Student Summer Scholars

Summer Showcase

August 1, 2012
Hager-Lubbers Exhibition Hall/Loosemore Auditorium
DeVos Center, Pew Campus, Grand Rapids, MI
4:00 PM – 7:00 PM

Welcome to the 2012 Student Summer Scholars' Summer Showcase!

The Student Summer Scholars (S3) Program provides funds for a student and faculty mentor to devote twelve weeks to a research and/or creative project during the spring/summer semester. Through these grants and the mentorship of a faculty member, the S3 program offers a unique opportunity for undergraduate students to do hands-on, professional research and creative practice in their chosen field. Combining academics, field work, and a reflection component provides students with a meaningful learning experience that helps to prepare them for graduate school and future careers.

For each S3 participant, the project begins with an innovative and thoroughly researched proposal. With guidance from faculty mentors, students identify a research question or an area of creative practice, and then shape the structure of their project. The value of mentorship is an important part of S3. Experienced faculty mentors act as support and a sounding board for their students.

Through S3, students begin to direct their own educational paths and familiarize themselves with the requirements and structure of professional research. Participants quickly learn that a successful project requires more than scholarship. Detailed planning, attention to budget, and creativity allow student researchers to innovate while working in a self-structured environment, and to cope with unexpected complications. By building on a foundation of academic and critical thinking skills provided by undergraduate courses, self-motivated students can use S3 to further their knowledge in a specific area while learning to incorporate academics with professional work.

The project's critical assessment component requires each participant to reflect on and evaluate his or her own project and the S3 experience as a whole. This comprehensive analysis of a self-directed project provides students with an opportunity to examine their own learning styles and academic strengths in order to shape further learning and working habits. S3 provides students with a new lens through which to view their long-term educational, work, and life plans.

We thank you for joining us for this important step in the learning process, and we know you will enjoy seeing the S3 Scholars' work thus-far.

2012 Student Summer Scholars

Danielle Bradke
Tami Brown
Brittany Cooke
Brianne Docter
Samantha Ellis
Jessica Franks
Danielle Grimm
Anthony Hage
Jose Jiménez
Kip-Chumba Kaitany
Joshua Lee
Jackie Main
Danielle Maryanski
Xinyi Ou
Michael Peruzzi
Jeremy Peshl
Kira Smith-Butland
Christopher Stretton
Jessica Thoe
Angela Tramontelli
Sarah VanOeveren
William Waalkes

Order of Events

4:00 PM – 5:00 PM	Remarks by Dr. Rachel Powers, Chairperson of Undergraduate Research Council
	Oral Presentations by: Brittany Cooke Jessica Franks Jose Jiménez Xinyi Ou Michael Peruzzi Kira Smith-Butland Angela Tramontelli
	Introduction of Poster Presentations
5:00 PM – 5:45 PM	Poster Presentations by: Daniel Bradke Tami Brown Brianne Docter Samantha Ellis Danielle Grimm Anthony Hage Kip-Chumba Kaitany Joshua Lee Jackie Main Daniell Maryanski Jeremy Peshl Christopher Stretton Jessica Thoe Sarah VanOeveren William Waalkes
6:15 PM – 7:00 PM	Dinner

Danielle Bradke
Faculty Mentors: Paul Keenlance, Biology & Joseph Jacquot, Biology

Den Site Characteristics and Kit Survival of American Marten in West Michigan

American marten (*Martes americana*) are small carnivorous mammals extirpated from Michigan's Lower Peninsula in 1911. In 1986, 36 marten were reintroduced to the Manistee National Forest. Recent monitoring indicates lower than expected population growth. Six females fitted with radio collars have been tracked to 25 confirmed dens. Remotely triggered cameras captured over 28,000 photos containing marten, allowing us to document 15 kits for the five females photographed. The sixth female likely lost her litter. Litter size ranged from 2-4 kits (avg = 3). Two females have lost radio collars leaving three in the study. Of these, a minimum of 7 out of 9 kits have survived to date. All dens have been in cavities of live trees except one which was in a fallen log. Macro and micro level den site characteristics are being analyzed and compared to random sites. Results will be supplied to the US Forest Service to inform management decisions and will give insight into whether low reproductive success is a factor in slow population recovery.

Tami Brown
Faculty Mentor: Neil MacDonald, Biology

Using DNA Barcoding for Plant Identification in a Long-term Prairie Restoration Study

We studied the effects of site preparation treatment, knapweed removal, and prescribed fire on plant community development in a restored prairie. As part of this study, plants needed to be identified to species in order to perform Floristic Quality Assessments. At times, identification can be difficult using traditional keys because of subtle differences among species. We selected 19 plants that had uncertain identifications to conduct a genetic barcoding study to help identify these specimens to species. Chloroplast DNA was extracted from these samples, amplified to sequence the *rbcL+matK* plastid coding regions, and the gene sequences were compared to those of species within the public Barcode of Life Database. Of the specimens sequenced to date, the genera found included *Lespedeza*, *Panicum*, and *Elymus*. While the study is not yet fully completed, our preliminary results showed that DNA sequencing facilitated plant identification to genus. Compared to traditional taxonomic keys, however, it may be more time consuming and a large degree of uncertainty remains when trying to identify plants to species using the available information in the public database.

Brittany Cooke
Faculty Mentor: Richard Vallery, Physics

Generation of Diffraction Gratings Using Photographic Film

The properties of light is one of the most interesting and complex topics in physics. For instance, multiple sources of light can interact with each other to create what are known as diffraction patterns – a series of alternating bright and dark spots. These patterns can be produced from a single source of light by use of a diffraction grating. A diffraction grating splits a source of light into multiple sources that can interact with each other. Commercial diffraction gratings are generally made from etched glass. This project determines how well diffraction gratings can be made using an alternative method: photographic film. This would give scientists a way to create diffraction gratings onsite rather than ordering them from another company. Photographs of a diffraction grating pattern were taken and developed onto slide film. The slides were tested using a helium-neon laser and factors such as exposure (aperture size and time), focal length of the camera's lens, and line spacing of the grating were tested for effectiveness. Effective gratings were ones producing a clear diffraction pattern.

Brianne Docter
Faculty Mentor: Brad Wallar, Chemistry

Probing the Binding Site in the Antibiotic Resistance Enzyme, AmpC β-lactamase

β-lactam drugs, such as penicillins and cephalosporins, are widely used to treat bacterial infections, but resistance to these drugs is increasingly becoming a problem. One of the main causes of resistance to these β-lactam drugs is the bacterial production of β-lactamase enzymes, such as AmpC. These enzymes are capable of breaking down the drug within their active sites, rendering the antibiotic unable to harm the bacteria. The exact roles that the active site amino acid residues play in the recognition and breakdown of the drug are not fully understood. Here, we investigate the role of the active site residue asparagine-152 (Asn152) in AmpC by mutating it to a glycine, serine, or threonine residue and examining the effect that these mutations have on kinetic and structural properties. Uncovering the specific role of Asn152 in the function of AmpC will be useful in the development of inhibitors to these enzymes in order to combat bacterial resistance.

Samantha Ellis
Faculty Mentor: Andrew Korich, Chemistry

Macromolecular Assemblies for Gas Storage from Dynamic Bonds

Three-dimensional organic polymers are important materials due to their ability to absorb various gasses including N2, CO2, and H2. Organic polymers are of particular interest to NASA, due to their light-weight nature, high surface area, and potential as a solid-state fuel source. This project focuses on developing new three-dimensional polymers, which fall into a particular class of compounds called covalent organic frameworks (COFs). These COFs are typically prepared using high efficiency reactions in high yields. However, due to their large molecular size, characterization by traditional techniques is difficult if not impossible. This project is designed to elucidate how these COFs aggregate in the solid-state by synthesizing a subunit of a COF. The subunit will allow for greater analysis by NMR, IR, and X-ray crystallography.

Jessica Franks
Faculty Mentor: Eric Snyder, Biology

Comparison of Constructed vs. Natural Wetlands

Wetland mitigation represents a vital tool to increase the number and extent of wetlands. However, there is uncertainty as to how constructed wetlands compare to natural wetlands. This study's objective is to evaluate the constructed wetlands on Allendale GVSU campus constructed at two times—2011 and 2009, and compare these to wetlands constructed in the mid '80's. The GVSU wetlands were not specifically constructed to mitigate for wetland loss; rather they are a proactive attempt to reduce erosion from excessive stormwater runoff in the GVSU ravines. Macroinvertebrates are currently being identified having been sampled following rapid bioassessment protocols used by the Michigan DNR. Preliminary results indicate the closer the wetlands are to parking lot runoff, the larger the percent of midge larvae (*Chironomidae*) and the lower the diversity. Environmental data indicates specific conductance and turbidity are significantly higher in the most recently constructed wetlands, while sites constructed in 2009 and the mid '80's are comparable. Although preliminary, this indicates that wetland function can rapidly evolve.

Danielle Grimm
Faculty Mentor: Ryan Thum, Annis Water Resources Institute

Using Artificial Breeding of Eurasian and Northern Watermilfoils to Study the Evolutionary Ecology of Herbicide Resistance

Eurasian watermilfoil is an invasive species that hybridizes with a benign native species. Both Eurasian watermilfoil and hybrids are treated with herbicides the same way. However, hybrids grow more invasively and can exhibit lower response to herbicides. A deeper understanding of the genetic bases of these traits can be achieved with artificial breeding studies. However, surprisingly little is known about the factors influencing flowering, seed maturity, seed viability, and seedling survival. This S3 project developed methods for laboratory breeding of watermilfoils. The factors promoting flowering remain unknown, and it is most efficient to perform crosses using flowering material collected from the field. However, hand pollination of flowering plants leads to reliable fruit production. Furthermore, seeds produced from artificial crosses are viable and have high germination rates under a range of laboratory conditions. Finally, germinated seeds have been successfully grown to seedlings. These methods will prove valuable for evolutionary genetic studies of invasiveness in watermilfoils.

Anthony Hage
Faculty Mentors: Martin Burg, Biomedical Sciences & Debra Burg, Biomedical Sciences

Detection of 6xHis Labeled HDC Protein in *Drosophila melanogaster*

Histamine is a neurotransmitter used in the fruit fly, *Drosophila melanogaster*, and is synthesized by the enzyme histidine decarboxylase (HDC). Immunocytochemical data indicates that histamine is localized to the nerve terminals in the photoreceptor cell layer where it is released as a neurotransmitter. The localization and the native size of the HDC protein have not been established however. If HDC were found close to the synaptic region, it would suggest that histamine synthesis occurs very close to the location where it is released. Likewise, the size of the protein would determine whether the HDC protein undergoes proteolysis, as occurs in other species and would allow purification of the protein in the future. Transgenic flies that bear a functional *Hdc* gene with an internal 6xHis epitope tag were studied. These flies were used in preparing protein extracts and tissue samples for Western blotting and immunolocalization, respectively. Western blotting results using a penta-HIS antibody detect a unique protein in flies bearing the 6xHis-HDC-Sac1 transgene. Immunocytochemical localization in tissue is also in progress and initial results will be reported.

Jose Jiménez
Faculty Mentor: Melanie Shell-Weiss, Liberal Studies

The Young Lords in Lincoln Park

Founded in Chicago's Lincoln Park neighborhood in 1968, The Young Lords transformed themselves from what had originally been a street gang into a political organization. These activists dedicated themselves to challenging the forced displacement of Puerto Ricans from their homes through urban renewal, Puerto Rican nationalism, and the struggle for democratic rights for all Latinos and the poor. This project explores the experience of these activists, focusing particularly on the community context in which the organization was founded and grown. Drawing upon the more than 75 oral histories and related photographs and archives, Mr. Jiménez has collected in the course of his summer research, this presentation will outline the key findings of the project, underscoring the unique contributions this research provides in the larger context of human rights, immigration, transnational/anti-colonial politics, and the Latino American experience.

Kip-Chumba Kaitany
Faculty Mentor: Dave Leonard, Chemistry

Biochemical Investigations of a High-Threat Family of β-lactamases

The carbapenem-hydrolyzing class D β-lactamase (CHDL) OXA-23 is commonly responsible for producing carbapenem antibiotic resistance within bacterial pathogens. Like most CHDLs, the ability to hydrolyze carbapenem drugs comes at the expense of activity towards other β-lactam antibiotics. Recent studies have indicated the importance of residues within the loop connecting strands β5 and β6 for substrate specificity. To investigate the potential role these loop residues play in carbapenemase activity, eleven site-mutations were made. All mutations were screened for drug hydrolyzing activity through lysate kinetic assays followed by steady-state kinetics. All mutations showed little change in the binding of carbapenems, while several (including two clinical variants) showed increased binding affinity towards penicillins and cephalosporins. These results suggest that increased structural flexibility of the β5-β6 loop allows structural conformations necessary to facilitate binding of larger β-lactams without hindering carbapenem binding.

Joshua Lee
Faculty Mentor: Merritt Taylor, Biomedical Sciences

Discovering New Genes that Regulate Neural Stem Cell Proliferation and Maintenance

A central obstacle in stem cell biology is revealing signaling pathways that drive stem cells to mature into differentiated daughter cells or proliferate into more stem cells (self renewal). Some genes that promote self-renewal also promote some forms of cancer. A subpopulation of cells within solid tumors exhibit stem cell-like properties, including resistance to cell death and exhibiting self-renewal. Reviewing published databases of gene expression profiles for glioblastomas and neural stem cells (NSC), we identified genes shared in both populations, including the gene ZSCAN21. Using *in ovo* electroporation of the chick embryonic spinal cord to overexpress ZSCAN21, we monitor if it is sufficient to promoting self-renewal using immunohistochemistry and comparative anatomical analysis. If ZSCAN21 sufficiently promotes self-renewal, overexpression of the gene should elevate markers for progenitor cells, possibly at expense of markers for differentiated cells (neurons and glia).

Jackie Main
Faculty Mentor: Amanda Dillard, Psychology

Exploring the Effects of Self-affirmation

Self-affirmation theory proposes that people's beliefs and behaviors are motivated by a desire to view the self as moral, adaptive, and capable. Researchers have found that allowing one to affirm leads to a decrease in defensiveness towards threatening health information including greater acceptance of the information and greater intentions to change a health behavior. However, few studies have examined why self-affirmation has these effects. In this study, college students were randomly assigned to either a self-affirmed condition in which they wrote an essay about their personal values or a non-affirmed condition in which they wrote about a non-personal value. Participants then read and responded to hypothetical coping scenarios and completed personality and other individual difference measures. We examined effects of the self-affirmation on coping responses. We also examined whether the effects of self-affirmation were moderated by self-esteem, personality, and optimism.

Danielle Maryanski
Faculty Mentor: Jennifer Winther, Biology

Novel MADS-box genes isolated from the gymnosperm cones of *Ephedra* and *Juniper*

MADS-box genes are essential in determining parts of a flower. Flowering plants belong to a larger group of plants that reproduce by making seeds called seed plants. Living seed plants can be divided into two major groups: those that develop seeds in flower structures (angiosperms) and those that develop seeds in cone structures (gymnosperms). Current knowledge of MADS-box genes in gymnosperms is limited, but it does support the hypothesis that flower parts and cone parts evolved from a similar set of MADS-box genes potentially common to all seed plants. In this study we focused on isolating and sequencing MADS-box genes from the gymnosperm cones of *Ephedra* and *Juniper*. This is the first report of MADS-box genes in *Ephedra*. Our increased sampling of gymnosperm MADS-box genes is improving our understanding of the evolutionary history of MADS-box genes in both gymnosperms and seed plants in general. This knowledge may help determine how cone and flowers are similar at the genetic level and how the genes involved in determining cone parts and flower parts evolved from a common ancestor.

Xinyi Ou
Faculty Mentor: Craig Benjamin, History

Review of Recent Research into Kushan Civilization

Trade, art, urban life and religion (particularly Buddhism and Zoroastrianism) all flourished under the great Kushan Empire. From the first to early-third centuries CE, the Kushan Empire was a notable world power that, at its zenith, controlled a vast span of territory stretching from present-day Afghanistan to Northwestern India and to the Tarim Basin in China. The Kushans prospered from their strategic location along the Silk Roads. As the middlemen between diverse cultures including Chinese, Indian and Greco-Roman, the Kushan Empire was a multiethnic and tolerant society. Research conducted over the past century and a half has revealed the true significance of the Kushans. Leaving behind no textual record of their own, much of Kushan history has been gleaned from archaeological, epigraphic, and numismatic evidence. Numerous new discoveries just within the last decade - the focus of this research project - have further clarified critical questions about chronology and genealogy, although there is still much to learn about this intriguing civilization.

Michael Peruzzi
Faculty Mentor: Shannon Biros, Chemistry

Synthesis of Tripodal CMPO Compounds for Heavy Metal Chelation

The chelation of heavy metals is of great importance due to the wide variety of applications, such as nuclear waste remediation, MRI contrast agents, and chelation therapy. Carbamoylmethyl phosphine oxides (CMPOs) are currently used as bidentate chelating agents in the TRUEX process, which is involved in nuclear waste remediation. However, many metals require a greater denticity for efficient chelation. Our lab's current interest lies in preorganizing these ligands with a tripodal cap to produce more efficient and selective binding agents by taking advantage of the chelate effect. By derivatizing these tripodal CMPOs, we hope to increase the variety of target metals and applications. Current efforts towards the synthesis of these compounds will be described.

Jeremy Peshl
Faculty Mentor: Karen Gipson, Physics

Explorations in Sonoluminescence

Single Bubble Sonoluminescence (SBSL) is the phenomena by which a bubble is levitated in a liquid medium and forced to oscillate using sound waves, which can make the bubble collapse violently enough to produce light. Various material parameters affect the light produced by these bubbles. This project provided an alternative methodology for the production of SBSL, as well as data acquisition. Intensity measurements were obtained using a photomultiplier tube and spectral measurements were obtained using a fiber optic spectrometer. The study focused on the effects of temperature and different liquid compositions on the intensity of the light produced by a SBSL bubble, as well as the spectrum produced by a sonoluminescing bubble. The results contribute to a better understanding of the effects of these material parameters.

Kira Smith-Butland
Faculty Mentor: Austin Bunn, Writing

Untitled Michigan Horror Script

This creative research project consists of a draft of a full-length horror movie script and a series of interviews with filmmakers who have experience in the horror genre. The goal of creating a script that is designed to be able to be filmed in Michigan is to support local filmmaking while also learning the basics of screenwriting. Interviews with horror filmmakers will be published with the goal of teaching other local filmmakers the basics of getting your work made into a film, with focus on pre-production, writing, funding, post production, and distribution. This project will illustrate the basic building blocks of filmmaking by producing a script and interviews with other filmmakers.

Christopher Stretton
Faculty Mentor: Roderick Morgan, Biology

The Testing of GV Derivatives for Antibacterial Activity in the Presence of Human Serum Protein

Despite advancements in many areas of human medicine, infectious disease continues to be a major cause of mortality worldwide. Improper and excessive use of antibacterial compounds has led to the rise of resistant species of bacteria like Methicillin Resistant *Staphylococcus aureus* (MRSA), Vancomycin Resistant Enterococci (VRE), and Extreme Drug Resistant Tuberculosis (XDR-TB). We have discovered a potential new class of antibiotics that inhibit the growth of Gram-positive bacteria. Upon discovery of inhibition against *S. aureus* and other Gram-positive bacteria, MRSA, VRE, and other resistant strains were tested. Inhibition by the newly developed compounds on the resistant strains was identical to their inhibition levels against non-resistant strains of these species. We have continued to synthesize and test chemical derivatives of our lead compound in an effort to increase their effectiveness. Overall, these results demonstrate that our carboxylic amide compounds are a novel, non-penicillin based antibiotic that could be used to treat MRSA and other Gram-positive infections.

Jessica Thoe
Faculty Mentor: Dawn Clifford Hart, Cell and Molecular Biology

Characterizing Protein-Protein Interactions for Accurate Cell Division in Fission Yeast

Cell division is a necessary process for growth and development. Fission yeast (*S. pombe*) provides a model system for polarity and cytokinetic mechanisms because, like human cells, they grow in a bipolar fashion and divide symmetrically. Mid1 is a founding protein of the cell division machinery and defines the division plane. Without Mid1, there is incomplete, uneven division. The orb mutants are classified by a loss of cell polarity and round shape. To study the relationship between polarity and cell division, we examined interactions between Mid1 and *orb* mutants. These *orb* mutants show more binucleate cells with internal septa, paired configurations where two cells are not completely separated, and differing localizations of Mid1. Specifically, Mid1 appears more concentrated at subcellular sites in the *orb6* mutants, suggesting higher protein levels. These phenotypes suggest a relationship between cytokinetic defects and the polarity genes, as well as a link between Mid1 and the Orb proteins.

Angela Tramontelli
Faculty Mentor: Kathryn Remlinger, English

Putting Michiganese on the Map: A Study in Perceptual Dialectology

Perceptual dialectology, the study of attitudes toward language variation, shows that people determine dialect boundaries not only by linguistic features, but also along geographic lines and according to sociocultural differences. Perceptions of places where speakers have accents and even what aesthetic qualities a given accent has are in this way a dynamic confluence of what speakers hear via variation in language use and also their internal, culturally mediated social attitudes. Speakers' perceptions of dialects therefore correspond directly to their attitudes about groups of people who speak them. This study investigates how Michigan speakers divide the state into dialect regions, and therefore into groups of speakers, and what characteristics are assigned to a "Michigan accent." Participants marked on a map of Michigan where they believe distinct dialect regions exist, and provided descriptions of the language and speakers in the places they indicated. We analyzed these responses using a language ideology framework to assess the strength of a correlation between attitudes toward language itself and toward its speakers, and to determine which factors, e.g. social, linguistic, or geographic, Michigan speakers use to classify their accents.

Sarah VanOeveren
Faculty Mentor: Georgette Sass, Biology

Germline Clonal Analysis of the *delorean* Mutation in *Drosophilia melanogaster*

We study a gain-of-function mutation in *Drosophila melanogaster*, known as *delorean*, caused by a transposon insertion in an intron of the *Protein kinase N* (*pkn*) gene. Preliminary evidence suggests that the *delorean* mutation is associated with a maternal-effect phenotype. During oogenesis, maternal-effect genes are transcribed in the both the germline and somatic cells that communicate to produce a functional egg and support zygotic development. The germline-specific role of the *delorean* mutation was studied using the FLP-DFS (Flp recombinase target-dominant female sterile) technique to generate germline clones (GLC). Chromosomes were engineered to contain both the *delorean* mutation and DNA sequence (FRT sites) required for mitotic recombination upon induction of FLP recombinase. The products will include a cell that is homozygous for the *delorean* allele and another that is homozygous for the dominant female sterile mutation ovo^{D1}. This approach allows the *pkn* gene expressed in oogenesis to be studied in order to gain insight into the molecular mechanisms that determine oocyte developmental competence.

William Waalkes
Faculty Mentor: Daniel Bergman, Biology

Pollutant Effects on Neurophysiological Recordings from Sensory And Motor Neurons Of The Crayfish

Proper sensory input and motor output relies on constant nervous system activity. We proposed to test the neurological effects of a chemical pollutant on crayfish, *Orconectes propinquus*. Nonylphenol is a chemical used in detergents and pesticides that is commonly concentrated in crayfish, fish, and birds. Crayfish were exposed to 0.20 µL of nonylphenol for seven days. At the conclusion, crayfish sensory and motor neuron capabilities were tested by allowing crayfish to find food in a Y-maze. Data recorded included percent success finding food, time to find food, time spent motionless, and time spent in the food arm of the Y-maze. In phase two of experiments, primary sensory and motor neurons will be isolated to test changes in membrane potential across axonal membranes. By doing so, we will elucidate any alterations in neuronal signals due to nonylphenol exposure. For example, a reduction in neuronal signaling would indicate the pollutant directly affects the crayfish nervous system.