Poster Title: Aphid Defense Strategies toward Parasitic Wasps

Your Name: Mattea Allert

Home institution: University of Wisconsin - Platteville

Research Program: LSSURP

Faculty mentor: Dr. George Heimpel

Grad student or post-doc mentor(s): Matt Kaiser

Department of Faculty Mentor: Entomology

Abstract:

Interactions between parasitic organisms and their hosts play an integral part in our understanding of ecology. The questions asked were whether an aphid could in fact induce higher mortality in a parasitoid wasp, if this effect could spill over to offer protection to other aphid species living on the same plant, and what mechanisms could cause parasitoid mortality. We tested the effects of *Myzocallis asclepiadis* on *Lysiphlebus testaceipes*, a native aphid parasitoid. *L. testaceipes* adults kept in the presence of *M. asclepiadis* died within twenty-four hours significantly more frequently than when with Aphis asclepiadis, a less defended aphid that is readily attacked by *L. testaciepes*. When *M. asclepiadis* and *A. asclepiadis* were paired together they also killed the wasp within twenty-four hours. Potential mechanisms by which *M. asclepiadis* kills parasitoids are still being researched. It is crucial to understand these complex relationships to fully understand the parasite and host relationships.

Poster Title: Equipping *Salmonella* with Specific Cytokines to Combat Cancer

Your Name: Yosef Assefa

Home Institution: University of Minnesota

Research Program: LSSURP

Faculty mentor(s): Dr. Lance Augustin and Dr. Janet Schottel

Grad student or post-doc mentor(s): Mike Mertensotto

Department of Faculty Mentors: Surgery & Biochemistry, Molecular Biology & Biophysics

Abstract:

Previous research has shown that *Salmonella enterica* can invade and proliferate within hypoxic areas in tumors and thereby avoid phagocytosis by the host immune system. In addition, *S. enterica* has been engineered to express various cytokines that can stimulate the immune system and potentially be used as a targeted anti-tumor therapy. The purpose of my research is to use Western blots to demonstrate that the *S. enterica* strains containing cloned mouse cytokine cDNAs produce these proteins. Soluble, insoluble and secreted protein fractions were isolated from cultures of the *S. enterica* strains. The results show production of soluble and insoluble forms of mIL12 and mTRAIL, but no production of the GMCSF cytokine. In the case of the mIL12 and mTRAIL constructs, no secreted protein was observed. Expression of soluble and secreted cytokines in *S. enterica* will be important for future testing in animal models of cancer.

Poster Title: Using Genome-Wide RNAi Screen For Genes Involved In Neuronal Transport And Development In *Drosophila melanogaster*

Your Name: Nicholas Backes

Home institution: Minnesota State University, Mankato

Research Program: LSSURP

Faculty mentor: Dr. Thomas S. Hays

Grad student or post-doc mentor(s): Dr. Min-gang Li, Jerid Robinson

Department of Faculty Mentor: Genetics, Cell Biology, and Development

Abstract:

Drosophila melanogaster is an effective model organism for studies of neuronal transport and its role in neurodegenerative disease. The transport of synaptic vesicles, receptors and ion channels by the microtubule motors dynein and kinesin is essential for neuronal function and survival. Mutations occurring in genes affecting transport can result in synaptic dysfunction, posterior paralysis, and a characteristic “tail flip” phenotype. To identify genes encoding

transport components and regulatory factors, we conducted an RNAi whole genome screen to selectively silence genes in neurons and neuroglial support cells. Following RNAi silencing of 890 separate genes, we scored for lethality and the "tail flip" phenotype in third instar larvae. We discovered 22 genes that gave rise to the "tail flip" phenotype and another 150 genes whose expression in neurons and neuroglia are essential for development. These results will direct future screens and provide guidance for the mechanistic analysis of neuronal transport.

Poster Title: Effects of Talin Ferm Domain Over Expression on Adhesion in Wild Type *Dictyostelium discoideum* Cells

Your Name: Allison Bakovic

Home institution: Milwaukee School of Engineering

Research Program: LSSURP

Faculty mentor: Dr. Margaret Titus

Grad student or post-doc mentor(s): N/A

Department of Faculty Mentor: Genetics, Cell Biology, and Development

Abstract:

Cellular adhesion is the binding of cells to surfaces, so that amoeboid cells of the immune system can migrate to their targets. Talin is a cytoskeletal protein that contributes to adhesion and contains a FERM domain, which binds to cytoplasmic tails of adhesion receptors. The function of the FERM domain alone was investigated in *Dictyostelium* amoeba. Wild type cells expressing either GFP-talin FERM domain (ptalA34-4) or GFP-F2-F3 (the C-terminus of the FERM domain; ptalA43) were tested for adhesion defects. A standard adhesion assay showed that wild type cells had an average percent detachment of 32.5% and ptalA34 had 61.2%. PtalA43 cell line had a greater percent detachment at 80.1%. Similar results were observed in a phagocytosis assay as the mutants were unable to bind particles. The results suggest that F2 and F3 are sufficient to inhibit adhesion among cells.

Poster Title: Transgenerational Effects of Perinatal Iron Deficiency on

Gene Expression in the Developing Rat Hippocampus

Your Name: Mariah Blegen

Home institution: Macalester College

Research Program: LSSURP

Faculty mentor: Dr. Michael Georgieff

Grad student or post-doc mentor(s): Dr. Phu Tran

Department of Faculty Mentor: Pediatrics

Abstract:

Early-life iron deficiency (ID) induces changes in expression of key genes underlying learning and memory in spite of rapid iron treatment. Epigenetic reprogramming of these key genes may account for the long-term repression from early ID. Given that early ID occurs during critical periods in both hippocampal and gonadal development, these epigenetic changes could be transmitted to the following generation, as is seen in other models of early-life adversity. To test this possibility, we evaluated gene expression in the offspring of formerly-iron-deficient (FID) rats. We compared hippocampal mRNA levels of key factors at postnatal day 15. We found that whereas FID rats showed down-regulation of genes associated with learning and memory, their iron-sufficient offspring showed an unexpected upregulation of these genes compared to the offspring of control rats. These results suggest a reversal of adverse effects of early ID and epigenetic modifications in the offspring of FID rats.

Poster Title: The Potential of *Toxomerus marginatus* for the Supression of the Invasive Soybean Aphid (*Aphis glycines*)

Your Name: Colin Borsh

Home institution: Carleton College

Research Program: LSSURP

Faculty mentor: Dr. Gregg Johnson

Grad student or post-doc mentor(s): Jim Eckberg

Department of Faculty Mentor: Agronomy & Plant Genetics

Abstract:

Toxomerus marginatus has potential as an agricultural biocontrol agent, but the existing studies and information on it are very limited. We tracked the life stage time periods and aphid consuming capacity of larval *T.marginatus* raised in a lab setting and fed on soybean aphids (*Aphis glycines* Matsumura). Consumption was used to evaluate the efficacy of *T.marginatus* as a biocontrol for the soybean aphid. Eggs were collected from captured wild *T.marginatus* larvae and, once hatched, fed second-instar aphids daily. Daily observations were made in order to track changes in syrphid life stages as well as daily aphid consumption. A second study was performed comparing *T.marginatus's* capacity for consuming *Aphis glycines* to its capacity for consuming two other aphid species, *Aphis nerii* and *Aphis monarda*. This study indicates *T.marginatus* has strong potential as a biocontrol for *Aphis glycines*.

Poster Title: Decellularized Scaffolding and Microneedle Arrays: New Tools for Treating the Debilitating Blistering Disease Epidermolysis Bullosa

Your Name: Beatrice Brumley

Home institution: Macalester College

Research Program: LSSURP

Faculty mentor: Dr. Jakub Tolar

Grad student or post-doc mentor(s): Nicole Skinner, Scott Warren

Department of Faculty Mentor: Pediatrics, Bone Marrow Transplantation

Abstract:

Loss-of-function mutations in the gene (COL7A1) encoding collagen type VII (C7), the major component of anchoring fibrils linking the epidermis and dermis in the skin, cause the loss of skin integrity associated with the genetic blistering disease, recessive dystrophic epidermolysis bullosa (RDEB). Although no cure for RDEB exists at present, therapies involving implantation of autologous, C7-producing

cells directly into the skin may provide therapeutic benefit. To demonstrate the applicability of microneedle injection of such cells into native or decellularized skin, we injected athymic, hairless mice with multipotent adult progenitor cells (MAPCs) and found a greater delivery dose, proliferation, and persistence of cells in subcutaneously-injected mice versus mice injected with a microneedle. To enhance cell transfer, we prepared cell-free matrices of native skin by submerging tissue in decellularizing reagents. To create functional tissue, the optimized microneedle delivery was used to recellularize the skin with C7-producing keratinocytes and fibroblasts. Autologously recellularized skin tissue may provide a less immunogenic source of material for skin grafts to treat the severe blistering of RDEB.

Title: Caffeine with your toast? Caffeine synthesis in *S. cerevisiae*

Name: Chung-Yun (George) Chao

Institution: University of Minnesota – Twin Cities

Research Program: LSSURP

Faculty Mentor: Dr. Jeff Gralnick

Graduate/Post-doc mentor: Dana Morrone

Department of Faculty Mentor: Biotechnology Institute

Abstract:

Contemporary trends in industrial synthesis of chemical compounds have shifted towards biological synthesis over traditional laboratory synthesis. Benefits include reduced cost, high efficiency, and minimization of hazardous reagents or waste. However, the difficulty of constructing complex, multi-step synthesis pathways in organisms continues to present a serious challenge. To simplify the pathway construction process, we introduced the four step caffeine synthesis pathway found in *Coffea arabica* into *S. cerevisiae* through building a de novo hybrid expression plasmid and modifying DXMT1 and XMT1 (the two enzymes responsible for caffeine synthesis) for use in *S. cerevisiae*. Throughout the process of inducing caffeine induction in *S. cerevisiae*, we developed several BioBrick compliant tools for future iGEM teams,

including a BioBrick hybrid expression plasmid backbone, protocols for overlap extension and Gibson as well as a software tool for gene optimization for *S. cerevisiae* in the hopes of simplifying similar endeavors in the future.

Poster Title: Examining the Functionality of the Mtr Pathway in *Vibrio parahaemolyticus* and *Aeromonas hydrophila hydrophila* Using *Shewanella oneidensis*.

Your Name: Ryan Chavez

Home institution: Coe College

Research Program: LSSURP

Faculty mentor: Dr. Jeffrey Gralnick

Grad student or post-doc mentor(s): Dr. Evan Brutinel

Department of Faculty Mentor: Microbiology and Biotechnology Institute

Abstract:

Shewanella oneidensis is a facultative anaerobe which utilizes the Mtr pathway to "breathe" a wide range of organic and inorganic substances, including Fe(III). Two pathogenic species, *Vibrio parahaemolyticus*, and *Aeromonas hydrophila hydrophila*, have genes that appear to be orthologous to mtr genes in *S. oneidensis*, and we wished to determine if these genes functionally complemented the corresponding mtr genes in *S. oneidensis*. Two strains of *S. oneidensis* with a deletion of the mtrB or mtrC gene were transformed with plasmids containing functional copies of the mtrB or mtrC genes from *V. parahaemolyticus* and *A. hydrophila hydrophila*. The transformants were tested for gene functionality by using an iron-reduction assay. If the genes do complement the pathway, further experiments could be done based on the hypothesis that *V. parahaemolyticus* and *A. hydrophila hydrophila* use these genes, and possibly their own variation of the Mtr pathway, in a similar fashion as *S. oneidensis*.

Poster Title: Green Carbon Capture By Reversing Metabolic Reaction

Pathway With Highly Stable Immobilized Enzymes

Your Name: Justine Cherwink
Home institution: University of Minnesota – Twin Cities

Research Program: LSSURP

Faculty mentor: Dr. Ping Wang

Grad student or post-doc mentor(s): Shunxiang Xia

Department of Faculty Mentor: Bioproducts and Biosystems Engineering; Biotechnology Institute

Abstract:

Biocatalytic processes have both economic and environmental advantages in chemical processing industry. We assume in this project, energy-efficient carbon capture is attainable by shifting thermodynamic equilibrium of a reversed metabolic reaction pathway. In this study we first analyzed the equilibrium thermodynamics of the carboxylation reaction of alpha-ketoglutarate in accordance with Debye–Hückel theory. Results indicated that the reaction favored high ionic strengths, elevated temperatures, and near-neutral pH. Next, we employed enzyme immobilization techniques to seek enzyme stabilization against non-native reaction conditions. Among a few different methods tested, including sol-gel immobilization and nylon entrapment, adsorption onto aminopropyl silica gel showed the most promise in achieving high enzyme activity. Our data shows that the fixation of CO_2 is feasible by carrying out biochemical reactions at ideal thermodynamic conditions. Future investigation is needed to enhance enzyme stability and performance such that carbon capture is eventually viable at industrial scale.

Poster Title: Characterization of Flowering-time Genes in *Thlaspi Arvense L.*

Your Name: Duc Dang

Home institution: Penn State University

Research Program: LSSURP

Faculty mentor: Dr. David M. Marks

Grad student or post-doc mentor(s): Kevin Dorn

Department of Faculty Mentor: Plant Biology

Abstract:

Pennycress (*Thalspi Arvense L.),* a common agricultural weed in the US, has a potential of becoming a promising non-food biofuel feedstock. Recent research has shown that Pennycress can be developed into a winter cover crop in a double-cropping system with soybean, optimizing land use during winter, providing another source of earning thanks to its high oil-content seeds, and naturally controlling spring weed growth. The goal of our research is to characterize the flowering and vernalization pathways in Pennycress by studying the highly characterized genes responsible for the same molecular mechanism in *Arabidopsis thaliana*, a closely related model species. The Pennycress homologs were cloned and the expression profile of them in various tissues at different developmental stages will be assayed via qPCR. This research will build a foundation for future genetic manipulation of the key genes regulating flowering time in Pennycress to develop fast maturing lines for use in the field.

Poster Title: Emergence of Multicellular Novelty

Your Name: Chelsea Du Fresne

Home institution: University of MN- Twin Cities

Research Program: LSSURP

Faculty mentor: Dr. Michael Travisano

Grad student or post-doc mentor(s): William C. Ratcliff

Department of Faculty Mentor: Ecology, Evolution & Behavior

Abstract:

The origin of novelty is a central question in evolution

biology. Previously we observed the de novo evolution of multicellularity in *Saccharomyces cerevisiae* as a consequence of selection for fast settling through liquid media, experimentally demonstrating a major evolutionary transition. Here we investigated if this transition promoted subsequent adaptations. Populations of clonally-related multicellular *S. cerevisiae* were subjected to daily selection for fast settling. This selection was applied on a gradient, ranging from zero to 300 seconds of settling by group. Adaptation to this selection regime was not uniform across lineages. Specifically, one lineage evolved an extreme phenotype, settling at a rate 47% faster than the mean for all lineages. This dramatic increase in settling does not occur as a consequence of increased body size, unlike all previous responses to selection. Instead, the lineage evolved a more hydrodynamic shape to settle faster. This biological novelty establishes a new dimension for selection.

Poster Title: The Localization of Three Clasp-N Related Proteins During Conjugation in *Tetrahymena thermophila*

Your Name: Erik Emanuelson

Home institution: St. Olaf College

Research Program: LSSURP

Faculty mentor: Dr. Daniel Romero

Grad student or post-doc mentor(s): N/A

Department of Faculty Mentor: Pharmacology

Abstract:

Microtubules are essential cytoskeletal components that are critical for a variety of cellular functions, including intracellular transport and nuclear dynamics. The ciliated protozoan *Tetrahymena thermophila* is an excellent model organism to study microtubule dynamics throughout the cell cycle and during development. We have identified three putative *Tetrahymena* CLASPs, a class of microtubule-associated proteins associated with the growing tips of microtubules that are required for proper microtubule positioning. The three putative

CLASPs all exhibit peak expression during meiosis in cells undergoing conjugation. We have tagged the N-terminus of the three proteins with Green Fluorescent Protein (GFP) and/or Red Fluorescent Protein (RFP) in order to determine their intracellular localization during conjugation. The simultaneous expression of two differentially labeled CLASPs during conjugation will also make it possible to observe the degree to which they co-localize, possibly revealing their association and possible role(s) during this stage of development.

Poster Title: Time To Target Temperature In Post-Resuscitation Therapeutic Hypothermia: Effect On Neurological Outcome

Your Name: Heather Estby

Home institution: Vanderbilt University

Research Program: LSSURP

Faculty mentor: Dr. Demetris Yannopoulos

Grad student or post-doc mentor(s): N/A

Department of Faculty Mentor: Medicine Cardiology

Abstract:

As our society's number one killer, sudden cardiac arrest not only causes over 300,000 deaths annually, but it also often leaves those who survive with sustained neurological damage after resuscitation. Past studies have shown that reducing core body temperature with therapeutic hypothermia after cardiac arrest can decrease this damage and improve patient outcomes. It was hypothesized that reaching the target hypothermic temperature earlier after resuscitation would be correlated with improved neurological function. To test this we induced mild hypothermia in swine models of prolonged cardiac arrest. Comparing scores of neurological function with time to target temperature, our results indicate that within thirty minutes after return of spontaneous circulation, achieving target temperature earlier had no significant correlation with improved neurological outcome. This suggests that in cases of cardiac arrest, physicians do not need to cool immediately after resuscitation and can instead focus on stabilizing the patient before inducing therapeutic hypothermia.

Poster Title: Genome Wide Association Study (GWAS) of Equine Recurrent Uveitis in Appaloosas

Your Name: Leah Freilich

Home institution: Macalester College

Research Program: LSSURP

Faculty mentor: Dr. Molly McCue

Grad student or post-doc mentor(s): Dr. Nichol Schultz, Dr. Annette McCoy

Department of Faculty Mentor: Veterinary Population Medicine

Abstract:

Equine recurrent uveitis (ERU) is a chronic, autoinflammatory disease of the uveal tract and one of the leading causes of blindness in North American horses, especially in Appaloosas. Preliminary data by Fritz et al in 2011 showed an association between two regions of the genome and incidence of ERU; on ECA1 within the TRPM1 gene, involved in Appaloosa coat coloring, and on ECA20 within the major histocompatibility complex, involved with immunity. To confirm and narrow these two regions as well as identify any other regions associated with disease, we ran a genome wide association study (GWAS) using about 65,000 reliable single nucleotide polymorphisms (SNPs) throughout the equine genome using a case-control design with Appaloosa DNA samples. Preliminary statistical analyses of the data have returned genome wide significant hits on regions of ECA11 and ECA1 as well as a single significant SNP on ECA31. Further haplotypic analysis is currently underway.

Poster Title: Characterization of Novel Protein Complexes that Facilitate Metabolic Reprogramming in Cancers

Your Name: Ryan Graff

Home institution: Wesleyan University

Research Program: LSSURP

Faculty mentor: Dr. Ameeta Kelekar

Grad student or post-doc mentor(s): N/A

Department of Faculty Mentor: Laboratory Medicine and Pathology and Masonic Cancer Center

Abstract:

Altered metabolism plays a major role in the ability of cancer cells to proliferate indefinitely. This alteration diverts glucose flux through the pentose phosphate pathway, increasing nucleotide synthesis and antioxidant production (for cell proliferation and oxidative stress control, respectively). Although this pathway is well understood, it is not known how cancer cells select for this metabolic rearrangement. Here we explore the contribution of two novel protein complexes to altered glucose metabolism in human leukemia cells. These complexes share a core component comprising the glycolytic enzyme GAPDH and two Bcl-2 proteins known to regulate apoptosis in leukemias in response to glucose stress. We are investigating ways in which these complexes and their components respond to glucose deprivation. Early studies indicate that glucose stress alters both the levels and the make-up of each complex. This supports the current hypothesis that the complexes are involved in the characteristic metabolic reprogramming of hematopoietic cancers.

Poster Title: Perforin Expression in Lymph Node Tissues of HIV Positive Individuals

Your Name: Mira Hager

Home institution: Macalester College

Research Program: LSSURP

Faculty mentor: Dr. Pamela Skinner

Grad student or post-doc mentor(s): Reece Wagstaff (Lab Staff)

Department of Faculty Mentor: Veterinary Biosciences

Abstract:

Under viral infection, CD8+ T cells utilize perforin to initiate the process

of apoptosis within target cells. Thus, understanding the expression patterns of perforin is relevant to a greater understanding of the immune systems's response and failure to prevent permanent infection in the case of HIV. Working in this vein, lymph nodes of HIV+ individuals were analyzed for HIV-specific CD8+ T cell and perforin co-staining. In situ tetramer staining allowed visualization of HIV-specific CD8+ T cells while antibody staining allowed visualization of perforin. Tissues were imaged using confocal microscopy and tetramer+ cells were analyzed individually for the quantity and localization of intracellular perforin. 47% of HIV-specific CD8+ T cells were found to contain perforin which was polarized to one side of the cell in 2% of cells and limited to the membrane in 9%. This offers a baseline for perforin expression in individuals with chronic HIV infection.

Poster Title: Defining Temporal and Spatial Enhancer Elements in the *C. elegans* mir-48/mir-241 Locus

Your Name: Dianarys Hernandez-Aquino

Home institution: University of Puerto Rico - Arecibo

Research Program: LSSURP

Faculty mentor: Dr. Ann Rougvie
Grad student or post-doc mentor(s): Tamar Resnick

Department of Faculty Mentor: Genetics, Cell Biology and Development

Abstract:

C. elegans is a powerful model organism for the study of genetics and developmental biology. It was in this nematode that microRNAs (miRNAs) were discovered. miRNAs are small RNA molecules that work as post-transcriptional negative regulators. mir-48/mir-241 are co-transcribed miRNAs that play important roles in the control of developmental timing in *C.elegans*, and they are members of a miRNA family conserved in humans. Our research focuses on identifying enhancer elements required for full function and expression of the mir-48/mir-241 locus. This study was accomplished generating transgenic nematodes expressing a series of mir-48/mir-241 promoter: GFP (green fluorescent protein) gene fusions containing different regions of the mir-48/mir-241 promoter. Analysis of these transgenic lines will

identify sequences required for the proper expression of these miRNAs.

Poster Title: Neurogenic Inflammation in Mice with Sickle Cell Disease: Neuropeptides Expression in the Skin

Your Name: Abdirisak Hussein

Home institution: San Diego Mesa College

Research Program: LSSURP

Faculty mentor: Dr. Kalpna Gupta

Grad student or post-doc mentor(s): Dr. Lucile Vincent

Department of Faculty Mentor: Medicine

Abstract:

Sickle cell disease (SCD) is associated with pain, inflammation and vascular alterations. We hypothesized that persistent pain in SCD is accompanied by neurogenic inflammation due to increased expression of substance P (SP) and calcitonin gene-related peptide (CGRP) in the skin, and that these increases are linked to mast cell activated-tryptase located near nerves fibers.

Transgenic mice expressing human sickle hemoglobin (HbSS-BERK) that exhibit pain behaviors similar to pain in human SCD, and control HbAA-BERK mice expressing normal human hemoglobin, were used to examine changes in the expression of tryptase, known to stimulate release of SP and CGRP from primary afferent neurons. Skin samples were immunostained and then analyzed using confocal microscopy. Results showed high expression of tryptase and significant amount of SP and CGRP. In the skin, HbSS mice showed increased mast cell activation and increased release of neuropeptide, which indicated neurogenic inflammation in the skin of sickle mice.

Poster Title: Association between *Clostridium botulinum* and the Alga *Cladophora* in The Great Lakes

Your Name: Chase Kahn

Home institution: Macalester College

Research Program: LSSURP

Faculty mentor: Dr. Michael J. Sadowsky

Grad student or post-doc mentor(s): Chanlan Chun

Department of Faculty Mentor: Biotechnology Institute/Soil, Water & Climate

Abstract:

Preliminary studies suggest that the pathogenic bacterium *Clostridium botulinum* is one of the main contributors to bird mortality in The Great Lakes. However, very little is known about the mechanisms of *C. botulinum* toxicity to birds. One hypothesis suggests it's due to ingestion of bacterial-contaminated algae. The overall objective of these studies was to examine the association of *C. botulinum* and the macrophytic alga *Cladophora*. Every month we received *Cladophora* from four different sample sites. The concentration of *C. botulinum* on *Cladophora* was determined by an MPN-PCR technique. DNA extractions from the algal samples were also completed to detect any of the botulinum toxin genes. We confirmed the presence of Botulism strain types A, B, and E within the macrophytic alga *Cladophora*. With an increase in concentration of botulinum as summer progressed, we conclude that *Cladophora* is an indirect source assisting in the die-off of birds.

Poster title: Repair Of UV-Induced And DNA-Protein Cross-Links In Normal And Repair-Deficient Mammalian Cells

Your name: Emma Lee

Home institution: St. Olaf College

Research program: LSSURP

Faculty mentor: Dr. Colin Campbell

Post-doc mentor: Dr. Jungeun Yeo

Department of faculty mentor: Pharmacology

Abstract:

DNA damage can be cytotoxic and is involved in mutagenesis and neoplasia. Cells have evolved mechanisms to repair a variety of DNA lesions; inherited deficiencies in these pathways are associated with greater risk of cancer. The purpose of this study was to assess repair of UV-induced photoproducts (URPs) and DNA-protein cross-links (DPCs) in normal and repair-deficient mammalian cells. URPs were created by exposing the target plasmid to ultraviolet radiation, and DPCs were formed by covalently cross-linking recombinant histone protein to the target plasmid with formaldehyde. Repair of these lesions was measured using a sensitive, quantitative luciferase gene reporter system. This study will provide insight into the respective contributions of different metabolic pathways to the repair of URP- and DPC-containing DNA. This and further research of xenobiotic DNA damage is relevant to the development of treatments for human syndromes associated with deficiency in DNA repair.

Poster Title: Role of Actin Isoforms in Facilitating T-cell Motility and Function

Your Name: Jianbing (Jim) Leng

Home institution: Pomona College

Research Program: LSSURP

Faculty mentor: Dr. Yoji Shimizu

Grad student or post-doc mentor(s): Brandon Burbach

Department of Faculty Mentor: Laboratory Medicine and Pathology

Abstract:

Motility of T-lymphocytes is essential to their function in the adaptive immune system, controlling T-cell development and interactions with antigens. The actin cytoskeleton functions by dynamic polymerization of G-actin monomers into F-actin filaments in the cytoplasm. Of the six known actin isoforms, only β-actin and γ-actin are expressed in T-lymphocytes, but the role of each isoform in T-cells is currently unknown. We first quantified the levels of beta and gamma actin in T-cells using isoform-specific antibodies. Next, we simulated antigens by using coverslips coated with antibodies that activated T-cells, and then

visualized the localization of the isoforms using fluorescent microscopy. We also used adenoviruses to alter the levels of β and γ actin to test for changes in cell motility. Preliminary data suggest that these isoforms may localize differently at the contact surface, which may implicate differential roles during antigen recognition and T-cell receptor signaling.

Poster Title: Testing the Utility of Antibodies for Detection of O-GlcNac Modified Plant Proteins

Your Name: Sarah Luciano-Perez

Home institution: Universidad Metropolitana

Research Program: LSSURP

Faculty mentor: Dr. Neil E. Olszewski

Grad student or post-doc mentor(s): Kerry Sokol

Department of Faculty Mentor: Plant Biology

Abstract:

O-linked N-acetylglucosamine (O-GlcNAc) is a type of post-translational modification that has an important role in signaling pathway. O-GlcNAC transferase (OGT) is an enzyme which makes this modification, by adding a sugar to the hydroxyl group of serines or threonines. This modification can change the activity or functionality of the protein. Plants have two OGTs, SPY and SEC, yet many of the proteins that are modified by this OGT remain unknown. The overall goal of this investigation was to assess the utility of antibodies to detect O-GlcNAc in Arabidopsis. We used antibodies that detect modified animal proteins, as we hypothesized they may also bind to modified plant proteins. After immunoblotting for O-GlcNAc modified proteins in wild-type, sec and spy mutants, we found a possible signal that suggest O-GlcNAc specific binding. Further investigation has to be done to determine whether this signals is specific or nonspecific to O-GlcNAc.

Poster Title: Role Of The Transmembrane Protein Chondroitin Sulfate Proteoglycan 4 (CSPG4) In The Growth And Motility Of Melanoma Cells

Your Name: Priyanka Manandhar

Home institution: University of California, Berkeley

Research Program: LSSURP

Faculty mentor: Dr. James B. McCarthy

Grad student or post-doc mentor(s): Matthew A. Price

Department of Faculty Mentor: Laboratory Medicine and Pathology

Abstract:

Metastatic melanoma is an aggressive malignancy that is associated with high patient mortality. Although advances in surgery and chemotherapy have reduced mortality resulting from malignant melanoma, disease recurrence and patient relapse represent a significant clinical problem. Melanoma progression is associated with expression of chondroitin sulfate proteoglycan 4 (CSPG4), a cell surface trans-membrane proteoglycan. While CSPG4 is known to promote adhesion and growth factor signaling, its effect on melanoma cell transformation must be determined. To determine the effect of CSPG4 on melanoma cell transformation, we analyzed two tumor cell properties: migration, and anchorage-independent growth. We conducted scratch wound and soft agar assays with CSPG4-expressing cells and cells in which expression of CSPG4 had been knocked down via inducible short-hairpin RNA (shRNA). Cells that expressed CSPG4 showed increased colony formation and migration versus cells with CSPG4 knocked down, indicating that CSPG4 plays an important role in the transformation of melanoma cells.

Poster Title: Internal Imaging of Human Hearts and the Creation of a Human Anatomical Database Primarily Focused on Variations of Coronary Arteries

Your Name: Irmarie Marrero-Marrero

Home institution: University of Puerto Rico-Arecibo

Research Program: LSSURP

Faculty mentor: Dr. Paul A. Iaizzo

Grad student or post-doc mentor(s): Julianne H. Eggum

Department of Faculty Mentor: Surgery

Abstract:

The human heart is one of the most important organs in the body; it pumps blood to all other organs within. In order to study the variability between human hearts we are performing various anatomical projects. One of them consisted of taking internal images of perfusion-fixed human hearts so to better visualize different cardiac pathologies for educational purposes, another was to create and measure 3D anatomical models of coronary arteries (including the main branches RCA, LCA, LAD, and C) generated from contrast-computed tomography (CT) scans. Today, Coronary Artery Disease (CAD) remains one of the leading causes of death. Worldwide it is usually treated with stenting or coronary bypass. In order to improve the design of these coronary artery devices, our resultant anatomical database can be used by device designers to better understand the variability within the human coronary artery system and how these can change due to various disease states.

Poster Title: The Role of Perineuronal Nets in Female Mate Preference in Zebra Finches

Your Name: Héctor A. Martell-Martínez

Home institution: University of Puerto Rico - Mayaguez

Research Program: LSSURP

Faculty mentor: Dr. Teresa Nick

Grad student or post-doc mentor(s): Grant Larson

Department of Faculty Mentor: Neuroscience

Abstract:

In the song system nuclei of the male Zebra Finch, perineuronal nets (PNNs) appear to stabilize neural circuitry and play a role in the termination of the critical period of song development. Female Zebra Finches do not sing, but PNNs were recently discovered in a subset of the brain areas that express PNNs in males, which could indicate an experience-dependent development of perception, e.g., sexual

imprinting. Thus, destruction of these PNNs may enable a state of plasticity in female perception, expressed by changes in female preference for male songs. To establish a measure for this preference, we both used a phonotaxis technique and monitored the heart rate of females. After degradation of PNNs in the female song nuclei by application of chondroitinase ABC, female preference will again be assessed. We hypothesize that the degradation of PNNs in the female song system nuclei may enable changes in this preference.

Poster Title: Expression and Characterization of the Cytochrome P450 2A6 Y351H Mutant

Your Name: Ruth M. Martell-Martinez

Home institution: University of Puerto Rico - Mayaguez campus

Research Program: LSSURP

Faculty mentor: Dr. Sharon E. Murphy

Grad student or post-doc mentor(s): Linda von Weymarn

Department of Faculty Mentor: Biochemistry, Molecular Biology and Biophysics

Abstract:

Nicotine addiction is a major public health problem given the large number of tobacco-related deaths worldwide each year. In smokers, nicotine is metabolized by cytochrome P450 2A6 into cotinine and then further to trans-3-hydroxycotinine. P450 2A6 is highly polymorphic. A newly discovered polymorphism, the Y351H mutation, appears to be a significantly poorer catalyst of nicotine metabolism in vivo than wild type enzyme. Therefore, we expressed and characterized this mutant in vitro. We mutated the protein and expressed and purified it from *E. coli*. The total protein concentration and the concentration of active enzyme were determined. The enzymatic activity of the mutant was measured using coumarin as a substrate. Finally, kinetic parameters for the conversion of coumarin to 7-hydroxycoumarin by the wild type and mutant enzymes were calculated and compared.

Poster Title: Estradiol Increases PSD-95 Expression in Striatal Neurons

Your Name: Jillian Millares

Home institution: California State University, Fresno

Research Program: LSSURP

Faculty mentor: Dr. Paul Mermelstein

Grad student or post-doc mentor(s): Dr. Valerie Hedges and Dr. John Meitzen

Department of Faculty Mentor: Neuroscience

Abstract:

The steroid hormone estradiol modulates the synapse, the site where neurons communicate. A prominent component of the synapse is the protein PSD-95. We tested whether estradiol induces changes in PSD-95 expression in the striatum and the hippocampus of female rat pups. The striatum is an important brain region that when compromised contributes to pathologies such as Parkinson's Disease. The hippocampus is a known locus of estradiol action involved in learning and memory. On postnatal days 0 and 1, pups were injected with estradiol in cottonseed oil or cottonseed oil alone. On postnatal day 2, hippocampal and striatal tissue were extracted. After performing western blotting and qPCR to measure protein and mRNA, we found increased PSD-95 expression in the striatum for both. No change was detected in the hippocampus. This indicates that estradiol modulates striatal synapses. This finding may contribute towards understanding how estradiol modulates both normal and pathological striatal function.

Poster Title: Entrainment of the Endogenous Adrenal Clock by ACTH Occurs via a cAMP-dependent Pathway

Your Name: Angelica Montanez

Home institution: Villanova University

Research Program: LSSURP

Faculty mentor: Dr. William Engeland

Grad student or post-doc mentor(s): Marina Yoder

Department of Faculty Mentor: Neuroscience

Abstract:

Recent studies from our lab have shown that adrenocorticotropic hormone (ACTH) can entrain the endogenous adrenal clock. The currently unknown cellular mechanism responsible for this entrainment served as the focus of our experiment. We hypothesized that ACTH affects the adrenal clock through a cAMP-dependent pathway. To test this, we treated the adrenals of PER2::Luc mice in vitro with 9-(tetrahydro-2-furyl)-adenine (THFA), a non-competitive inhibitor of adenylyl cyclase, an enzyme required for cAMP formation. The subsequent clock rhythms, reflected by the bioluminescent conversion of luciferin to light, were then measured in a PMT. Our data showed an expected phase delay in the PER2 rhythm in adrenals treated with ACTH, while no delay was evident in the adrenals treated with THFA alone or THFA + ACTH. Since THFA successfully prevented the ACTH-induced phase shift, we conclude that cAMP is indeed a key component in the mechanism by which ACTH entrains the adrenal clock.

Poster Title: Isolation and Charactization of Plasmid DNA from Transformed *Escherichia Coli* Cultures for Producing CXCR5-Transducing Lentivirus.

Your Name: Jaleesa Morris

Home institution: University of Minnesota

Research Program: LSSURP

Faculty mentor: Dr. Pamela Skinner

Grad student or post-doc mentor(s): Preethi Haran

Department of Faculty Mentor: Veterinary and Biomedical Sciences

Abstract:

HIV producing cells are present in high concentrations inside B cell follicles while virus specific cytotoxic T cells (CTL) are largely excluded. The aim of this project is to suppress viral replication within B cell follicles by targeting CTL to the follicles by expressing the follicular homing molecule CXCR5. To engineer CXCR5- expressing CTL, we used

lentiviral transduction by transfecting 293 T cells with plasmids encoding CXCR5-GFP, VSV-G, and GAG/POL. *E coli* were transformed, plasmids were propagated and plasmid DNA was extracted. Restriction digests were performed on isolated plasmids and the products were run on an agarose gel. This visual representation of our DNA fragments that were cut with specific enzymes demonstrated that the colonies we selected did contain the correct plasmid of interest. We concluded that we have the correct plasmids needed to produce the CXCR5-transducing lentivirus that can be inserted into virus specific CD8+ T cells.

Poster title: Identification of *Geobacter sulfurreducens* Mutants Defective in Extracellular Fe(III) Reduction

Participant student: Andrés Moya-Rodríguez

Home institution: University of Puerto Rico - Mayagüez Campus

Research Program: LSSURP

Faculty mentor: Dr. Daniel Bond

Grad student mentor: Caleb Levar

Faculty mentor Department: Biochemistry, Molecular Biology & Biophysics

Abstract:

The anaerobic bacterium *Geobacter sulfurreducens* is able to generate energy from reduction of extracellular iron oxides, yet the mechanism of electron transfer to insoluble substrates is not fully understood. It was hypothesized that a transposon screen could identify mutants that are only defective in moving electrons beyond the outer surface. First, a library of *G. sulfurreducens* transposon mutants was incubated with soluble Fe(III) to select for mutants still capable of transferring electrons out of the cell. Single colonies isolated from this enrichment were inoculated into 96-well plates containing insoluble Fe(III) oxide, as well as a soluble acceptor to maintain viability. Clones unable to reduce insoluble Fe(III) were identified by lack of a characteristic color change. Subsequently, potential mutants will be re-isolated and their reduction phenotype on soluble and insoluble forms of Fe(III) verified. Clones of

interest will then be sequenced to determine the gene whose disruption yields the desired phenotypes

Poster Title: Angiogenesis Inhibition in Endothelial Cells

Your Name: Geoffrey Moyer

Home institution: Clarion University

Research Program: LSSURP

Faculty mentor: Dr. Sundram Ramakrishnan

Grad student or post-doc mentor(s): Goutam Ghosh

Department of Faculty Mentor: Pharmacology

Abstract:

Hypoxic cancers arise when tumors deprived of oxygen metastasize. These cancers are highly resistant to therapeutics currently available. Lysyl oxidase (LOX) is an enzyme that catalyzes extracellular matrix remodeling but when over-expressed assists with the metastasis of tumors. Developing cancer therapies are beginning to target endothelial cells instead of the tumor itself due to their stability. The question that has arisen is, will treating endothelial cells with β-aminopropionitrile (BAPN) down regulate the expression levels of LOX? We have found that BAPN inhibits angiogenesis our results of a scratch wound assay on endothelial cells comparing normoxic and hypoxic conditions. Other assays have been performed using matrigel to determine the fibro-network that arises under hypoxic conditions. Micro-RNAs will be used to determine if they are capable of down regulating the translation of LOX. This project is showing suitable therapeutics for inhibiting LOX by preventing angiogenesis in human endothelial cells.

Poster Title: Novel Drugs Capable Of Selectively Inducing DNA-Protein Cross-Links Are Cytotoxic In Human Fibrosarcoma Cells

Your Name: Gabriela Ortiz-Soto

Home institution: University of Puerto Rico - Cayey

Research Program: LSSURP

Faculty mentor: Dr. Colin Campbell

Grad student or post-doc mentor(s): Dr. Teshome B. Gherezghiher (Post-doc student)

Department of Faculty Mentor: Pharmacology

Abstract:

Covalent bonds formed between DNA and cellular proteins–referred to as DNA-protein cross-links (DPCs) can occur spontaneously and in response to a variety of DNA-damaging agents. It is believed that these lesions interrupt DNA replication, transcription and repair, and can induce cell death. The precise consequences of DPCs are not well understood because drugs that cause DPCs invariably induce other types of DNA damage as well. In this work, cisplatin and diepoxybutane were reacted with purified proteins. The resulting protein-drug conjugates containing a single reactive group can form covalent bonds with DNA. These agents were introduced into human cancer cells using streptolysin-O, resulting in concentration-dependent cell death. Our observations reveal that these novel reagents can be used to gain insight into the biological consequences of spontaneous and drug-induced DPC formation.

Poster Title: Rescuing Essential Functions in *E. coli* by Artificial Proteins

Your Name: Ravi Patel

Home institution: University of Minnesota

Research Program: LSSURP

Faculty mentor: Dr. Burckhard Seelig

Grad student or post-doc mentor(s): Misha Golynskiy

Department of Faculty Mentor: Biochemistry, Molecular Biology and Biophysics

Abstract:

In nature, there are a plethora of proteins that are essential for life. We have previously generated two synthetic collections of proteins (libraries) based on either a $(\beta/\alpha)_8$ barrel scaffold, a structure highly

prevalent in nature, or random sequences of 80 amino acids. We are interested in identifying members of our libraries that can support a biologically relevant function. Our test system is *E. coli* strains missing single genes that are essential for growth on nutrient-poor media (auxotrophic). We identified 36 such strains. The auxotrophic strains will only be able to grow on minimal media when supplemented with either a de novo protein from the random library or a $(\beta/\alpha)_8$ barrel protein with novel function capable of replacing the missing activity due to the absent gene. Currently, the libraries are being cloned into a plasmid which can then be transformed into the auxotrophic strains.

Poster Title: Fibril Expression in *S. gordonii* Adhesin Mutants

Name: Krizia M. Pérez-Medina

Home institution: University of Puerto Rico - Humacao

Research Program: LSSURP

Faculty mentor: Dr. Mark Herzberg

Department of Faculty Mentor: Diagnostic and Biological Sciences

Abstract:

Streptococcus gordonii is a common commensal member of the human oral flora and an etiological agent in infective endocarditis. Bacterial surface structures called fibrils are comprised of adhesin proteins, mediating adhesion of commensal and opportunistic pathogens. SspAB is a well characterized adhesin of *S. gordonii* and paradoxically ΔSspAB mutants adhere better than the wild-type strain. We hypothesized that the absence of SspAB leads to compensatory structural changes in adhesin-bearing fibrils. To characterize surface fibrils, we analyzed transmission electron micrographs of the wild type *S. gordonii* and six adhesin mutants. We tabulated the number of short, medium, and long fibrils. Adhesin mutants had reduced numbers and varied sizes of fibrils. Loss of adhesion function mutants (ΔHsa, ΔCshA, ΔCshB, ΔSspA, ΔSspB) showed short fibrils, whereas the gain-in-adhesion function in ΔSspAB corresponded to long fibrils. In conclusion, loss of adhesin proteins alter fibril length and quantity on *S. gordonii*.

Poster Title: Flowering-Time Gene Expression in *Cannabis sativa*

Your Name: Linnea Peterson-Bunker

Home institution: Earlham College

Research Program: LSSURP

Faculty mentor(s): Dr. George Weiblen & Dr. David Marks

Grad student or post-doc mentor(s):

Department of Faculty Mentor: Plant Biology

Abstract:

Plants often flower in response to seasonal cues including change in day length or temperature. The genetics of flowering time has been studied in *Arabidopsis thaliana* extensively, where the genes Flowering Locus T (FT) and Constans (CO) are expressed in leaves. These genes are associated with flower development and are highly conserved among species. Flowering is triggered by increased day length in *Arabidopsis* whereas the shortening of day length triggers flowering in marijuana (*Cannabis sativa*). Flowering in *Cannabis* is of interest as female flowers are the source of psychoactive cannabinoids. It is unknown whether FT and CO play roles in *Cannabis* flowering. We sampled female plants grown under 18-hour and 12-hour days to compare FT expression using quantitative PCR. Expression was elevated in plants exposed to short days relative to long days. Additionally, expression of FT and its inducer, CO, fluctuate with the day-night cycle.

Poster Title: Mapping Antigenic Epitopes of Glycoprotein B in Guinea Pig Cytomegalovirus Using Panel of gB-GST Fusion Proteins

Your Name: Rashed Rab

Home institution: Carleton College

Research Program: LSSURP

Faculty mentor: Dr. Mark Schleiss

Grad student or post-doc mentor(s): Josephine Gnanandarajah and Jason Zabeli

Department of Faculty Mentor: Pediatrics, Division of Infectious Diseases and Immunology

Abstract:

Congenital infection by Cytomegalovirus (CMV) is the leading cause of birth defects in the United States. Hence, there has been considerable effort made towards the development of a vaccine. CMV glycoprotein B (gB), which has been found to elicit a protective humoral immune response, is a major target for potential vaccine development. In this study, we produced a series of fusion proteins encoding short, overlapping guinea pig CMV gB fragments fused to glutathione S-transferase (GST). These constructs were used to map the major virus-neutralizing epitopes recognized by two anti-gB monoclonal antibodies: IE3 and 29-29. In western blots, the IE3 monoclonal recognized amino acids spanning Val_{527} to Val_{575} while the 29-29 monoclonal demonstrated a slightly different pattern of immunoreactivity, recognizing amino acids Leu_{453} to Ser_{539}. The elucidation of key epitopes involved in the induction of the virus-neutralizing antibody response to gB should help facilitate future vaccine studies in congenital CMV infection.

Poster Title: “Green” *in situ* Epoxidation Using Genetically Engineered Esterase

Your Name: Michael Ries

Home institution: University of Minnesota – Twin Cities

Research Program: LSSURP

Faculty mentor: Dr. Romas Kazlauskas

Grad student or post-doc mentor(s): Jan von Langermann

Department of Faculty Mentor: Biochemistry, Molecular Biology, and Biophysics

Abstract:

Peracid-aided epoxidation forms a three-membered, oxygenated heterocycle and is a vital reaction in the paper and biofuels industries. Pure peracids, however, are highly unstable making in situ peracid

production optimal. In this study researchers attempted to optimize aqueous reaction conditions for the epoxidation of an aqueous alkene. In the target mechanism esterase accepts an H_2O_2, not H_2O, nucleophile and converts ethyl acetate to peracetic acid to react with alkene. Reaction contents at pH 7.0 included phosphate (0–1 M), H_2O_2 (150-500 mM), ethyl acetate (180-500 mM), alkene (67 mM) and esterase. Epoxidation conditions that have previously accumulated high peracid levels were most successful; no epoxide product was visualized by TLC, however TLC confirmed that reactant was consumed. The high substrate concentration ensured efficient epoxidation. Quantitative HPLC analysis of this reaction need be done, may reveal the epoxide product, and should allow further reaction condition optimization.

Poster Title: A Synergistic Approach to an APOBEC3 Knockout Human Cell Line

Your Name: Nikita Shah

Home institution: St. Olaf College

Research Program: LSSURP

Faculty mentor: Dr. Reuben Harris

Grad student or post-doc mentor(s): Eric Refsland

Department of Faculty Mentor: Biochemistry, Molecular Biology, & Biophysics

Abstract:

Members of the APOBEC3 (A3) enzyme family are associated with inhibiting retroviral retrovirus and retrotransposons and thereby protecting cells from potentially harmful pathogens. To further characterize the functions of these proteins, our lab has demonstrated the usefulness of recombinant adeno-associated virus (rAAV) to generate A3 knockout cell lines. However, this rAAV technology has proven ineffecient with certain A3 family members – specifically, A3B and A3H. The goal of this project was to utilize site-specific nucleases, known as TAL effector nucleases (TALENs), in hopes of identifying TALENs that target various A3 family members by creating a double-stranded break within the gene. Based on studies in model organisms

and human cell lines we hypothesize that a double-stranded break will increase A3 gene targeting efficiencies. TALENs for A3A, A3B, and A3H were constructed via a golden gate cloning reaction and introduced into human HEK293T cells by transfection. PCR/CEL-I assays were used to assess double-strand break inducing activity. TALEN technology in conjunction with our current gene-targeting approach has the potential to enhance the efficiency of constructing A3-null cell lines.

Poster Title: Fine-Mapping of Hypersensitive to Red and Blue (HRB3) in *Arabidopsis thaliana*

Your Name: Hannah Spaulding

Home institution: Bethany Lutheran College

Research Program: LSSURP

Faculty mentor: Dr. Min Ni

Grad student or post-doc mentor(s): Chen Chen

Department of Faculty Mentor: Plant Biology

Abstract:

Light is one of the most important environmental factors involved in the regulation of plant development and growth. A light response mutant, hypersensitive to red and blue 3 (hrb3), which expresses a short hypocotyl under red or blue light was isolated from genetic screening. This will contribute to our knowledge of the plant light-signaling cascade by cloning and functional analysis of the underlying HRB3 gene. We hypothesized that the HRB3 gene, was involved in the blue/red light response signaling pathway in *Arabidopsis thaliana*. PCR and Gel Electrophoresis were used for analyzing the genotypes. We identified phenotypes by measuring the hypocotyls length under red and blue light in seedlings. Based on the genotypes of the individuals of the mapping population, HRB3 gene is located between the markers of nga129 and cer455033. Some recombinants were gained between these two markers and could be used to further narrow down the underlying gene.

Poster Title: The Efficacy and Mechanism of Triptolide as an Inhibitor of

Cellular Inflammation

Your Name: Laura Stapler

Home institution: University of Massachusetts, Amherst

Research Program: LSSURP

Faculty mentor: Dr. Patrick Arndt

Grad student or post-doc mentor(s): Dr. Weiyu Zhang

Department of Faculty Mentor: Pulmonary, Allergy and Critical Care Medicine

Abstract:

Acute respiratory distress syndrome (ARDS) presents as the rapid onset of respiratory failure due to excessive inflammation caused by neutrophils- the first responders in innate immunity. We attempted to reduce this inflammation by treating isolated human neutrophils with Triptolide- a compound from a Chinese herb and an anti-inflammatory agent in rheumatoid arthritis treatments. The cells were stimulated with lipoteichoic acid (LTA) or lipopolysaccharide (LPS)- toll-like receptor agonists generated from bacterial cell walls. The transcription and levels of the cytokines TNFα, Il-1β, Il-6, and Il-8 were quantified using qPCR and ELISA respectively. Results showed a significant dose dependent reduction in both gene expression and levels of cytokines after LPS or LTA exposure. Western blots of signaling molecules p38 and Akt were performed, but failed to indicate any mechanistic explanation for the observed effects of Triptolide. Nevertheless, these findings warrant mechanistic follow-up and application in-vivo in models of ARDS.

Poster Title: The Effect Of Plant Defenses On Predator Performance

Your Name: Erik Swanson

Home institution: Wheaton College

Research Program: LSSURP

Faculty mentor: Dr. George Heimpel

Grad student or post-doc mentor(s): Emily Mohl

Department of Faculty Mentor: Entomology

Abstract:

Plant defenses affect performance of insect predators used as biological control agents. Understanding the effect of defenses on predator performance is important in selecting biocontrol agents. Plants can affect predators directly and indirectly through mechanical defenses and reduced prey quality. This study examined the effect of trichomes and cardenolide concentration in common milkweed (*Asclepias syriaca*) on the performance of two aphid predators: *Aphidoletes aphidomiza*, and *Orius insidiosus*. *Aphidoletes aphidimyza* larvae and *O. insidiosus* nymphs were placed on *A. syriaca* plants with aphids and consumption, growth, and survival were recorded. *Aphidoletes aphidimyza* showed no significant difference in growth between treatments. However, there was a significant difference in survival and consumption. Preliminary results indicate increased cardenolide concentration significantly decreases consumption rates of *O. insidious*. These results are consistent with the theory that plant defenses affect predator performance and highlight the need to consider plant defenses when creating management plans for invasive insects.

Poster Title: Measurements of Cardiac Veins Thru the Method of Contrast Injection Perfusion-Fixed Hearts.

Your Name: Katia Yarí Torres-Román

Home institution: University of Puerto Rico - Arecibo

Research Program: LSSURP

Faculty mentor: Dr. Paul A. Iaizzo

Grad student or post-doc mentor(s): Julianne H. Eggum

Department of Faculty Mentor: Surgery

Abstract:

Approximately 5 million of Americans have heart failure, and consequently, 250,000 die annually. 10-20% of the heart failure population has cardiac dyssynchrony. One of the main treatments for

this disease requires the delivery of devices to be placed thru the coronary sinus (CS) and into cardiac veins. To improve such treatments, it is necessary to fully understand the anatomies of the human cardiac veins. By using contrast-computed tomography (CT) of perfusion-fixed human hearts, we have created 3D models using Mimics software. This novel technique of generating models has allowed us to visualize all the different cardiac veins and obtain anatomical measurements for each one. The use of such a developed database of cardiac vein anatomies will allow device design engineers to make more efficient products and also provide insights for clinicians to allow them to do more accurate procedures in such HF patients.

Poster Title: Optimizing BALF Preparation for iTRAQ-Labeled Proteomics to Identify Biomarkers for Chronic Lung Allograft Rejection

Your Name: Van Tra

Home institution: Bowdoin College

Research Program: LSSURP

Faculty mentor: Dr. Christine Wendt

Grad student or post-doc mentor(s): Brian Sandri, Makedonka Gulcev

Department of Faculty Mentor: Division of Pulmonary, Allergy, and Critical Care Department of Medicine

Abstract:

Chronic allograft rejection is the leading cause of mortality and morbidity in lung transplant recipients. Proteomic profile analysis of bronchoaveolar lavage fluids (BALF) by mass spectrometry can identify protein biomarkers for chronic rejection, however, several factors complicate biomarker discovery. The presence of mucus complexes and high salt concentration in BALF interferes with protein quantification assays, downstream labeling, and protein detection by iTRAQ-labeled mass spectrometry. We investigated the removal of interfering substances by commercial spin filters (Amicon 3K, Vivaspin 2, PES 3K and 5K) and the disruption of mucus complexes via sonication for 5, 30, and 120 seconds. We found that all tested sonications equally increased

the total protein content in BALF. Additionally, the highest protein yields, from 70-99%, were obtained by concentrating and desalting with Amicon or PES 3K spin filters after sonication. Potentially, this method of BALF preparation could lead to consistent detection of a variety of protein biomarkers.

Poster Title: Colocalization of Dopamine and Glutamate in the Nucleus Accumbens

Your Name: Avery Tucker

Home institution: Drake University

Research Program: LSSURP

Faculty mentor: Dr. Robert Meisel

Grad student or post-doc mentor(s): Nancy Michael and Laura Been

Department of Faculty Mentor: Neuroscience

Abstract:

The nucleus accumbens region of the brain is a critical part of the reward pathway, in which dopamine is released in response to rewarding stimuli. Previous work has suggested that these dopamine neurons are also capable of coreleasing glutamate, however there is controversy surrounding this phenomenon. To further investigate this, immunohistochemistry was performed on adult male and female hamster brain tissues to determine if there was colocalization in the nucleus accumbens core, shell, and caudate putamen. We expect our data to show that these dopaminergic axons do not express significant amounts of glutamate, providing evidence against colocalization. These results may have further implications on how the brain responds to motivational stimuli, including drugs of abuse. By continuing to understand how the reward pathway functions, more effective treatments can be developed to help those suffering from addiction.

Poster Title: A Synthetic Toolkit For Engineering Bacterial Microcompartments

Your Name: Haley Vaseghi

Home institution: George Mason University

Research Program: LSSURP

Faculty mentor: Dr. Claudia Schmidt-Dannert

Grad student or post-doc mentor(s): Dr. Mark Held

Department of Faculty Mentor: Biochemistry, Molecular Biology & Biophysics

Abstract:

Bacterial microcompartments (BMCs) have tremendous potential for biotechnology applications as "nano-bioreactors." These polyhedral protein shells sequester enzymes and substrates, increasing their concentration, proximity and reaction efficiency; thus expediting metabolic reactions, improving metabolic flux, and protecting the cell from toxic reaction intermediates. In a recent breakthrough, recombinant Ethanolamine utilization (Eut) compartments were heterologously produced in *E. coli*. Our goal is to advance the bioengineering of Eut BMCs, and increase their application potential for targeted biochemistry. To that end, a creative suite of synthetic fusion constructs were created, focusing on (1) targeting different fluorophors to these compartments, (2) physically tagging shell proteins with fluorescent reporters, and (3) attempting to produce Eut compartments in *Saccharomyces cerevisiae*. These engineered protein compartments open many, exciting avenues for basic and applied research in the fields of synthetic biology, biochemistry, bioprocessing and biocatalysis. This research will greatly expand the toolset for engineering targeted biochemistry in recombinant microcompartments.

Poster Title: Characterization and Use of NAADP Probes for Identification of the NAADP Receptor

Your Name: Kathryn Wagner

Home institution: Viterbo University

Research Program: LSSURP

Faculty mentor: Dr. Timothy Walseth

Grad student or post-doc mentor(s): NA

Department of Faculty Mentor: Pharmacology

Abstract:

Nicotinic acid adenine dinucleotide phosphate (NAADP) releases calcium from lysosomal stores. NAADP regulates two-pore channels on lysosomes; however, it has been determined that NAADP does not bind to the channels directly. To further investigate the NAADP receptor we developed NAADP analogs that would allow enrichment through introduction of a biotin affinity tag via click chemistry. The first analog synthesized (8-azido-5-propylazido-NAADP) contains an azido group on the 8-position of the adenine ring and a propylazido group on the 5-position of the nicotinic acid ring. The 8-azido allows for photocrosslinking the probe to the receptor and the 5-propylazido was used to attach a biotin moiety with click chemistry. The 8-azido-5-propylazido-NAADP was able to release calcium and compete with NAADP in a competition-binding assay, although the probe was less potent than NAADP. 8-azido-5-propylazido-NAADP will be used to purify the NAADP receptor for the purpose of identifying this protein by mass spectroscopic techniques.

Poster Title: Cysteinyl Leukotriene Effect on Lipolysis of 3T3-L1 Adipocytes

Your Name: Matthew Wagner

Home institution: Concordia College – Moorhead

Research Program: LSSURP

Faculty mentor: Dr. David Bernlohr

Grad student or post-doc mentor(s): Dr. Ann Hertzel, Ph.D.

Department of Faculty Mentor: Biochemistry, Molecular Biology and Biophysics

Abstract:

Obesity-related insulin resistance and diabetes contribute to the death of over 200 million people per year in the US alone. Insulin resistance triggered by inflammatory conditions increases lipolysis, the conversion of triglycerides to free fatty acids and glycerol. This project tests the

hypothesis that arachidonic acid derivatives known as cysteinyl leukotrienes affect lipolysis via molecular receptors cysLTR1 and cysLTR2, leading to increased release of FFA and glycerol. 3T3-L1 adipocytes with one or both cysLTR receptors were cultured and treated with either LTC4 or LTD4. The adipocytes' non-esterified fatty acid and glycerol output was determined through kinetic collection and colorimetric assay. Both cysLTR receptors, in basal and stimulated conditions, resulted in a marked increase in the production of FA and glycerol in the presence of LTC4, but not LTD4. Identification of cysLTR receptors and the respective leukotrienes responsible for insulin resistance in adipocytes may reveal potential therapeutic targets.

Poster Title: The Effects of Foliar Fungicide Applications on Alfalfa Pathogens

Your Name: Jaime Willbur

Home institution: Lawrence Technological University

Research Program: LSSURP

Faculty mentor: Dr. Deborah Samac

Grad student or post-doc mentor(s): N/A

Department of Faculty Mentor: Plant Pathology

Abstract:

Fungal pathogens drastically reduce the quality and yield of alfalfa crops, an essential supplement of dairy cattle diets. Recently, Headline® fungicide was approved for the management of foliar pathogens on alfalfa; however, the sensitivity of alfalfa fungal pathogens to Headline® is not yet known. The efficacy of fungicide applications was determined by comparative visual evaluations of diseased leaf area and defoliation in control and Headline® treated crops. Pathogens were then isolated from diseased stems and identified via DNA sequence analysis. Assays of isolate sensitivity to pyraclostrobin, the active ingredient in Headline®, were conducted in vitro. Headline® applications reduced disease and defoliation in alfalfa plants during the first and second harvests; and fungi isolated from diseased stems were identified as known alfalfa pathogens. Additionally, pyraclostrobin effectively

inhibited spore germination of fungal isolates in vitro. In conclusion, Headline® fungicide effectively decreases fungal growth in alfalfa crops during the spring and early summer.

Poster Title: *Ex Vivo* Lentiviral IDS Transduction of Hematopoietic Stem Cells for MPS II

Your Name: Galina Yakovlev

Home institution: Normandale Community College

Research Program: LSSURP

Faculty mentor: Dr. Walter C. Low

Grad student or post-doc mentor(s): Dr. Zhenhong Nan

Department of Faculty Mentor: Neurosurgery

Abstract:

Mucopolysaccharidosis type II (MPS II, Hunter syndrome) is an inherited X- linked recessive disorder caused by a deficiency of the lysosomal enzyme iduronate-2-sulfatase resulting in progressive accumulation of the glycosaminoglycans. This buildup leads to a number of serious symptoms such as skeletal abnormalities, organomegaly, cardiac/valvular heart disease, and in the severely enzyme deficient form, neurologic degeneration and death by age 10.

We hypothesized that transplantation of genetically engineered bone marrow cells will provide effective metabolic crosscorrection. To test this hypothesis marrow from IDS deficient mice were transduced with lentiviral vector carrying the IDS gene and transplanted into IDS deficient recipients. Treated animals showed elevated levels of IDS in blood samples, and improved performance in neurobehavioral tests of learning and memory, and motor functions. These results demonstrate the efficacy of *ex vivo* gene therapy of bone marrow for treating MPS II.