum myosin, myoG that is phylogenetically distinct from unconventional myosins and plays a critical role in cell polarization and chemotaxis. MyoG null mutant cells placed in a cAMP gradient are noticeably round, indicating that they fail to polarize and move randomly when exposed to a chemotactic gradient. The MAP kinase ERK2 plays an important role in the response to the chemoattractant cAMP. It was shown previously that Dictyostelium MAP kinase ERK2 is required for normal activation of adenylyl cyclase and erk2 null cells are aggregation-deficient. These findings suggest MAP kinase ERK2 is rapidly and transiently activated in response to the chemoat-tractant cAMP in the myoG mutants. The goal of this study is see if a chemotaxis mutant (the myoG null mutant) has a defect is ERK2 activation following cAMP stimulation. Analysis of a collection of chemotactic myoG mutants reveals that the mutants are defective in ERK2 activation following cAMP stimulation. This data suggest that myoG is required for ERK2 signal pathway that is requirement for chemotaxis signaling in myoG mutants.

Presenter: Pamela Rodriguez-Vega
Poster Number: 51
Home Institution: University of Puerto Rico - Mayaguez
Program: LSSURP
Faculty Mentor: Dr. Kalpna Gupta
Poster Title: **Mechanism of Mast Cell Nuclear Extracellular Traps**
Abstract:

Sickle cell disease (SCD) is an inherited autosomal recessive blood disorder characterized by inflammation, oxidative stress, ischemia reperfusion injury, hemolysis, vaso-occlusive crises, and pain. Our laboratory has demonstrated earlier that mast cell activation contributes to inflammation and pain in transgenic mice with SCD. We hypothesize that increased inflammation and free heme released during hemolysis activates protein arginine deiminase 4 (PAD4) in mast cells leading to nuclear extracellular trap (NET) formation. We are examining different pathways that activate PAD4 to see which influence downstream signaling and NET formation. We found that co-incubation of mouse skin-derived mast cells with hemin and TNF-α leads to mast cell NET (MCNET) formation. Silencing high-affinity IgE receptor (FCεR1), which stimulates the tyrosine kinase SYK, has no effect on inhibiting TNF-α/hemin induced MCNETs. We used different inhibitors, including GSK484, a PAD4 selective inhibitor, and Imatinib, a c-kit inhibitor, to see their effects on MCNETs. Our results demonstrate that Imatinib reduces the release of TNF-α and GSK484 reduces the formation of traps in activated mast cells from the skin of sickle cell mice.

Presenter: Anne Roffler
Poster Number: 52
Home Institution: Chapman University
Program: LSSURP
Faculty Mentor: Dr. Ameeta Kelekar
Poster Title: **Developing a Novel High Throughput Enzymatic Assay for Malate Dehydrogenase I**
Abstract:

Increased glucose consumption and glycolysis is a hallmark of cancer. The regeneration of NAD^+, an essential cofactor for glycolysis, had been largely attributed to the activity of lactate dehydrogenase (LDH), which converts pyruvate to lactate. However, diversion of glucose for biosynthesis to support proliferation reduces carbon supply to LDH. Thus, cancer cells must rely on alternative pathway/s to replenish NAD^+ for sustaining glycolysis while enabling biomass synthesis. Recent studies from the Kelekar group revealed that cytosolic NAD^+ is also replenished by malate dehydrogenase I (MDH1) through conversion of oxaloacetate to malate. As proliferating cancer cells rely on both LDH and MDH1 activity, inhibition of both enzymes promises to be an effective therapeutic approach against these cancers. To identify synthetic inhibitors that are highly specific to MDH1, and not MDH2, a novel and sensitive high throughput assay was developed to measure MDH1 activity. The assay cocktail contains oxaloacetate and NADH, the two substrates for MDH activity, and either *in vitro* translated FLAG-tagged MDH1 or purified human recombinant MDH1 or MDH2. The readout for activity is oxidation of NADH to NAD^+, measured by loss of absorbance at 340 nm over time. Substrate concentrations were optimized through extensive Michaelis-Menten kinetics while enzyme concentration and incubation time were adjusted through kinetic concentration gradients. The results of this study will lay the foundation for a high throughput screen for small molecule MDH1 inhibitors that can potentially be administered in combination with LDH inhibition to prevent tumor progression.

Presenter: Robert Rosenblatt
Poster Number: 53
Home Institution: University of Albany
Program: LSSURP
Faculty Mentor: Dr. Anja Bielinsky
Poster Title: **CDC45 Knockout using CRISPR/Cas9**
Abstract:

CDC45 is part of the CDC45:Mcm2-7:GINS (CMG) helicase complex required for DNA replication. It interacts with several other replication factors, including the minichromosome maintenance 10 (MCM10) protein. MCM10 is essential and involved in helicase activation. A ~50% decrease in MCM10 due to the ablation of one of the two copies of the gene has been previously shown to cause telomere erosion in transformed cell lines, leading to cell death. Therefore, establishing the exact mechanism by which telomere shortening occurs is of key importance. The goal of this project was to generate a heterozygous CDC45+/- cell line to determine if the telomere erosion phenotype of MCM10+/- cells can be mimicked. A comparison between the two cell lines will allow us to assess if telomere maintenance is only reliant on MCM10 or on other replication proteins as well. Utilizing the CRISPR/Cas9 knockout system, we knocked out one allele of CDC45, and then planned to use TRF (Telomere Restriction Fragment) analysis to determine whether the heterozygous CDC45 cell line also displays short telomeres. Regardless of the outcome, this comparison will be informative. If a set of proteins or the MCM10 protein alone is established as the cause of telomere erosion in transformed cells, an effective protein inhibitor could be developed that may work to override telomerase activity in cancer cells, thus driving these cells to killing themselves.

Presenter: Mario Soto-Soto
Poster Number: 54
Home Institution: University of Puerto Rico - Mayaguez
Program: LSSURP
Faculty Mentor: Dr. Robert Tranquillo
Poster Title: **Effect of fibrin source on development of tissue engineered vascular graft.**
Abstract:

Understanding interactions of the human body with biomaterials is key to experimental design in tissue engineered vascular grafts. Fibrin is currently used as scaffold material for vascular graft modeling. The fibrin molecule is biodegradable and suitable for cell remodeling. Human fibrin and bovine fibrin are placed under analysis in this experiment for the first time in our lab to compare biochemical and mechanical properties that are of importance for blood vessel construction. Preliminary data indicates positive biochemical and mechanical properties in vitro for bovine fibrin. Cell viability is observed in constructs with bovine fibrin and human dermal fibroblast. Human fibrin (Baxter) is used to build a similar construct to the bovine model. The human model exhibits same biochemical and mechanical properties at the initial phase, without cells in matrix. When cells were added to the human bovine construct, a decrease in vessel length was observed continuously from day 3 to day 14 of incubation. The fibrin model of bovine construct remained stable exhibiting an increase in cell density. Vascular like anatomical features were observed in the bovine model but not in the human model. In contrast, an increase of collagen production by the cells was observed in the human fibrin scaffold. Optimal tensile strength, maximum tension and membrane stiffness favored the human fibrin construct over the bovine. Vessel shrinking is attributed to the fact that cells produce more collagen in the human construct. New protocols are being established in order to develop blood vessels using human fibrin while conserving native anatomical features.

Presenter: Sarah St. Pierre
Poster Number: 55
Home Institution: Worchester Polytechnic Institute
Program: LSSURP
Faculty Mentor: Dr. Victor Barocas
Research Advisor: Julia Quindlen
Poster Title: **A Finite-Element Model of Wave Transmission and Vibrotactile Sensing in the Finger**

Abstract: The Pacinian corpuscle (PC) is known to play a central role in vibrotactile sensing, but the detailed mechanical and neurological response of the finger to vibratory surface stimuli, mediated by the PCs, has yet to be completely modeled. I created a 3D finite element (FE) model of the human finger comprised of layers for the epidermis, dermis, subcutaneous and bone. Then, I embedded PCs in anatomically correct locations within the model. Finally, I devised numerical experiments to test the output of my model to various stimuli both with and without incorporating PCs and compared my results to several published studies. My model closely replicates the behavior of a human finger as demonstrated by displacement patterns similar to human experimental and validated model publications. I have determined that the inclusion of multiple layers of skin, notably the epidermis, affects the results of the model. As such, a 3D FE model with accurate mechanical properties and a complex view of the finger is necessary to improve models of the PC. This research presents a novel model of multiple PCs in a 3D FE finger analogue that can replicate and demonstrate the correct response of the PCs and the finger to stimuli.

Presenter: Helen Streff
Poster Number: 56
Home Institution: University of Notre Dame
Program: LSSURP
Faculty Mentor: Dr. Scott Dehm
Poster Title: **Inhibition of the Androgen Receptor N-terminal Domain in Castration-Resistant Prostate Cancer**

Abstract: Prostate cancer claims 26,000 American lives each year despite its 99% 5-year survival rate. The androgen receptor (AR) acts as an important transcription factor in prostate cancer. Thus, therapies for metastatic prostate cancer typically aim to inhibit the AR through chemical androgen deprivation. However, androgen deprivation is not curative because prostate cancer cells can become resistant to such therapies and progress to castration-resistant prostate cancer (CRPC). In CRPC, AR alternative splicing occurs, giving rise to AR variants that lack the ligand binding domain (LBD). Because these AR variants retain the transcriptionally active N-terminal domain (NTD), inhibiting the AR NTD may be a more promising approach for developing new therapeutics. A high-throughput screen of 100,353 compounds led to the identification of four potential inhibitors of the AR NTD. Cell growth inhibition by these compounds was tested using crystal violet and soft colony formation assays on two prostate cancer cell lines which are driven by the AR or AR splice variants (LNCaP and 22Rv1, respectively). As controls, we tested two prostate cancer cell lines that lack expression of the AR (PC-3 and DU145). The results indicated that three of these compounds successfully target the AR, most likely through inhibition of the NTD. Additional studies are warranted to characterize the AR NTD specificity of these compounds, which could lead to new therapies that improve the lives of men with advanced CRPC.

Presenter: Aidan Tirpack
Poster Number: 57
Home Institution: Macalester College
Program: LSSURP
Faculty Mentor: Dr. Craig Henke
Research Advisor: Jeremy Herrera
Poster Title: **Determining Hyaluronan's Effect On Idiopathic Pulmonary Fibrosis**

Abstract: Idiopathic Pulmonary Fibrosis (IPF) is a progressive lung disease of unknown cause with few treatment options. It has a prevalence of one million people worldwide. IPF is defined by the accumulation of extracellular matrix (ECM) within the lung that leads to patient death by asphyxiation. It has been previously reported that when fibroblasts are cultured on decellularized IPF-ECM, ECM synthesis is activated through the deregulation of microRNA-29 (a master negative regulator of ECM synthesis). We also show that this deregulation is due to Dicer1 (a key regulator of microRNA processing machinery) suppression in IPF. Left unanswered is the mechanism by which IPF ECM regulates Dicer1 expression. Hyaluronan (HA) is a hydrating, space filling polymer that is involved with inflammation and wound healing within the ECM. HA has been reported to be upregulated in IPF, and HA has been shown to upregulate fibroblast collagen synthesis both in vitro and in vivo. However, the direct link between HA and Dicer1 has not yet been described. To determine if HA has an effect on Dicer1 we will be treating fibroblasts in cell culture with various forms of HA under multiple conditions. We hypothesize that with an increase in HA there will be a decrease in Dicer1 expression. If this is the case, this could lead to new treatment of IPF.

Presenter: Valeria Torres-Irizarry
Poster Number: 58
Home Institution: University of Puerto Rico - Cayey
Program: LSSURP
Faculty Mentor: Dr. Deepali Sachdev
Research Advisor: Katelyn Hoff, Matthew Martien
Poster Title: **Characterization Of A Novel In Vivo Model Of Tamoxifen-Resistant Breast Cancer**

Abstract: The most common type of breast cancer diagnosed in the United States is estrogen receptor positive (ER+). ER+ patients are treated with anti-hormonal therapies such as the selective estrogen receptor modulator (SERM) tamoxifen, which inhibits the effect ER. Nearly 1/3 of these patients develop resistance to hormonal therapies and recur. ER and the type I insulin-like growth factor receptor (IGF1R) signaling pathways communicate and work together to stimulate growth of breast cancer cells. Drugs targeting IGF1R and IR may work as treatment for resistant cancer cells. However, initial trials with IGF1R drugs indicated a paucity of preclinical models of endocrine resistant breast cancers. To develop more clinically relevant models to study new drug combinations for ER+ patients and understand the mechanism of resistance to tamoxifen, we previously developed and characterized an in vitro model of acquired tamoxifen resistance by culturing ER+ breast cancer cell line MCF-7L in increasing concentrations of tamoxifen (MCF-7L TamR cells). In this study, we developed an in vivo model of tamoxifen resistance by growing MCF-7L TamR cells as xenograft tumor in the presence of tamoxifen but not estradiol. The in vivo tamoxifen resistant line, c287m1 MCF-7L-TamR, was established from the MCF-7L TamR tumor following continued tamoxifen resistance in vivo for 100 days. Herein, this line was characterized for continued resistance to tamoxifen, IGF/insulin signaling, and ER regulated gene expression. We found that MCF-7L TamR xenograft tumor as well as the in vivo tamoxifen resistant line, C287m1 MCF-7LTamR, maintained loss of IGF1R expression as measured by quantitative reverse transcription PCR (qRT-PCR) and western blotting. In vivo tam resistant cell line also maintained resistance to tamoxifen and signaling by insulin but not IGF-I, We aim to create a new in vivo model of tamoxifen resistance where targeted therapies can be developed for tamoxifen resistant ER+ breast cancer so it can be successfully treated.

Presenter: Jesus Vazquez
Poster Number: 59
Home Institution: University of New Mexico
Program: LSSURP
Faculty Mentor: Dr. Neil Anderson
Poster Title: **Stem Width, Dry Weight, And Chlorophyll Level Differences In *Brassica juncea* And *B. Oleracea* In Sodium Chloride**

Abstract: High salinity in soil negatively affects the production of food crops in agriculture. Hydroponics, the culture of plants in nutrient-enhanced water without soil, can alleviate the adverse effects of high salinity on the ground as well as other issues, by offering a better control environment. The objective of this research is to understand the effects of sodium chloride in plants grown hydroponically to access the possibility of using waste water from breweries and creameries in hydroponic systems. This experiment assesses the relative growth of stems, plant height, leaf number, and chlorophyll levels in Kale (*B. oleracea*) and mustard greens (*B. juncea*) grown in different concentrations of sodium chloride in hydroponics. Four different hydroponic systems were used, each one containing different concentrations of NaCl: 0 ppm, 50 ppm, 100 ppm and 200 ppm for two trials; and 0 ppm, 200 ppm, 400 ppm and 800 ppm for two additional trials. All systems contained the same basic nutrient solution for hydroponics. Dry weight differences were present when mustard greens were exposed to 800 ppm of NaCI. At this level, mustard greens were significantly 0.33 grams heavier than mustard greens exposed to only 100 ppm of NaCI.

Presenter: Esther Vega-Quiñones
Poster Number: 60
Home Institution: University of Puerto Rico - Arecibo
Program: LSSURP
Faculty Mentor: Dr. Maxim Cheeran
Research Advisor: Venkatramana D. Krishna, Walter C. Low, Ling Li
Poster Title: **Effects of M2 Macrophages on Neuroinflammation and Neurogenesis in Aged APP/PS1 Mice**

Abstract: Alzheimer's disease (AD) is a debilitating neurodegenerative disorder resulting from neuroinflammation and accumulation of amyloid-β plaques and neurofibrillary tangles. Alternatively activated (M2) macrophages/microglia have been shown to impart neuroprotective effects by reducing amyloid-β induced inflammation. In addition, previous studies in the laboratory have shown that M2 macrophages enhance neurogenesis in mice. In the present study, we examined whether adoptive transfer of M2 macrophages decreased inflammation and increased neurogenesis in a transgenic murine model of AD (APP/PS1). Through random assignment, 7-8 month-old mice received either M2 macrophages or saline via intra-peritoneal injection, 3 times/week for 6 weeks. After M2 macrophage treatment, changes in inflammatory cell phenotypes and gene expression will be analyzed. The frequencies of macrophage activation phenotypes in the brain will be determined by flow cytometry and gene expression by RT-PCR. We hypothesize that adoptive transfer of M2 macrophages in aged mice decreases neuroinflammation and associated amyloid-β plaque accumulation in the brain of aged mice. In addition, M2 macrophages are expected to increase neurogenesis by increasing neural stem cell numbers and inducing differentiation into neurons. Understanding the role of M2 macrophage on neuroinflammation and neurogenesis could result in developing new treatments to decrease the effects of Alzheimer's Disease.

Presenter: Loren Weber
Poster Number: 61
Home Institution: Berea College
Program: LSSURP
Faculty Mentor: Dr. Julie Grossman
Research Advisor: Vivian Wauters
Poster Title: **The Changes in Labile Carbon Before and During Summer Cover Crop Growth**
Abstract: An assessment of soil carbon dynamics during summer cover crop growth, via comparison of the levels of labile carbon before cover crop planting and after 36 days of cover crop growth with four different treatments and two bare controls. Four replications were grown on Calafarm in Turtle Lake, WI with each of the following treatments: 1) chickling vetch and sorghum-sudangrass, 2) cowpea and sorghum sudangrass, 3) sunn hemp, 4) buckwheat, 5)two bare controls. Soil samples from each treatment were measured for active carbon using POX-C lab assay, in which potassium permanganate oxidizes the active carbon in dry soils. Labile carbon levels at cover crop planting (0 day) were found to be significantly different compared to labile carbon levels during the summer cover crop growth (36 days). The data showed a significant difference in labile carbon levels between the four replications, while there was no significant difference between treatments. Based on these sampling time points labile carbon levels appear to be more affected by management or seasonal factor than by cover crop growth.

Presenter: Amelia Windorski
Poster Number: 62
Home Institution: Smith College
Program: LSSURP
Faculty Mentor: Dr. Patrick Rothwell
Poster Title: **Establishing Sensitization to Oxycodone in Wild Type Mice**
Abstract: Oxycodone addiction impacts thousands of individuals who become sensitized to the motivational effects of drugs. Underlying this enhanced motivation are changes to the reward system. In mice, locomotor sensitization is a proxy for observing the underlying changes to the reward system. The goal of this research was to determine how different methods of administration impact oxycodone sensitization. Cohort A was administered oxycodone (0 mg/kg, 2.0 mg/kg, 6.32 mg/kg, and 20 mg/kg) via subcutaneous injection once per day for seven days. Cohort B was implanted with oxycodone (0 mg/kg, 6.32 mg/kg, 20 mg/kg, and 45 mg/kg) Alzet pumps. On days one and seven all mice were tested for analgesia and locomotion. After 13 days of withdrawal, mice from all groups were challenged with saline, followed by increasing doses of oxycodone. Mice on intermittent oxycodone exhibited locomotor sensitization on day 7 ($p < 0.0001$) while mice on continuous oxycodone did not. Mice on 20 mg/kg/day of intermittent oxycodone exhibited locomotor sensitization ($p < 0.019$) that extended after withdrawal. The project showed that locomotor sensitization to oxycodone occurs with higher doses of intermittent oxycodone and can persist over time. Sensitization, resulting in changes to the brain reward system, reflects a biological process that contributes to addiction. Administration that does not lead to sensitization may render individuals less likely to abuse opioids.