WM RUGS

WEST MICHIGAN REGIONAL UNDERGRADUATE SCIENCE RESEARCH CONFERENCE

Saturday, November 15, 2014

ABSTRACT BOOKLET

Organizing Institutions:

- Aquinas College
- Calvin College
- Grand Valley State University
- Hope College
- Van Andel Institute Graduate School

VAN ANDEL RESEARCH INSTITUTE

333 Bostwick Avenue, NE
Grand Rapids, MI 49503
www.vai.org

WEST MICHIGAN REGIONAL UNDERGRADUATE
SCIENCE RESEARCH CONFERENCE

Saturday, November 15, 2014

SCHEDULE OF EVENTS

8:30 ARRIVAL AND POSTER SETUP *Cook-Hauenstein Hall*

9:00 WELCOME *Tomatis Auditorium*

Steve Triezenberg, Ph.D.
President and Dean of Van Andel Institute Graduate School

9:15 KEYNOTE ADDRESS *Tomatis Auditorium*

Emily Rauscher, Ph.D.
President's Postdoctoral Fellow
Research Fellow, Astronomy, College of Literature, Science, and the Arts
University of Michigan
"Atmospheric studies of extrasolar planets: a young, exciting, and rapidly growing field"

10:00 POSTER SESSION I *Cook-Hauenstein Hall*

Presenters at even-numbered posters
Refreshments served

11:15 FACULTY TALKS *Tomatis Auditorium*

Jennifer Moore, Ph.D.
Assistant Professor
Natural Resource Management Program
Biology Department
Grand Valley State University
"How do landscapes affect gene flow and connectivity of threatened reptiles and amphibians?"

Mary E. Winn, Ph.D.
Core Manager
Bioinformatics & Biostatistics Core
Van Andel Research Institute
"Life at the intersection of biology, statistics, mathematics, and computer science"

12:00 LUNCH *Cook-Hauenstein Hall*

1:00 POSTER SESSION II *Cook-Hauenstein Hall*

Presenters at odd-numbered posters

2:15 FACULTY TALKS *Tomatis Auditorium*

Deanna van Dijk, Ph.D.
Professor
Geology, Geography & Environmental Studies
Calvin College
"Building our Knowledge of Michigan Coastal Dunes: A Few Grains at a Time"

Clark Danderson, Ph.D.
Professor
Biology Department
Director of the Aquinas, College Herbarium (AQC)
Aquinas College
"The Arracacia Clade (Apiaceae): Attempting to Bring Order to a Disordered Complex"

3:00 CONCLUSION

WEST MICHIGAN REGIONAL UNDERGRADUATE SCIENCE RESEARCH CONFERENCE

ACKNOWLEDGEMENTS

Costs for the 2014 West Michigan Regional Undergraduate Science Research Conference are underwritten by the following organizing institutions: Aquinas College, Calvin College, Grand Valley State University, Hope College, and Van Andel Institute Graduate School.

The organizing committee for this conference includes:

Dr. Jennifer Hess, Aquinas College
Dr. Keith Grasman, Calvin College
Dr. Mark Staves, Grand Valley State University
Dr. Greg Fraley, Hope College
Dr. Nick Duesbery, Van Andel Research Institute
Dr. Xiaohong Li, Van Andel Research Institute
Dr. Lena Brundin, Van Andel Research Institute
Dr. Anthony Chang, Van Andel Research Institute

Administrative support provided by Michelle Love, graduate students of Van Andel Institute Graduate School, graduate students of Michigan State University and post-doctoral students from Van Andel Research Institute.

Audiovisual services provided by Terry Ballard and Bill Baillod with VAI Production Services, and Tim Sundt with Viking Creative, LLC.

Catering services provided by Eurest Dining Services.

Facilities services provided by Van Andel Institute.

KEYNOTE SPEAKER

Emily Rauscher, Ph.D.
President's Postdoctoral Fellow
Research Fellow, Astronomy, College of Literature, Science, and the Arts
University of Michigan

"Atmospheric studies of extrasolar planets: a young, exciting, and rapidly growing field"

While the planets within our solar system have been studied for hundreds of years, it was only 20 years ago that the first exoplanet was discovered, orbiting a nearby star. Yet within the typical lifetime of a undergraduate, there have been thousands of exoplanets detected, most within the last several years. Even more exciting, perhaps, is the development in the last 10 years of methods that are being used to directly measure atmospheric properties of these planets. The (relatively) easiest exoplanets to observe are the type known as "hot Jupiters", exotic planets that push our understanding of planetary science beyond the bounds of the solar system. I will describe my work on modeling the atmospheres of these strange worlds, along with some explanation of how my career path led me to where I am today.

ABSTRACTS OF FACULTY RESEARCH TALKS

Jennifer Moore, Ph.D.
Assistant Professor
Natural Resource Management Program
Biology Department
Grand Valley State University

"How do landscapes affect gene flow and connectivity of threatened reptiles and amphibians?"

Landscapes can have profound effects on the functional connectivity of wildlife populations. Human-mediated landscape change can impose barriers that impede gene flow and isolate populations, which can ultimately result in elevated extinction risk. The nascent field of landscape genetics is increasingly being applied to elucidate the landscape and environmental factors that affect processes like population dynamics, dispersal, and gene flow. This talk will focus on the application of landscape genetic techniques to understand the impacts of landscape change on threatened amphibians and reptiles from New Zealand (tuatara, *Sphenodon punctatus*), Alaska (boreal toads, *Bufo boreas*), and Michigan (eastern box turtles, *Terrapene carolina carolina*). Results from these case studies provide evidence that natural and human-altered landscapes can strongly affect wildlife movements and dispersal at multiple scales, which has implications for conservation management of at-risk species.

Mary E. Winn, Ph.D.
Core Manager
Bioinformatics & Biostatistics Core
Van Andel Research Institute

"Life at the intersection of biology, statistics, mathematics, and computer science"

As data sets continue to grow in size and complexity the need for the interdisciplinary skills of a bioinformatician are in increasing demand. A successful bioinformatician will have an array of skills including the ability to manage, interpret, and analyze large data sets; familiarity with and the ability to apply relevant statistical and mathematical concepts; proficiency in a number of scripting languages; and detailed knowledge of a variety of biological disciplines. Because of this need for a broad skill set there are many paths to becoming a bioinformatician and many areas of specialization. The best bioinformaticians don't come from one discipline or another. They come from self-motivated, independent thinkers and problem-solvers for whom starting the day not knowing how to do something and figuring out how to do it is a way of life. Our group puts these skills to the test analyzing a variety of different types of data from next-generation sequencing data to quantitative imaging data and more.

ABSTRACTS OF FACULTY RESEARCH TALKS

Deanna van Dijk, Ph.D.
Professor
Geology, Geography & Environmental Studies
Calvin College

"Building our Knowledge of Michigan Coastal Dunes: A Few Grains at a Time"

Described as the largest collection of freshwater dunes in the world, Michigan's coastal dunes are well-loved and frequently visited but not well-researched. Research students and faculty from a handful of Michigan institutions have been piecing together an understanding of the dunes along the Lake Michigan coast. Studies of contemporary dune activity by Calvin College researchers include investigating dune characteristics, changes and influential variables; studying patterns of human impacts; and evaluating the effectiveness of management strategies. Research projects are diverse, ranging from short-term studies to multi-year data collection efforts, from single-investigator projects to 30+ researchers focusing on the same dune, and from investigations by PhD scientists to first-year undergraduate students. The projects and investigators share a common goal of advancing knowledge by asking and answering interesting questions about the dunes. Results include a better understanding of storm and seasonal influences on dune changes, information for dune managers about the effectiveness of their actions, and a growing list of additional questions to investigate. The multi-faceted research on Michigan coastal dunes illustrates the value of a community of scientists for building knowledge about a research topic.

Clark Danderson, Ph.D.
Professor
Biology Department
Director of the Aquinas, College Herbarium (AQC)
Aquinas College

"The Arracacia Clade (Apiaceae): Attempting to Bring Order to a Disordered Complex"

The *Arracacia* clade (Apiaceae: Apioideae) is a heterogeneous assemblage of 12 genera, comprising 111 species distributed in high montane temperate and sub-alpine habitats of meso- and South America. Recent molecular studies have indicated that some of the genera (i.e., *Arracacia*, *Coulterophytum*, and *Prionosciadium*) are polyphyletic. Initial cladistic analyses utilizing highly variable, fast-evolving nuclear ribosomal DNA (nrDNA) ITS sequence data were unable to adequately resolve the relationships among these taxa. To further resolve relationships in the clade, a study examining the utility of 20 non-coding chloroplast DNA (cpDNA) loci was performed using nine species representing disparate lineages, as well as intra- and intergeneric-level relationships based on the results of the aforementioned ITS analyses. The cpDNA regions investigated were chosen based on their utility at elucidating low-taxonomic level relationships as demonstrated in previous studies (i.e., Calviño et al., 2010; Miller et al., 2009; Shaw et al., 2005, 2007). To determine how many regions would be necessary to recover resolved phylogenies, a cost-benefit analysis involving the incremental inclusion of loci was performed. Regression analyses examined whether the total number of variable sites (potentially informative characters or PICs in Shaw et. al., 2005) are a good indicator of the total number of parsimony informative characters contained within a region. Additionally, regression analyses considered the effect of aligned sequence length on the total number of variable characters and the number of PI characters, and the relationship between indel length and homoplasy. This study demonstrated that many of the regions commonly used to resolve low-level relationships in angiosperms are not adequate in the *Arracacia* clade and that the combination of the five fastest-evolving non-coding cpDNA loci and nrDNA ITS provide similar resolution as using 20 non-coding cpDNA loci and ITS.

RECRUITER INFORMATION

FERRIS STATE UNIVERSITY
http://www.ferris.edu/colleges/pharmacy

College of Pharmacy
Pharmacy Building
220 Ferris Drive
Big Rapids, MI 49307

Dr. Stephen Durst, Dean
Email: dursts@ferris.edu
Telephone: 231-591-2254

Dr. Thomas Dowling, Assistant Dean/Director of Research and Discover
Email: thomasdowling@ferris.edu
Telephone: 616-643-1137

Ferris State University recruiters/representatives will be available from 9:00 AM to 1:00 PM during the conference/grad fair.

GRAND VALLEY STATE UNIVERSITY
http://gvsu.edu/

Office of Graduate Studies
401 W Fulton Street/318C DEV
Grand Rapids, MI 49504
http://www.gvsu.edu/gs

Jeffrey Potteiger, Ph.D., Graduate Dean
Email: Jeffrey_Potteiger@gvsu.edu
Telephone: 616-331-7105

Jennifer Palm, Office Coordinator
Email: palmj@gvsu.edu
Telephone: 616-331-6858

Department of Biomedical Sciences
312 Padnos
Allendale, MI 49401
http://gvsu.edu/bms

Debra Burg, Ph.D., Associate Professor
Email: burgd@gvsu.edu
Telephone: 616-331-3721

Professional Science Master's (PSM)
301 W. Fulton Street
Grand Rapids, MI 49504
http://www.gvsu.edu/psm/

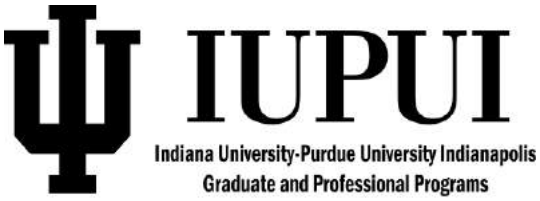
Tim Born, Ph.D., PSM Coordinator
Email: bornti@gvsu.edu
Telephone: 616-331-8643

Guenter Tusch, Ph.D., Professor
Email: tuschg@gvsu.edu
Telephone: 616-331-2106

GVSU recruiters/representatives will be available from 9:00 AM to 3:00 PM during the conference/grad fair.

RECRUITER INFORMATION

INDIAN UNIVERSITY-PURDUE UNIVERSITY INDIANAPOLIS
http://graduate.iupui.edu



Graduate Office
755 W Michigan Street
UL 1170
Indianapolis, IN 46202

Jennifer Mahoney, Graduate Recruitment Coordinator
Email: mahoney2@iupui.edu
Telephone: 317-278-4305

IUPUI recruiters/representatives will be available from 9:00 AM to 3:00 PM during the conference/grad fair.

MICHIGAN STATE UNIVERSITY – COLLEGE OF OSTEOPATHIC MEDICINE
http://www.com.msu.edu/Admissions/Index.htm

College of Osteopathic Medicine
965 Fee Road
A136 East Fee Hall
East Lansing, MI 48824

Lorie Culham, Admissions Manager
Email: com.admissions@hc.msu.edu
Telephone: 517-353-7740

MSU's College of Osteopathic Medicine recruiters/representatives will be available from 9:00 AM to 2:00 PM during the conference/grad fair.

OHIO STATE UNIVERSITY, THE
http://lsn.osu.edu/

Life Sciences Network
Biological Sciences Building
484 W. 12th Avenue
Columbus, OH 43210

Franci Brink, OSBP Program Coordinator
Email: osbp@osu.edu
Telephone: 614-292-1463

OSU's Life Sciences Network recruiters/representatives will be available from 9:00 AM to 3:00 PM during the conference/grad fair.

RECRUITER INFORMATION

PURDUE UNIVERSITY
http://www.purdue.edu/gradschool/

The Graduate School
155 S. Grant Street
West Lafayette, IN 47907

Jeff Goecker, Marketing & Communication Manager
Email: jgoecker@purdue.edu
Telephone: 765-494-2600

Purdue University recruiters/representatives will be available from 9:00 AM to 3:00 PM during the conference/grad fair.

UNIVERSITY OF NOTRE DAME
http://www.nd.edu/

Graduate School
502 Main Building
Notre Dame, IN 46556
http://graduateschool.nd.edu

Lindsay Baxter, Recruiter
Email: lchism@nd.edu
Telephone: 574-631-4694

Integrated Biomedical Sciences
College of Science
233 Nieuwland Science Hall
Notre Dame, IN 46656
http://ibms.nd.edu

Dr. Holly Goodson, Professor
Email: hgoodson@nd.edu
Telephone: 574-387-0077

Elizabeth Loughran, Graduate Student
Email: loughran.11@nd.edu

University of Notre Dame recruiters/representatives will be available from 9:00 AM to 3:00 PM during the conference/grad fair.

RECRUITER INFORMATION

VALPARAISO UNIVERSITY
http://valpo.edu/grad

Graduate School
1700 Chapel Drive
Valparaiso, IN 46383

Megan Mankerian, Admissions Specialist
Email: megan.mankerian@valpo.edu
Telephone: 219-464-5313

Valparaiso University recruiters/representatives will be available from 9:00 AM to 1:00 PM during the conference/grad fair.

VAN ANDEL INSTITUTE GRADUATE SCHOOL
http://www.vai.org/vaei/graduate-school.aspx

Graduate School
333 Bostwick Avenue, NE
Grand Rapids, MI 49503

Carol Rappley, Enrollment and Records Administrator
Email: registrar@vai.org
Telephone: 616-234-5708

VAI Grad School recruiters/representatives will be available from 9:00 AM to 1:00 PM during the conference/grad fair.

WAYNE STATE UNIVERSITY
http://wayne.edu/admissions/graduate/

Office of Graduate Admissions
5057 Woodward
Suite 6000
Detroit, MI 48202

Sarah Weinstein, Relationship Manager
Email: sarah.weinstein@wayne.edu
Telephone: 313-577-7943

Andrew Feig, Associate Dean of the Graduate School
Email: afeig@chem.wayne.edu
Telephone: 313-577-9229

Sondra Auerbach, Manager, Graduate School Master's Office
Email: sondra.auerbach@wayne.edu
Telephone: 313-577-0096

Wayne State University recruiters/representatives will be available from 9:00 AM to 3:00 PM during the conference/grad fair.

Poster Presentations

1. Samantha Morsches, Grand Valley State University **Aquatic Biology**

(Co-Authors: David J. Janetski, Carl R. Ruetz III)

"Spatial patterns of fish communities in Lake Michigan tributaries"

Recognizing spatial patterns in freshwater fish communities is critical for successful resource management and understanding aquatic ecosystems. Spatial patterns of species similarity of fish assemblages can be affected by dispersal and environmental conditions. We hypothesized that as distance increased between drowned river mouths (DRMs), species similarity would decrease. We sampled 15 DRMs connected to Lake Michigan, conducting 10-minute electrofishing transects (n = 5-6 per DRM) along the shoreline to characterize littoral fish assemblages. At each transect, we also characterized environmental conditions (e.g., specific conductivity or # of shoreline buildings). We captured 3,080 individual fish representing 45 species across the 15 DRMs. Catch ranged from 115-358 individuals and species richness ranged from 11-26 species per DRM. The most abundant species caught were Perca flavescens (13.9%), Lepomis gibbosus (10.9%), and Lepomis macrochirus (9.8%). We found a weak positive correlation between species similarity and distance between each pair of DRMs (R2 = 0.03), which did not support our hypothesis that species similarity would decrease with distance, despite evidence of spatial autocorrelation for environmental variables. A potential explanation for our findings is related to gear selectivity of boat electrofishing. We suggest that sampling fish with additional gear or approaches would more rigorously test for the spatial pattern of species similarity among DRMs.

2. Lydia DeJonge, Calvin College **Biochemistry**

(Co-Authors: Nicole L. Michmerhuizen, Margaret A. Van Winkle, Amanda B. Witte; Kumar Sinniah)

"A Biophysical Study of the Interaction between Insulin and G-Quadruplex DNA"

The binding of insulin to the G-Quadruplexes formed from different variants of the insulin-linked polymorphic region (ILPR) was investigated by isothermal titration calorimetry and CD spectroscopy. The thermodynamic parameters (KD,ΔH, ΔG and ΔS) for the insulin-G-quadruplex complex were measured in the temperature range 20 - 37 deg C. A binding affinity in the micromolar range was obtained for the four DNA sequences examined. At higher temperatures, the ILPR b and c DNA sequences were found to be enthalpically driven while the ILPR b and c variants were found to be entropically driven.

3. Abigail Leistra, Calvin College **Biochemistry**

(Co-Authors: Kayla Scholten, Lydia J. DeJonge, Kumar Sinniah)

"A Dynamic Force Spectroscopy Study of the Interaction Between G-Quadruplex DNA and Insulin"

A single molecule force spectroscopy study was performed by AFM to examine the binding interaction between insulin and the G-quadruplex formed by the consensus DNA sequence found in the insulin linked polymorphic region (ILPR). In the AFM force measurements, a gold coated AFM tip was used to unfold the ILPR G-quadruplex strand that was tethered to an ultra-flat gold surface. The unfolding of the G-quadruplex was performed at various pulling speeds and the resulting dynamic force spectrum was analyzed with the Bell-Evans model. The dissociation rate at zero force and the width of the energy barrier were extracted using this model. Future studies will compare these parameters to the unfolding of the G-quadruplex-insulin complex.

4. Margaret Van Winkle, Calvin College **Biochemistry**

(Co-Authors: Kumar Sinniah)

"A Microcalorimetry Study of the Interaction between Hexameric Insulin and G-Quadruplex DNA"

In this study differential scanning calorimetry, and isothermal titration calorimetry were used to characterize the interaction between hexameric insulin and a G-Quadruplex DNA sequence that is found in the human genome. It has been shown that insulin interacts with this G-Quadruplex DNA in previous studies, but studies prior to this have only examined the interaction with monomeric/dimeric insulin. Hexameric insulin in the more common form of insulin in the body, however. This study has interesting implications as this sequence of DNA is only 363 base pairs down stream of the coding sequence for insulin, so if insulin is interacting with this sequence in vivo, it could be regulating it's own transcription.

5. Jedidiah Bell, Calvin College **Biochemistry**

(Co-Authors: Dr. Brendan Looyenga; Dr Larry Louters)

"BRET to Explore the Aggregation of GluT1"

GluT1 is a trans-membrane protein ubiquitous in mammalian cells and responsible for the basal uptake of glucose. Recently, studies have shown that the protein can be acutely activated and understanding the method of activation may be important for developing novel therapeutic approaches for diabetes. Furthermore, there are potential avenues of treatment for cancer since a number of cancers have been shown to over-express GluT1 as a means of supporting their proliferative growth. Research with red blood cells, which express high levels of GluT1, has shown that a tetramic aggregation of the GluT1 protein has the greatest glucose transport activity. Our lab has developed a BRET assay that was able to detect both the aggregation and orientation of GluT1 proteins. Additionally, in conjugation with Flow Cytometry analysis, we were able to estimate the GluT1 concentration at which multimers begin to form on the cell surface.

---

6. Ranu Sinniah, Calvin College **Biochemistry**

(Co-Authors: Mike Catalano, Dr. Kent Gates)

"Can Arylamines form Covalent Adducts with Abasic Sites in DNA?"

Conventionally, Mutagenesis has dealt with small molecule damage to DNA base-pairs resulting in lesions that lead to incorrect replication by error prone polymerase resulting in mutated DNA. Pathways to repair said lesions often go through an Ap (Apyrimidic/purinic) site formation which is then cleaved and repaired. Previous research in the Gates laboratory has shown that the ring open form of an Ap site reveals an aldehyde moiety from the anomeric carbon that can be attacked to form an adduct. This adduct also results in incorrect replication past the site by error prone polymerase. Arylamines are well known functionalities that are used in pharmaceuticals to this day and have also been shown to form stable adducts via the aldehyde moiety. Using dR(Deoxyribose), Aniline, and a series of para-disubstituted Anilines, we were able to observe in vitro adduct formation at the anomeric carbon for the aforementioned Anilines, using various techniques to characterize structure, rate of reaction, and equilibrium constants. Contradictory to source material, the dR ring also isomerized under adduct formation from a 5 to 6 membered ring. In sum, the potential for arylamines as mutagens in relation to Ap directed mutagenesis should be heeded in regards to past and future developments of pharmaceuticals.

---

7. Eve Gardner, Michigan State University **Biochemistry**

(Co-Authors: Eve Gardner, Witawas Handee, Min-Hao Kuo)

"Effect on Phospholipid Content from TAG Metabolism"

Intracellular lipids are responsible for storing energy, protecting cells under adverse cellular conditions and aiding in membrane synthesis. Neutral lipids, namely triacylglycerol (TAG), have been described as energy-storing lipids, while phospholipids (PL) primarily serve as the major structural component of the cell membrane. Recent research from our lab shows that in budding yeast, Saccharomyces cerevisiae, TAG has a novel pro-longevity function of non-dividing cells. Budding yeast has been used as a model for aging studies of both dividing and non-dividing cells in two modes of lifespan regulation, chronological (non-dividing cells) and replicative (dividing cells). Forcing TAG synthesis extends the chronological lifespan, but shortens the replicative lifespan. We suspect that forced TAG accumulation in dividing yeast cells reduces the availability of PL for membrane biosynthesis during division. This research is aimed at understanding the relationship between the synthesis and regulation of TAG and PL in correlation with one another and their respective roles in replicative lifespan.

8. Alyssa Shepard, Central Michigan University **Biochemistry**

(Co-Authors: Dr. Michelle Steinhilb; Alyssa Shepard)

"Examinig the intracellular breakdown of toxic tau fragments: Optimizing Drosophila neuron culture"

Alzheimer's disease is characterized by two pathological abnormalities in the brain: plaques and tangles. Increasing evidence suggests that the tangle pathology, caused by abnormalities in the microtubule-associated protein known as tau, is primarily responsible for toxicity in the brain. Our lab and others have recently implicated the generation of small toxic tau fragments as a critical step in tau-induced neurotoxicity. We hypothesize that tau toxicity may be ameliorated either by preventing the generation of toxic tau fragments or enhancing their degradation. Healthy neurons recycle proteins by degrading them using either the ubiquitin-proteasome system or the autophagy-lysosomal system. Results from several other laboratories suggest that the autophagic pathway might be particularly important for clearing toxic proteins associated with several neurodegenerative diseases. The goal of this project is to determine how toxic tau fragments are eliminated by neurons. We speculate that, similar to the removal of other toxic proteins, neurons will utilize the autophagic clearance pathway to degrade toxic tau fragments. In this study, primary cell cultures of Drosophila brain cells will be optimized for treatment with different substances to enhance autophagy or to diminish it. Microscopy techniques will then be used to measure the rate of autophagy and general cellular toxicity levels in Drosophila neurons.

---

9. Taylor Hegg & Matthew Hollowell, Calvin College **Biochemistry**

(Co-Authors: Susan Hromada, Alexandra Bognar, and Dr. David E. Benson)

"Formation, Function, and Biological Scope of Tyrosine-Cysteine Crosslinking"

The role of the post-translationally modified tyrosine-cysteine (Tyr-Cys) and other crosslinks has been shown to have significant effects in various biochemical systems. Tyr-Cys functions as a co-oxidant in galactose oxidase and has been proposed to contribute a rigid, regiospecific hydrogen bond donation in cysteine dioxygenase. Histidine-tyrosine, an analogous crosslink, in cytochrome c oxidase acts as a sacrificial reductant to decrease the reactivity of the heme site. As such, an exploration into the mechanistic details of Tyr-Cys crosslink formation has been examined using an orphan protein from Bacteroides fragilus, BF4112, as a chemical model. BF4112 has a tyrosine and cysteine sidechain geometrically predisposed for Tyr-Cys crosslink formation adjacent to a His2Glu coordinated metal binding site. We previously reported that dioxygen exposure of the Cu(I) derivative forms a Tyr-Cys crosslink based on absorbance (317 nm), fluorescence (400 nm emission), and proteolytic mass spectrometry. Further details of copper-mediated Tyr-Cys formation in BF4112 along with iron-mediated and metal-free conditions for Tyr-Cys formation will be discussed. BF4112 contains only one tryptophan, which allows for absorbance as the preliminary tool to work out reaction conditions. Gel electrophoresis has been shown to indicate covalent crosslink yield but only with moderate precision. Fluorescence spectrophotometry has been found to have a higher precision while consuming similar amounts of protein. Proteolytic mass spectrometry coupled with X-ray crystallography provides the regiospecificity of the crosslink but does not provide the amount of crosslink in solution. Two-dimensional NMR has proved viable in identifying crosslink regiospecificity while also quantifying formation of Tyr-Cys in BF4112 using selective 13C-Tyr labeling. These results will be discussed.

10. Aimee Vos, Calvin College **Biochemistry**

(Co-Authors: Dr. Larry Louters, Dr. Brendan Looyenga, Dr. Eric Arnoys)

"GLUT1 Abundance in Lipid Rafts"

The GLUT1 collaboration project at Calvin College explored the activity of the GLUT1 glucose transporter and its role in chronic diseases such as cancer and diabetes. Glucose transporters are proteins in a cell membrane that allow glucose, a sugar necessary for replication, into the cell. In cancerous cells, these proteins are hyperactive. In the case of diabetes, the proteins are not active enough. Our model of GLUT1 activation proposes that the transporter is active in sections of the membrane that are concentrated with cholesterol. These areas, called lipid rafts, are also abundant in proteins and sphingolipids and therefore are denser than the rest of the membrane. We hypothesize that GLUT1 is abundant and more active in these rafts. Using two similar proteins—hRAS and kRAS—the location of GLUT1 in the membrane can be approximated. hRAS is a lipid raft marker. Its homologue, kRAS, is not typically found in lipid rafts. Using a novel technique called BRET (Bioluminescent Resonance Energy Transfer), the interactions between GLUT1, hRAS, and kRAS can be measured to reflect the proteins' proximity.

11. Evans Lodge, Calvin College **Biochemistry**

(Co-Authors: Jed Bell, Kathryn Wrobel, Dr. Larry Louters)

"Glut1 Surface Expression and Activation"

Presentation that focuses on Glut1, a membrane protein involved in the absorption of glucose in all mammalian cells. Using glucose uptake assays, flow cytometry, and western blotting, presents new data on the relationship between the surface abundance of Glut1 and the related uptake rates of glucose in several different cell lines. Particular attention is given to new techniques involving the use of flow cytometry to detect Glut1 on the cell surface vs. Glut1 abundance in the cytosol. End goal is to elucidate the means by which Glut1 is activated and deactivated, particularly regarding multimerization.

12. Sarah Glass, Kalamazoo College **Biochemistry**

(Co-Authors: Sarah M. Glass, Victoria M. Osorio, Michael J. Glista, Parker W. de Waal, Laura Lowe Furge)

"Interactions of Human CYP2D6 Polymorphisms with the Mechanism Based Inactivator SCH 66712"

Cytochrome P450 enzymes (CYPs) are a heme-containing enzyme superfamily that have a major role in the metabolism of drugs in humans. CYP2D6 is highly polymorphic with over 100 different allelic variants and is responsible for approximately 15% of CYP-mediated drug metabolism. Molecular modeling simulations of the polymorphisms CYP2D6*1, *17-2, *17-3, *34, and *53 with docked SCH 66712, a ligand that is a mechanism-based inactivator, suggest that SCH 66712 should inactivate these variants. The studies further suggested that varied flexibility and substrate binding-pocket accessibility within the allelic variants may alter interaction abilities between the enzyme and drug. In the current study, the CYP2D6 allelic variants are expressed and purified to further characterize these interactions with inactivators. Physical studies with the variants will be compared to molecular dynamics models and be used to broaden the understanding of interindividual interactions with mechanism-based inactivators.

13. Michael Brunner, Grand Valley State University **Biochemistry**

(Co-Authors: Rachel A. Powers)

"Investigating the Potential of Arylboronic Acids as Novel OXA-1 β-Lactamase Inhibitors"

β-lactam antibiotics, such as penicillin and carbapenems, have been used within the medical community to battle bacterial infections for several decades. However, due to years of overuse, widespread resistance has developed within bacteria. β-lactam resistance is obtained through many different means, yet perhaps the most effective is the production of β-lactamase enzymes. These enzymes hydrolyze the lactam ring of these drugs, which renders them inactive. To overcome this obstacle, β-lactamase inhibitors were developed. Unfortunately, these inhibitors mimic the classic β-lactam antibiotic structure, which results in bacteria developing resistance to these inhibitors as well. This presents an urgent need to develop novel inhibitors for the four classes of β-lactamases. Class D β-lactamases are some of the least understood and most clinically dangerous enzymes, and are capable of hydrolyzing last resort antibiotics, such as carbapenems. They are also not inhibited by clinically available β-lactamase inhibitors, like clavulanic acid. Boronic acids are known transition-state-analog inhibitors of both class A and C β-lactamases and provide a novel means to inhibit class D β-lactamases. Fourty-one different arylboronic acids were tested for inhibition of the class D β-lactamase OXA-1. Smaller compounds armed with functional groups that are cooperative with the enzyme offered more encouraging leads than bigger, bulkier compounds that do not seem to interact well with it. Compound 18 offered the most encouraging results with a Ki = 110 uM. Further exploration of these smaller compounds, alongside identification of an enzymatic structure with the drug bound, might lead to development of a novel Class D β-lactamase inhibitor.

---

14. Lauren Hillers, Hope College **Biochemistry**

(Co-Authors: Carissa Perez Olsen)

"Investigating the Protective Role of the Peroxisome in Stress Response with C. elegans"

Cellular macromolecules can be easily attacked by reactive oxygen species, and the cell must limit this oxidative damage to survive. An understudied mechanism to protect against oxidative damage is a specialized group of ether-linked lipids that are hypothesize to absorb reactive oxygen species. Because these ether-linked lipids are exclusively synthesized in the peroxisome, we examined the role of this organelle in stress response by inhibiting the peroxisome biogenesis pathway in Caenorhabditis elegans with RNAi. First, we looked for changes in fatty acid composition with gas chromatography/mass spectrometry and found an increase in saturated C18:0 abundance, demonstrating a disruption of peroxisome function. Then, we treated these nematodes with hydrogen peroxide and found a diminished capacity to recover, establishing an important role for the peroxisome in stress response. Moving forward, we are quantifying the abundance of ether-linked lipids with peroxisome biogenesis knockdown to explicitly test their role in stress recovery.

---

15. Miriam Rienstra, Calvin College **Biochemistry**

(Co-Authors: Calvin Van Opstall, Brendan Looyenga)

"LRRKing for Cure"

Leucine-rich repeat kinase 2 (LRRK2) is protein involved in vesicle trafficking. LRRK2 is overexpressed in renal and lung cancer cells. Previous experiments have shown that when LRRK2 is knocked down the golgi apparatus is destroyed which causes cell death. It was hypothesized that a therapy could be designed combining LRRK2 inhibitor drugs with a chemotherapy drug. The combination drug would be just as effective but more targeted to cancer cells and therefore less toxic. The LRRK2 inhibitor drugs used were GNE, L2N1, PFE and the chemotherapy drug used was Vincristine a cell viability assay was used to test this hypothesis. It was also hypothesized that LRRK2 inhibitor drugs would affect cell growth and cell migration. This hypothesis was tested by using a soft agar assay and a scratch assay. From the cell viability experiments a concentration range and LD50 were found for treatments of Vincristine on cancer cell. The soft agar and scratch assays both showed LRRK2 inhibitors to have some effect on the tumorgenicity and migration (respectively) of the renal and lung cancer cells. Future experiments would include more testing of the combination LRRK2 inhibitors and Vincristine in cell viability assays. Further utilization of soft agar assays and scratch assays would also be used to collect more data on the effects of LRRK2 inhibitor drugs on tumorgenicity and cell migration in renal and lung cancer cells.

16. Brandy Mullen, Hope College **Biochemistry**

(Co-Authors: Roudeland Metellus, Megan Munger, Luke Ragon, Dr. Micheal Pikaart)

"Microbial Tracking to Identify Fecal Contaminants in Recreational Surface Waters"

Over the past 2 years, the Pikaart research groups have been working in parallel with the Outdoor Discovery Center to remediate the Lake Macatawa Watershed. Project Clarity, was a plan set forth by the Outdoor Discovery Center and other organizations to restore the watershed to its former glory in November 1, 2012. Project Clarity's goals to improve the watershed would reduce the amount of sediment, nutrients, and bacterial pollution. With a multi-faceted approach to long-sustainability, best management practices, land restoration, and community education, the watershed can be restored in time. To further investigate the cleanliness of the water, the Pikaart group has been working to identify the fecal contaminants in the Lake Macatawa watershed. This was done by tracking the source of the contaminants using qPCR. With qPCR, the microbiological 16s RNA gene sequence was amplified based on primer sets to track the source of the bacteroides. The findings of various sample locations will be discussed along with plans for the future.

17. Sean Cushman, Hope College **Biochemistry**

(Co-Authors: Abigail Schnell, Dr. Maria Burnatowska-Hledin)

"Mutational analysis of VACM-1 and Its Implications for Cancer"

Abstract: VACM-1 (Vasopressin-activated calcium-mobilizing receptor) is a member of the cullin family that has been shown to inhibit cellular proliferation in endothelial and cancer cell lines. The VACM-1/cul-5 gene product regulates the cell cycle by involvement in the E3 ligase complex that leads to protein degradation. The mechanism by which VACM-1 decreases cell growth is unknown, but its cellular functions are modulated by the binding of Nedd8 to the VACM-1 protein. Analysis of the VACM-1 protein sequence has identified consensus sites specific for neddylation. The aim of this study was to view the effects of mutating the three neddylation sites of VACM-1 on cell growth because little is known about the structure-function relationship of this protein. The results of growth assays suggest that the antiproliferative effect of VACM-1 is attenuated in cells transfected with a mutated neddylation site. This lead to the assumption that there must be an on/off mechanism at the neddylation site with Nedd8 for VACM-1's antriproliferative effects to occur.

18. Scott Kitzmiller, Alma College **Biochemistry**

"Potential Inhibitor of Group-1 Neuraminidase"

Some strains of human influenza have high mortality rates, thus identifying more effective treatments is important. After analysis of virus's neuraminidase active site, possibilities of inhibition have been unearthed by the discovery of the 150 cavity. The molecule BANA, an aromatic inhibitor known to inhibit neuraminidase, has been coupled to amino acids that are projected to reach the 150 cavity in effort to inhibit the function of group 1 neuraminidase. Of the 20 amino acids, 16 are being used in the coupling process. Once coupled to BANA, a deprotection step is performed with analysis by NMR and HPLC. When needed, flash chromatography is performed to purify the product. Finally, once the bank of molecules have been synthesized, information will be gathered on the structural and electronic requirements of the 150 cavity.

19. Rina Fujiwara, Kalamazoo College **Biochemistry**

(Co-Authors: Amanda K. Bolles, Laura L. Furge)

"SCH66712 and EMTPP are the First Mechanism Based Inactivators of Both Human CYP2D6 and CYP3A4"

Cytochrome P450s (CYPs) are heme-containing enzymes that metabolize small organic molecules including drugs. CYP3A4 and CYP2D6 are responsible for more than 70% of pharmaceutical drug metabolism and inactivation of these enzymes can lead to drug-drug interactions. The substituted imidazole compounds, 5-fluoro-2-[4-[(2-phenyl-1H-imidazol-5-yl)methyl]-1-piperazinyl]pyrimidine (SCH 66712) and 1-[(2-ethyl-4-methyl-1H-imidazol-5-yl)methyl]-4-[4-(trifluoromethyl)-2-pyridinyl]piperazine (EMTPP), have been previously identified as mechanism-based inactivators (MBIs) of CYP2D6. The current study shows SCH66712 and EMTPP are also MBIs of CYP3A4. The partition ratios for SCH66712 and EMTPP were 11 and 94, respectively. The rates of inactivation, kinact, and inhibition constant, Ki, were 0.21 min-1 and 1.6 µM for SCH66712, and 0.046 min-1 and 11.7 µM for EMTPP, respectively. Whole protein MS analysis was consistent with a binding stoichiometry of 1:1 for both MBIs on CYP3A4 apopprotein. MS analysis of digested peptides of inactivated enzymes was not able to show the site of protein adduction due to low sequence coverage (~65%). Studies of SCH66712 and EMTPP metabolites formed by CYP3A4 showed four mono-oxygenated SCH66712 metabolites and eight mono-oxygenated EMTPP metabolites. Further analysis with MSn coupled with TiCl3 treatments suggested that one mono-oxygenated product of SCH66712 and one of EMTPP were the result of N-hydroxylation. Additionally, inactivation mechanisms of enzymes by possible electrophiles of SCH66712 and EMTPP are proposed. SCH66712 and EMTPP are the first MBIs to be shown to be potent inactivators of both CYP2D6 and CYP3A4.

---

20. Sam Schuiteman, Calvin College **Biochemistry**

(Co-Authors: Drs. Eric Arnoys, Larry Louters, Brendan Looyenga and Aimee Vos)

"The Effect of Cell Density on GLUT1 Activity"

Glucose transporter 1 (GluT1) is a universally expressed facilitative transporter responsible for basal glucose uptake in mammalian cells. GluT1 has significant implications for both cancer and diabetes, where glucose uptake is either constantly stimulated or hardly stimulated. It is believed that multiple GluT1 proteins can oligermize to allow for increased glucose uptake in cells; this study seeks to determine if cell density (the amount of cells in a given area) leads to the activation of GluT1 oligimerization. Supported by Calvin College and the National Institutes of Health.

---

21. ABSTRACT WITHDRAWN

22. Anna Michmerhuizen, Calvin College **Biochemistry**

(Co-Authors: Zac Drees, SeongEun Kim, and Douglas A. Vander Griend)

"The Practical Mathematical Limits of Global Analysis"

For the 1:1 host:guest system, the theoretical limit for determining binding constants has been clearly established, but using the techniques of global analysis, the practical limits for determining the binding constants can be extended. Using global analysis techniques, artificial datasets of spectrophotometric titrations with error added in composition and transmittance have been modeled in order to determine the practical limitations that affect accurate determination of binding constants. When using optimal conditions for the artificial data sets, the practical limits of global analysis increased over a million fold. When poor conditions were used (higher error and non-ideal molar absorptivity curves), the practical limits were 15,000 times as large as the theoretical limits. The extent to which various types of error and molar absorptivity curves shift this limit is also quantified in the results. Overall, global analysis proves to be surprisingly helpful for the determination of binding constants even under conditions where there are strongly binding complexes coming into play.

23. Charles Hyde, Aquinas College **Biology**

(Co-Authors: Dr. Clark Danderson)

"An examination of Synthyris bullii and its presence and abundance in Michigan"

Synthyris bullii (known as kitten-tails) is an endangered species of plant in Michigan. We visited known populations of S. bullii, collected samples and data (soil samples, population size, light availability,etc.), botanized each site, and performed molecular techniques to attempt to assess the conservational status of the plant in Michigan. This will help add to a pool of data on S. bullii from Michigan and surrounding states in the Midwest.

24. Courtney Glupker, Calvin College **Biology**

(Co-Authors: Mark P. Schotanus, John L. Ubels)

"Apoptotic pathway and effect of potassium on corneal epithelial cells exposed to UVB radiation"

Purpose: The goal of this study was to determine the mechanisms by which UVB radiation activates apoptotic pathways in corneal epithelial cells, as well as to determine the possible protective effects high potassium levels, such as those found in tears, have in inhibiting apoptosis in corneal epithelial cells. Methods: Corneal epithelial cells were transfected with specific siRNAs to knock down expression of Fas, FADD, caspases-3 , -6 & -8. This was followed by investigation of UVB-induced activation of apoptosis, as well as effects of a high [K +] on UVB activation of apoptosis. Caspase-activity assays for caspase-3 and caspase-8 were used to determine the possible pathway of activation of apoptosis along with the effects of high K+ concentrations. Knockdown of caspases was quantified by western blot analysis. Results: UVB induced caspase-8 activity increased after caspase-6 knockdown, showing a possible negative feedback effect of caspase-6 on caspase-8. When both caspase-6 and 8 were knocked down, there was still significant UVB induced caspase-8 activity. When FADD and Fas were knocked down, significant caspase-3 and caspase-8 activity was still present following UVB radiation. Conclusions: Caspase-3 and -8 activation even after Fas and FADD knockdown suggests that the pathway activated by UVB in corneal epithelial cells may not be the Fas/FADD pathway. Future research must be done on the mitochondrial/caspase-9 pathway to determine if it could be the pathway activated by UVB. Caspase-3 activity remaining even after caspase-3 knockdown suggests that the apoptotic pathways are very robust, requiring only small amounts of proteins, and thus could still be activated to a certain extent even with siRNA knockdown. Thus caspase inhibitors will also be used in further research to attempt to completely inhibit enzyme activity of caspases-9, -8 and -3.

25. Leanna DeJong &Thuy-Nhi Nguyen, Calvin College **Biology**

(Co-Authors: Darren Proppe)

"Attracting Songbirds with Conspecific playback: a multispecies approach"

Studies show that the presence of conspecifics is an indicator of good habitat for a number of songbird species, a cue positively associated with territory selection. Thus, conspecific playback may be used as a cost-effective tool for attracting songbirds to specific, pre-selected sites of high-quality habitat or to sites where controlled, limiting factors are present. Previous studies have used conspecific playback to encourage the establishment of a single species, however, few have researched the potential for the simultaneous conspecific attraction of multiple species. Further, the effect of song playback on non-focal species is poorly understood. We investigated whether six migratory songbird species are more likely to use habitats and establish nesting territories in response to simultaneous, conspecific playback. To evaluate the effect on the greater songbird community, we assessed the responses of 22 non-focal species. Three of six focal species increased their use of areas near playback speakers, and none were negatively impacted.

26. Catherine Holmes, Cornerstone University **Biology**

"Black-Throated Blue Warbler as a Forest Interior Species"

Black-Throated Blue Warblers are generally considered forest interior species. However, there have been conflicting studies on this. Some studies have found Black-Throated Blue Warblers more common in edge habitats while other studies found them more common in the forest interior. To determine if Black-Throated Blue Warblers are good indicators of intact mature forest, I counted the number of Black-Throated Blue Warblers at the edge, 250m, 500m, and 750m into the forest along 29 different transects in northern Wisconsin. There was no statistical significance between the sites. However, there was a slight positive correlation as distance increased. The small number of Black-Throated Blue Warblers caused the lack of statistical significance. The location of Black-Throated Blue Warblers is more likely due to the density of the shrub layer rather than the distance from the edge. This could explain the conflicting studies with respect to Black-Throated Blue Warblers being forest interior species.

27. McLane Watson, Hope College **Biology**

(Co-Authors: Penny Berger, Dr .Cindy Miranti)

"Discovering ING4 Targets Important in Prostate Epithelial Cell Differentiation Using RNA Sequencing"

Transient expression of chromatin remodeling protein ING4, a crucial downstream switch of Myc and Pten, is required for proper human prostate epithelial differentiation. However, the mechanisms that directly regulate ING4 are poorly understood. Through an RNA sequencing approach, data mining revealed transcription factor CREB1 to play a potentially important role late in differentiation by negatively regulating ING4. CREB-1 activity peaks concurrently with ING4 and is high late in differentiation. Expression of CREB1 targets are increased late in differentiation. Immunofluorescence reveals p-CREB1 localizes to the cytoplasm at day 8 of differentiation, where knockdown of Pten results in nuclear localization of p-CREB1. It is known that loss of Pten results in a loss of transient expression of ING4. Together these data suggest that CREB1 is a key player in proper prostate epithelial differentiation.

28. Jared Grimmer, Kalamazoo College **Biology**

(Co-Authors: Dr. Ann M. Fraser)

"Do bees prefer spotted knapweed over other co-flowering plant species?"

Spotted knapweed (Centaurea stoebe) is a biennial herb native to Europe and Asia that was introduced to North America during the late 1800's. Although considered a noxious, invasive weed, the plant exists as a floral resource for many insect pollinators. This study used field and laboratory approaches to investigate the attractiveness to bees of knapweed flowers compared to those of co-occurring plant species. Transect surveys were used to catalog pollinator diversity and abundance on knapweed and other plant species. From here, knapweed and four focal flowering plant species were selected for use in choice tests of attraction to common pollinators based on floral scent. Bumblebees (Bombus spp.) and European honeybees (Apis mellifera L.) were tested in a glass Y-maze apparatus. Each bee was tested for its preference to each flower's scent against a blank control arm and against knapweed. Floral volatiles were collected from each plant species using Solid Phase Micro-extraction (SPME) and analyzed using gas chromatography mass-spectrometry (GC-MS). Field observations revealed a greater number of bees frequented knapweed over other co-flowering plants. Y-maze experiments showed that the bumblebees generally preferred knapweed over bee balm (Monarda fistulosa), queen anne's lace (Daucus carota), and showy goldenrod (Solidago speciosa), but were equally attracted to hyssop hedge nettle (Stachys hyssopifolia), whereas honeybees consistently preferred the knapweed. All of the bees preferred knapweed and the hyssop sp. to the blank control as well. Volatile profiles are in the process of identification and verification using spectral data and authentic standards. Taken together, the results of this project demonstrate spotted knapweed's attractiveness to bees based on floral scent. Further research should focus on the benefits that spotted knapweed provides to visiting insects relative to other co-flowering species.

29. Clara Schriemer, Hope College **Biology**

(Co-Authors: Dr. Joe Nickels, Dr. Virginia McDonough)

"Effect of the ARV1 Mutation on Sterol Profiles of Candida albicans"

The gene ARV1 encodes a protein that regulates sterol trafficking in Saccharomyces cerevisiae. In S. cerevisiae, loss of ARV1 function results in altered sterol profiles and hypersusceptibility to particular antifungal drugs. Candida albicans is a potentially pathogenic yeast strain that exists in healthy human beings. The cARV1 protein is conserved at the amino acid level. To determine if the ARV1 protein serves a similar role in C. albicans as in S.cerevisiae, we have developed a method to identify the components of the sterol pathway in Candida. Using gas chromatography and GC-mass spectroscopy, we are currently working to determine the sterol profiles of wild type and arv1 mutant C. albicans samples. Our findings will facilitate a better understanding of the relationship between arv1 mutations and drug susceptibility in C. albicans.

30. Caitlin Strikwerda, Calvin College **Biology**

(Co-Authors: Dr. Dave Warners, Caitlin Strikwerda)

"Effects of Climate Change on Blooming Times at Flat Iron Lake Preserve"

This project explores the effects of climate change on flowering times of summer blooming wildflowers at the Calvin-owned Flat Iron Lake Preserve in Greenville, Michigan. This is a multi-year project which began in 2008 and involves students surveying the same area once a week over the course of ten weeks. Flat Iron Lake Preserve includes many different habitats including prairie, forest, swamp, and lake allowing for a wide variety of species to be assessed. As the land was thoroughly covered, all species in flower were identified and recorded. Due to differences in the way data were recorded and collected, not all species in every year can be directly compared. In addition, this multiple-year project is still in its infancy, making any confident conclusions premature. However as data have been accumulating, they appear to show evidence of later blooming times for most species. Some flowering periods also appear to be shortening, while others appear to be lengthening. In the future this extensive floral data set will be analyzed with climate data from the National Oceanic and Atmospheric Administration's National Climatic Data Center (www.ncdc.noaa.gov) to look at correlations between changes in flowering period and climate change. The end goal is to understand how climate change directly influences wildflowers, and how it may indirectly influence higher trophic levels. This study may also provide insight into the adaptability of species in regards to climate change.

31. Deirdre Courtney, Western Michigan University **Biology**

(Co-Authors: Dr. David Karowe)

"Effects of Future Elevated Atmospheric CO2 on Pitcher Plant (Sarracenia purpurea and S. alata) Size, Nectar, Color and Prey Capture"

Due primarily to fossil fuel burning and deforestation, atmospheric carbon dioxide (CO2) is expected to reach at least 750parts per million (ppm) by 2100. When grown under elevated CO2, most plants grow larger, but this results in decreased leaf percent nitrogen. Carnivorous plants have adapted to survive in low nutrient soils by evolving leaves that capture insect prey, from which they extract nitrogen. Pitcher plants attract insects by producing carbon-rich sugary nectar and red anthocyanin pigments. This study asks whether, when grown under elevated CO2, pitcher plants use the additional carbon to enhance these prey capture traits. We grew 40 Sarracenia purpurea and 40 S. alata in open-topped chambers maintained at ambient (400 ppm) or elevated (750 ppm) CO2 at the University of Michigan Biological Station near Pellston, Michigan. One pitcher per plant was sampled for nectar sugar, percent red tissue, pitcher biomass, and biomass of captured prey. Growth under elevated CO2 resulted in significantly higher nectar sugar, but did not affect percent redness, pitcher biomass, or total weight of all pitchers in the pot. Pitchers grown under elevated CO2 also captured significantly more prey biomass, which was nearly significantly positively correlated with both nectar sugar and percent redness. We therefore conclude that future elevated atmospheric CO2 is likely to benefit pitcher plants by providing additional carbon that can be used to enhance prey capture traits.

32. Sara Stack, Kalamazoo College **Biology**

(Co-Authors: Dr. Sara Tanis)

"Effects of the emerald ash borer, Agrilus planipennis, infestation on Carabidae abundance and diversity in southern Michigan"

Agrilus planipennis Fairemaire, emerald ash borer (EAB), is an Asian species whose larvae consume the phloem of ash trees. Emerald ash borer was brought to North America in the early 1990s, and it has since spread to twenty-four states and two Canadian provinces, killing tens of millions of native ash trees (Fraxinus spp). As an invasive species, the potential effects of EAB on North American biodiversity are unknown. Carabidae, a family of large ground beetles, serve as useful invertebrate biodiversity indicators. This study explored how ash mortality, as a result of EAB invasion, affected Carabidae species abundance and diversity in the Lower Peninsula of Michigan. Using pitfall traps, Carabidae populations from eight different sites across Michigan's Lower Peninsula containing living and dead ash were sampled over a period of ten weeks, from June to September of 2014. Only data from three sites were analyzed due to trap flooding at the other five sites. Within each site, two plots were selected, one with and one without a canopy. I hypothesized that greater Carabidae diversity and abundance would be found in sites with living ash and/or an intact canopy than in sites with dead ash and/or a canopy gap. I found that Carabidae diversity and abundance was affected by ash mortality caused by EAB invasion. Highest Carabidae species diversity was found at a site containing living ash, but greatest Carabidae abundance was found at a site containing dead ash. More Carabidae were captured in plots with a canopy than plots without a canopy. Within twenty years of its arrival, EAB has changed North American invertebrate biodiversity and community composition, and its future effects are unknown.

33. Ayaka Abe, Kalamazoo College **Biology**

(Co-Authors: Ayaka Nomichi, Takuro Tsutsumi, Yongtae Hwang, Kazuya Akiyama, Chiya Numako, Hitoshi Abe, Yasuhiro Niwa, Yoshito Mayumi, Kazuhisa Matsumoto)

"Environmentally friendly way of cleaning heavy metal containing sulfuric acid waste"

The experiment described in the following sentences was a replication of the experiment conducted in Dr. Numako's lab at Chiba University. In Dr. Chiya Numako's lab at Chiba University, Japan, a student accidentally dropped metallic lab spoons in a sulfuric acid bath that was intended for cleaning experimental instruments. In this experiment, our aim was to remove the heavy metals dissolved in the waste liquid by using environmentally friendly materials, such as seashells and fish bones. In order to achieve our purpose, we attempted to clean the waste liquid by using the following three methods: A) ion exchange method, B) hydroxide method, and C) ferrite method. As a result of the experiment, we figured out that hydroxide method and ferrite method had the highest heavy metal removal efficiency. Although steps are similar in both methods, since ferrite method requires an extra step for producing ferrite, we concluded that the most efficient method was hydroxide method. In hydroxide method, calcined and powdered seashell, which has alkaline property, was used for forming heavy metal precipitate from sulfuric acid waste liquid. In this experiment, we demonstrated possibility of using waste food materials for cleaning waste liquid. These techniques can be utilized for cleaning waste products from places such as factories and school science experiments.

34. Jodie DeVries, Calvin College **Biology**

(Co-Authors: Mark Schotanus, Prof. Loren Haarsma, Prof. John Ubels)

"FAS, FADD siRNA knockdown does not prevent UVB activated K+ currents through Kv3.4 in corneal epithelial cells"

Human Corneal Limbal Epithelial (HCLE) cells form an optically smooth surface on the eye when coated with tear fluid. When exposed to 80 mJ/cm2 of ultraviolet-B (UVB) – which can happen in less than an hour on a sunny day – potassium (K+) channels open leading to K+ loss. Without the increased K+ in tear fluid, this could lead to apoptosis. (Ubels et. al., 2011). The mechanism of UVB-activated K+ channel opening is unknown. FAS and FADD are membrane proteins well established in the triggering of apoptosis. Using a siRNA knock down of FAS and FADD, it is possible to determine if either protein is involved in early stages of UVB-triggered apoptosis. Whole-cell voltage-clamp current recordings were made using amphotericin B perforated patch techniques. Holding potential was -80mV and the recording protocol consisted of command voltages of -80mV to +120mV at 10mV increments for 250 ms. Whole-cell currents were recorded before and after UVB exposure. BDS-1 (1µm), a specific K+ ion channel blocker, reversibly blocked most of the UVB-activated K+ current. It appears that FAS and FADD knockdown have no effect on the UVB-activated whole-cell K+ currents, so FAS and FADD are not required for UVB-activated K+ currents. However, ion chromatography indicates that FADD knockdown may be affecting UVB-induced K+ loss over longer periods, so more research is required to determine the mechanism of apoptosis after UVB exposure including possible FADD modulation of the ion channels or pumps.

35. Jonathan Knott & David Postma, Calvin College **Biology**

(Co-Authors: Dr. Randy Van Dragt)

"Forty Years of Forest Development in the Calvin College Ecosystem Preserve"

In 1974, the diameter at breast height (DBH) was measured for all trees in the Calvin College Ecosystem Preserve by a Prof. Alan Gebben and John Ubels (a recent graduate). Each tree was categorized by species, size class, and status (e.g. dead-standing, live-leaning, etc.). The trees have been re-measured on a 5 year interval. This summer (2014) we measured all of the trees in the original area (2.0 ha) and expanded the sampling area to include previous "edge" areas (2.0 ha; 4.0 ha total). We measured DBH at 1.3m and 1.5m above ground for all trees >2" DBH. We used a ceptometer (Decagon LP-80) to measure the light level—Photosynthetically Active Radiation (PAR) and Sunfleck (% of the meter in sunlight)—in each quadrat. In total, we measured 3009 trees >2" DBH, and counted 8652 saplings (in the original quadrats). We found that most of the white ash (F. americana) have died in the past 20 years due to Ash Yellows disease and the emerald ash borer (120 trees present in 1994, only 8 remain this year). We also found that the original study area has been progressing towards, and now seems to be stable at a Beech-Maple climax community. American Beech (F. grandifolia) and Sugar maple (A. saccharum) have shade-tolerant saplings which might be related to low light level and high canopy thickness. Finally, we also found that the edge areas had many more earlier successional species with higher importance values, such Red Oak (Q. rubra) and Wild Black Cherry (P. serotina).

36. Megan Munger, Albion College **Biology**

(Co-Authors: Luke Ragon, Roudeland Metellus, Brandy Mullen, Shaylyn Pritchard, Josh Welsch, Dr. Aaron Best*, and Dr. Michael Pikaart*)

"Fun in the Sun with Escherichia coli: Environmental Adaptation and Viability"

Bacteria of fecal origin present a health risk when present in bodies of water used for recreation. These organisms may be reduced in number when exposed to sun - a process known as insolation. The survivability of fecal indicator bacteria, specifically E. coli, of lab, environmental, and fecal isolates was examined. Bacterial cultures were made of all isolates then pipetted into polyethylene bags. The bags were placed outside in direct sunlight for up to three hours. Samples were removed from insolation in forty-five minute intervals and spread on plates to evaluate cell viability. E. coli counts decreased markedly with sun exposure and were completely inactivated after the full time period. There were clear differences in the survivability of each strain. The laboratory strain died most rapidly whereas the fecal isolates proved to be hardy and consistently decayed slower than most of the environmental isolates. These findings suggest that the environmental E. coli strains may not be better adapted to solar radiation than fecal isolates.

37. Abby Stapleton, Calvin College **Biology**

(Co-Authors: Randall J. DeJong, John T. Wertz)

"Genomic Characterization of Jumbo Bacteriophage Shaista"

Termites have complex symbiotic gut microbial communities that perform the essential functions of cellulose digestion, nitrogen fixation, acetate production, and oxygen use. Members of the Enterobacteriaceae family have been implicated in several of these important functions. However, the degree to which external bacteriophages are able to infect these symbionts is unknown. Here we describe the bacteriophage Shaista, isolated from non-termite associated soil on the relatively uncharacterized termite gut Enterobacter sp. KBB.

38. Stacy Hooker, Monica Langeland & Dorthea Leisman, Calvin College **Biology**

(Co-Authors: Dr. Keith Grasman)

"Great Lakes Restoration Initiative: Reassessment of Wildlife Reproduction and Health Impairments in the Saginaw Bay and River Raisin Areas of Concern and Grand Traverse Bay"

This assessment investigated contaminant effects on reproduction and immunological health of fish-eating birds during 2010-14 in the Saginaw Bay and River Raisin Areas of Concern (AOCs) and in the Grand Traverse Bay as part of the Great Lakes Restoration Initiative. Saginaw Bay studies were conducted at two herring gull colonies, two Caspian tern colonies and one black-crowned night heron colony. River Raisin herring gulls were studied at the Detroit Edison Monroe Power Plant. Reference sites were located in the lower St. Mary's River (gulls and terns) and Northern Lake Huron (herons). Embryonic nonviability rates, measured during late incubation, in gulls at AOCs and in Grand Traverse Bay (multiyear means of 4.5-7.4% (Saginaw Bay)and 7.7% (River Raisin)) were generally higher than at reference sites (<2.6%). Infertility and embryonic mortality contributed to nonviability at all sites. Gull and tern chicks in AOCs experienced poor to marginal productivity and growth during some years. Mean phytohemagglutinin skin responses for T-cell mediated immunity were suppressed dramatically in AOCs and Grand Traverse Bay compared to reference sites in young gulls (52-57% AOCs, 47% Grand Traverse), terns (46-49%) and herons (39%). Total antibody response (4.3-4.7, log2 scale) and IgG antibody response (2.1-2.8) were significantly lower at AOCs compared to reference sites (total: 5.5, IgG: 4.1) for young gulls. Total antibody response was lower at Grand Traverse Bay (4.3). Ongoing immunological, developmental, and reproductive impairments in birds at these AOCs are consistent with previous studies on the effects of persistent pollutants, such as PCBs, in Great Lakes wildlife. Grand Traverse Bay shows immune suppression similar to that at AOCs.

39. Tran Nguyen, Calvin College **Biology**

"Identification of Cytokines That Aid Endothelial Cells in HIV Infection of CD4+ Resting T Cells"

Resting CD4+ T cells have been found to be the major targets of HIV infection. Their frequent interaction with endothelial cells (ECs) has been concerned, since ECs appear to exchange certain soluble factors that aid the virus in infecting the cells. In this study, we attempted to further understanding the interaction between resting CD4+ T cells and ECs and the roles of specific cytokines IL6, IL8 and CCL2 in infection of the cells. We performed different infection assays on resting CD4+ T cells isolated from donated blood. We found that the amount of infection was the same, whether or not direct contact between resting CD4+ T cells and ECs happened. We successfully showed that among the three cytokines, only IL6 played a significant role in rendering infection of resting CD4+ T cells. Our research provided more insights into our understanding of EC-stimulated resting CD4+ T cells and the roles of IL6 as well as the importance of soluble factors in HIV infection.

40. Peter Boersma, Calvin College **Biology**

(Co-Authors: Peter Boersma, Mark Schotanus, and John Ubels PhD)

"Identifying the Role of Fas and FADD in UVB induced K+ efflux"

It has been documented that exposure to UVB radiation can induce an efflux of K+ ions from corneal epithelial cells. What has yet to be determined is the mechanism by which the K+ channels are opened. Human corneal limbal epithelial (HCLE) cells were exposed to 150 mJ/cm2 of UVB radiation. Intracellular K+ levels were then measured by analyzing the lysate of the cells using an ion chromatograph. The first protein tested for involvement in the signaling pathway was Fas. Fas was knocked down using siRNA. Cells with negative control siRNA showed a 45% drop in intracellular K+ following UVB exposure compared to cells with no UVB exposure. Cells with inhibited Fas had a 38% UVB-induced drop in intracellular K+. Due to the relatively small effect of Fas knockdown, it appears that Fas is not involved in the UVB induced signaling pathway in HCLE cells. Next, FADD was inhibited using siRNA. When exposed to UVB, FADD inhibited cells demonstrated a 15% loss in K+ compared to control cells. This was a considerably less K+ loss compared to the negative control and was statistically significant. In addition, the average intracellular concentration of K+ of negative control cells not exposed to UVB was 55.4 µg/mg protein, while in cells not exposed to UVB with FADD knockdown the average concentration was 69 µg/mg protein. This statistically significant difference represents a difference of 13.6 µg/mg protein, suggesting that FADD may play a role in maintaining the baseline concentration of K+ in HCLE cells and that UVB may activate K+ channels via FADD.

41. Emily Holloway, Kalamazoo College **Biology**

(Co-Authors: Katie Bezold, Louis Muglia, MD, PhD)

"Immunohistochemical localization of INF2, a novel preterm birth risk allele, in the placenta"

Preterm birth (PTB) in humans is defined as birth prior to 37 weeks of gestation. PTB is a serious health problem as it is the leading cause of death among infants. Overall, PTB is a misunderstood condition that involves a complex interplay between social, environmental, and genetic factors. A recent genome wide association study preformed on term and preterm fetal genomes revealed a SNP (rs7153053) located 5.4 kb upstream of the inverted formin-2 (INF2) gene that is significantly and reproducibly associated with PTB. While INF2 has been linked with various kidney diseases, it is now being considered as a novel candidate gene involved in pregnancy outcome. Initial results showed both substantial and differential expression levels of INF2 in the mouse placenta. Furthermore, immunohistochemical analysis revealed that INF2 localizes to the wildtype placenta and is expressed in placental trophoblast cells throughout as well as near maternal blood vessels of the placenta. These preliminary findings suggest a functional role for INF2 in pregnancy outcome, specifically in placental formation and organization, which could be contributing to PTB.

42. Kaitlyn Greiner, Kalamazoo College **Biology**

(Co-Authors: Mary K. McCarthy; Megan C. Procario; and Dr. Jason Weinberg, MD)

"Immunoproteasome Inhibition Confers Protective Effects in a Murine Model of Adenovirus Myocarditis"

Myocarditis is an inflammatory disorder that affects the myocardium, or the muscle tissue of the heart. Myocarditis is commonly caused by viral infection, and adenoviruses are frequently identified in patients with myocarditis. Because adenoviruses are host-specific, we used mouse adenovirus type 1 (MAV-1) to study adenovirus myocarditis in vivo. During viral myocarditis, the host immune response functions to limit viral replication, but the ensuing inflammation may also damage the infected heart. The immunoproteasome is an alternative form of the constitutive proteasome that is active during inflammation. Prior research has demonstrated the importance of immunoproteasomes in MHC class I presentation of viral epitopes, inflammatory signaling via the NF-κB pathway, and modulation of oxidative stress responses. We hypothesized that immunoproteasome activity both facilitates viral clearance and contributes to detrimental inflammation during adenovirus myocarditis. To test this hypothesis, we used a selective inhibitor of the β5i immunoproteasome subunit, ONX-0914, to characterize the role of immunoproteasomes in MAV-1 infection. We also used RT-qPCR and qPCR to quantify expression of inflammatory markers and viral loads, respectfully. Intranasal MAV-1 infection of neonatal mice induced cellular inflammation, upregulated expression of multiple pro-inflammatory cytokines, and decreased cardiac function at 10 days post infection (dpi). ONX-0914 treatment of neonatal mice beginning 6 dpi led to decreased expression of pro-inflammatory cytokines and chemokines and decreased cellular inflammation at 9 dpi. Our work suggests that immunoproteasome activity contributes to cardiac damage during adenoviral infection, and it points towards immunoproteasome modulation as a potential therapy for adenovirus myocarditis.

43. Miranda Ulmer, Hope College **Biology**

(Co-Authors: Dr. Thomas L. Bultman)

"Indirect Relationship Between Herbivores as Mediated through Endophyte-Containing Plants"

Fungal endophytes are a key aspect to the defense mechanism of many grasses, and it is their production of alkaloids that has been shown to inhibit herbivory. Up until this point, studies of this kind have primarily been focused on the effect endophytes have upon herbivores. There is a whole breadth of knowledge still to be discovered pertaining to the reciprocal effect, that of the effect of the herbivore on the endophyte. Here, we tested if horse (Equus ferus caballus) saliva has an effect on alkaloid levels produced by endophytes within Tall fescue (Schedonorus arundinaceus). We noted a treatment effect between infected and uninfected plants. In addition, we intend for future experiments to separate the plant's response from that of the fungus in order to increase the relevance of our results.

44. Brittany Leonard, Hope College **Biology**

(Co-Authors: Dr. Thomas Bultman)

"Influence of Buchnera on the Detoxification of Fungal-Toxins in Rhopalosiphum Padi"

The bacteria symbiont of many aphids, Buchnera aphidicola, is instrumentally important in the survival of aphids. The bacteria supply essential amino acids, which aphids do not acquire from their diet of phloem sap. However, there is little knowledge of the symbiotic relationship beyond this and it is possible the bacteria are involved in detoxification of toxins. Aposymbiotic (without bacteria) aphids were obtained by feeding them antibiotics via barley. Disruption of bacteria was assessed with PCR and light microscopy. These aphids and symbiotic aphids (Rhopalosiphum padi) were placed on both infected (containing the endophyte, Neotyphodium coenophialum) and uninfected tall fescue (Schedonorus arundinaceus) for a week. The number of live aphids was recorded and analyzed. Two experiments were performed and the results of the two experiments were contrary to what was expected. The aposymbiotic aphids survived significantly better than symbiotic aphids in the first experiment and both aposymbiotic and symbiotic aphids survived equally well in the second experiment. Further tests will need to be performed to confirm the disruption in the aposymbiotic aphids.

45. Josiah Valk, Calvin College **Biology**

(Co-Authors: Ryan M. Bebej, PhD)

"Interpretation of Tail Function in Fossil Cetaceans through Multivariate Analyses of Caudal Vertebrae in Modern Mammals"

One of the keys to understanding the evolution of cetaceans involves elucidating the details of how their derived swimming mode evolved from that of a four-legged, terrestrial ancestor. The development of a specialized tail fluke allows for efficient generation of thrust and is the hallmark of modern cetaceans, but little is known about exactly when and how the fluke evolved. All 21 caudal vertebrae are known for the fossil archaeocete Maiacetus inuus, making it a representative model for the earliest whales. Principle components analysis was used to analyze nine measurements for the first four caudal vertebrae, as well as relative length and width-height ratio of the last nine, in comparison with a wide range of semi- and fully aquatic modern mammals. The first four caudal vertebrae of Maiacetus are consistent with a highly flexible tail. However, the proportions of the terminal caudal vertebrae do not indicate a well-defined tail fluke as they do in basilosaurids and modern cetaceans. Thus, the tail of Maiacetus seems truly intermediate in form and function between terrestrial and aquatic mammals. It appears to have had significant epaxial musculature for controlling its movement, and though a well-defined fluke may not have been present, a tail with a poorly defined nascent fluke cannot be ruled out. Maiacetus represents an early cetacean that likely used its muscular tail to supplement paddling of the hind limbs for generating propulsion during swimming.

46. Erika Steensma, Calvin College **Biology**

(Co-Authors: Dr. Daniel Michele)

"Mechanically-Activated Nitric Oxide Signaling in Duchenne Muscular Dystrophy"

Duchenne Muscular Dystrophy (DMD) is a fatal genetic disorder which causes severe muscle weakness, as well as dilated cardiomyopathy. On a cellular level, DMD is characterized by a lack of dystrophin, a protein of the dystroglycan protein complex which is hypothesized to regulate neuronal nitric oxide synthase (nNOS) activity. Mouse cardiomyocyte models have displayed a disruption in mechanically-activated nNOS activity upon the loss of dystrophin, which could be a source of DMD-related cardiomyopathy as nitric oxide regulates cardiac contractile functioning. However, as cardiac systems between mice and humans vary greatly, there is a need for nitric oxide signaling to be tested in human cardiac tissue. Therefore, nitric oxide synthase activity in response to mechanical stimulation was examined in human induced pluripotent stem (IPS) cell-derived cardiomyocytes. It was determined that mechanical stimulation is useful in regulating nitric oxide production in these cells, although the pathways by which this occurs are not certain. Further understanding of these signaling pathways could be useful in determining therapeutic approaches to restoring nitric oxide production, and thus cardiac function, in DMD patients.

47. Sophie Bennett & Heather Taylor, Grand Valley State University **Biology**

(Co-Authors: Dr. Alexandra Locher and Dr. Todd Aschenbach)

"Modeling the presence of exotic invasive shrubs in West Michigan Forests based on habitat characteristics"

The eradication of invasive species costs the U.S. government over 1 billion dollars annually. In order to more efficiently fight their spread, predictive models can be constructed to guide land managers to invasive hot spots. Forest type, canopy cover, soil properties, past treatment, and the presence of other invasive species were investigated as possible predictors for the presence of autumn olive (Elangus umbellatus), honeysuckle (Lonicera maakii, L. morrowii, or L. tatarica), and multiflora rose (Rosa multiflora) in West Michigan forests. A predictive map was produced that reflected current distributions of these species as well as the possibility of future spread. The viability of predictive models was further supported.

48. Nicholas Arnold, Alma College **Biology**

(Co-Authors: Joe Beckmann, Nicholas Arnold)

"Modulation of CYP1A1 Induction due to Cigarette Smoke in Bronchial Epithelial Cells"

Cigarette smoking is a major risk factor for lung cancer, and the bronchial epithelium is a primary site for carcinogenesis. Some compounds in smoke are enzymatically-activated to carcinogens by members of the cytochrome P-450 (CYP) family, and CYP genes can be induced by chemical exposures. CYP gene induction is mediated by the aryl-hydrocarbon receptor (AhR) which binds some compounds in smoke such as benzo[a]pyrene (BaP) and nicotine. Thus, exposure to these compounds creates a positive feedback loop for the generation of carcinogens. This study is intended to discover compounds that interfere with the AhR transcription pathway and thus mitigate the induction of CYP1A1. The human bronchial epithelial cell line, BEAS-2B, was exposed to varied doses and durations of cigarette smoke extract (CSE) followed by RNA extraction. Both standard and qRT-PCR demonstrated reversible induction of CYP1A1 transcripts. Numerous compounds and hormones were then chosen as candidates to disrupt CYP1A1 induction, the effects of which were first determined without CSE exposure. Epidermal Growth Factor (EGF), retinoic acid (RA), db-cAMP, and TGF-beta lowered CYP1A1 expression, and these were therefore considered for co-exposure experiments. For example, preliminary results indicate that RA partially impedes the CSE induction of CYP1A1 expression. Further dose-response and time-course experiments are in progress.

49. Jamaal Tarpeh, Aquinas College **Biology**

(Co-Authors: Kendra Garcia, Emerald Butko, Natasha DelCid, Ph.D. and L. Rob Peters, Ph.D.)

"Mutagenesis of Zebrafish (Danio rerio) nod1 and nod2"

Nod1 and nod2 encode cytosolic innate immune receptors that bind either, or both, intracellular Gram-positive and Gram-negative bacteria. Ligand-binding by these receptors plays a critical role in activating downstream signaling proteins that upregulate the production of inflammatory molecules critical in protecting against disease. While it is established that Nod receptors play an important role in innate immunity, this role is not fully characterized. Characterizing the role of Nod receptors in the etiology of intestinal immune disorders is challenging due to the intricate relationship between the commensal microbiota and the intestinal innate immune system. The zebrafish (Danio rerio) embryo is an amenable model system for studying the interaction of the immune system with the intestinal microbiota and the concurrent development of the immune system and colonization of the zebrafish embryo with the microbiota. The transparency and ex vivo development of the embryo is highly beneficial in studying real-time biological processes (Kanther et al. 2010). Since a role for Nod receptors is established in intestinal immunity, we will use the zebrafish model system to further characterize the role of these receptors in the intestinal innate immune system. To do this, we plan to create dominant negative Nod receptors and express the receptors in zebrafish intestinal epithelial cells to block the function of the endogenous proteins.

50. Kara Smit, Calvin College **Biology**

(Co-Authors: Deanna Geelhoed, Kara Smit, Dr. Dave Warners)

"Native Habitats in Urban Landscapes: Prince Prairie on Calvin's Campus"

Increased human development has led to decreased native landscapes and biodiversity. In urban areas this loss can be combated by establishing green spaces comprised of native plants and trees. These local flora have many benefits including decreased fossil fuel use, decreased herbicide and insecticide use, wildlife habitat restoration, increased trophic support, storm water and erosion control, genetic diversity enhancement, and pollination attraction. This study's aim was to determine how to install a prairie in an urban area to produce optimal growth with minimal maintenance. In 2013, the 60-plot Prince Prairie was installed on Calvin College's campus to compare the growth of five different prairie species (Sedge, Sand Coreopsis, Pasture Rose, Northern Blazing Star, and Little Bluestem) in six different soil treatments. These treatments consisted of combinations of rototilled or non-rototilled ground and sand:organic soil compositions. The 2014 data show all prairie species grew optimally in the sandiest soil ratios. Growth for rototilling was species dependent; some species preferred the loose rototilled plots, while others preferred non-rototilled soil. There was no correlation between weed mass and soil ratio, rototilling, or the plot's position in the prairie. Taking these results, future prairie restoration projects can know that while rototilling should be species dependent, all the species studied yielded optimal growth in the sandiest soil composition ratio.

51. Jonathan Lin, Calvin College **Biology**

(Co-Authors: John T. Wertz)

"Physiological Characterization of Bacteria Belonging to a Novel Genus of Verrucomicrobia from the Guts of Cephalotes Ants"

Ants play an integral role in terrestrial ecosystems. Yet, little is known about their behavior, feeding habits, and source of nutrition. Bacterial symbionts are known to play a key role in the diversification and ecological adaptation of numerous organisms, including ants. Previously, we successfully isolated CV41 and CAG34, two novel bacteria belonging to Verrucomicrobia from ant guts. In this study, we physiologically characterized and determined the roles of the bacteria in Cephalotes guts. Growth was possible in an atmosphere of 0.5-20% O2 and up to 5% CO2, pH 6.9-7.7, and 0.5-1.5% NaCl (w/v) for CV41 and CAG34. CV41 could not grow in the absence of CO2, making it a capnophile. Both isolates grew optimally at 37 C. While this temperature is higher than expected, it is possible that the bacteria have adapted to the tropical habitat of the ants. CV41 and CAG34 have different substrate preferences, perhaps reflective of long-term co-speciation and dietary preferences of the ants. From comparisons of their 16S rRNA gene sequences, CV41 and CAG34 are 98% similar and both share a 93% similarity with their closest cultivated neighbor, suggesting that they form a novel genus.

52. Jenai Quan, Calvin College **Biology**

(Co-Authors: Dr. Lawrence D. Lemke)

"Small-Scale Variability of Metals in an Urban Garden"

This project evaluated the distribution of seven metals (As, Cr, Cu, Mn, Ni, Pb, and Zn) in an urban garden in northeast Detroit. It was postulated that small-scale soil metal variability would be present and that higher metal concentrations would be found in areas of the garden plots where anthropogenic sources of metal pollutants were suspected. If these metals had shared sources, then covariance between their concentrations was also hypothesized to be present. Composite samples were collected following EPA protocol and nested grid sampling methods were used to investigate meter-scale variability. Soils were analyzed using x-ray fluorescence (XRF). Variability on the order of 3-10m was evident in variograms and in ordinary kriged concentration maps for each metal. The unique concentration patterns observed indicated that metals are not consistently present in greater concentrations in particular regions of the plots. Linear regression of collocated metal concentrations yielded statistically significant correlations ($p \leq 0.05$) among 14/21 metal pairs. The strongest correlation was between Pb and Zn ($R2 = 0.63$, $p < 0.001$). With the exception of As, concentrations of the metals investigated met MDEQ criteria for direct soil contact. These results are promising for urban gardening in Detroit. The protocols developed can be used for future soil studies in other small urban gardens. Further inquiry on XRF accuracy and the risk assessment levels guiding As criteria is recommended.

53. Cassidy Richard, Calvin College **Biology**

(Co-Authors: Randy Van Dragt, Ph.D.)

"The Effect of Prairie Burns on Arthropod Communities at Flat Iron Lake, Kent Co., MI"

Controlled burns are a part of proper prairie management. Prairies have developed over millions of years to recover from and thrive with occasional wildfires that serve to reduce leaf litter, prevent shrub overgrowth, and suppress invasive species. It is not always clear how frequently burns should occur, however, as burning too frequently destroys arthropods and their eggs so that their ability to repopulate the area is hampered. At Flat Iron Lake Preserve, half of the prairie has been burnt each May so that the same plot of land gets burnt every other year. This project examines the arthropod community as a whole and the differences in that community between the more and less recently burned prairie sections. This project seeks to continue activity from last year's work by building on the established inventory of arthropod species in the prairie. The community structures of areas burned in spring 2013 and 2014 are compared to assess the impact of burn recency on arthropod community composition.

54. James Hentig, Western Michigan University **Biology**

(Co-Authors: Dr. Christine Byrd-Jacobs)

"The Olfactory Epithelium in Adult Zebrafish Rapidly Recovers from Chemical Ablation with Zinc Sulfate"

Zinc sulfate is a known olfactory toxicant, although its effects on the olfactory epithelium of zebrafish have not been examined. We tested the hypothesis that intranasal administration of 1M zinc sulfate in the adult zebrafish would result in degeneration and regeneration of the olfactory epithelium within 7 days. Fish were anesthetized, and 2 µl of 1M zinc sulfate were infused into the right olfactory organ; the left side was untreated to serve as an internal control. Fish were allowed to survive for 2, 3, 5, 7, and 10 days post treatment. Tissue was processed and sectioned, then stained with hematoxylin and eosin to analyze structural changes and anti-calretinin to label olfactory sensory neurons. To quantify the amount of neuronal labeling in the olfactory epithelium, the optical density of anti-calretinin labeling was measured by sampling three lamellae per section from three alternating semi-serial sections of each fish. At 2 days and 3 days after treatment, we observed severe morphological changes to the olfactory organ, accompanied by a significant decrease in anti-calretinin staining in the olfactory epithelium. Lamellae of the olfactory organ appeared fused, and there was obvious inflammation of the epithelium, with large vacuoles within the cells. The structure of the olfactory organ returned to near-control morphology with a lamellar arrangement by 5 days after chemical exposure; however, the amount of anti-calretinin labeling in the olfactory epithelium had not returned to control levels. By 7 and 10 days, both olfactory organ structure and anti-calretinin labeling were similar to controls. Thus, chemical ablation of the olfactory epithelium with zinc sulfate results in degeneration of the olfactory organ and removal of most olfactory sensory neurons within 2 days. Rapid regeneration of olfactory organ structure and return of olfactory sensory neurons occurs within a week. Zinc sulfate is an effective olfactory toxicant in zebrafish that can be used to examine injury-induced neuronal turnover of the olfactory epithelium.

55. Alexander Swain, Hope College **Biology**

(Co-Authors: Kyle J. Hill, Donald H. Burke)

"Unraveling the Packaging of HIV's Genome"

An estimated 35 million people are infected with HIV globally, and this sweeping, chronic disease has spawned an intense international effort to develop novel, preventative therapies. Although many aspects of the viral life cycle have been well researched and are relatively well understood, the process of genome packaging remains somewhat ambiguous. Dimerization of two genome copies is important for viral production, which causes an association with other polyproteins (like Gag-Pol), assisting in transporting the genome copies to developing virions for packaging. Dimerization occurs in a 335 nucleotide-long region known as the 5' untranslated region (5'UTR), wherein secondary structures form which are critical in assisting the dimerization. It is still uncertain which nucleotides are necessary for functional genome packaging. To assess this problem we constructed an expression plasmid containing the 5'UTR along with 200 nucleotides of the first open reading frame (gag). Furthermore, we are producing a second plasmid containing a truncated 5'UTR found to be the minimum packaging unit, known as Psi159. These templates will be subjected to mutagenesis and run through a cellular SELEX process, through which several rounds of selective packaging will enrich the libraries for species that contain the most conserved regions necessary for packaging. The RNA will be reverse transcribed and sequenced. The expectation is that the most highly conserved, non-mutagenized regions will continue through SELEX with significantly less mutagenic variability than areas of the 5'UTR not as necessary for dimerization and packaging. This will provide a clearer visualization of the nucleotides most necessary for the dimerization of the HIV genome.

56. Laura Blohm, Calvin College **Biomedical Engineering**

(Co-Authors: Zachery Hernandez, Teresa Tse, Dr. Jose L. Contreras-Vidal)

"Understanding the Mirror Neuron System from Freely Behaving Infants via Scalp Electroencephalography"

The mirror neuron system (MNS) refers to the set of neurons that fire not only when a subject performs an action, but also when that same action is observed being performed. To learn about the development of this system, we studied infants while they were freely interacting with an actor/experimenter. We collected data using active EEG, inertial motion sensors, and video recording. The experimenter interacted and played with the infant throughout the duration of the experiment. Based on preliminary spectral analyses, we found that there is higher spectral power for imitate events over observe events across all electrodes, that a 9-month-old had higher overall spectral power than a 20-month-old, and that there is a greater difference in spectral power in the 6-9 Hz range between tasks in the centroparietal area than in other areas of the brain.

57. Salma Mumuni, Western Michigan University **Biomedical Sciences**

(Co-Authors: Dave Karowe)

"Effects of Future Atmospheric Nitrogen Deposition on the Purple Pitcher Plant (Sarracenia purpurea) Color, Nectar, and Prey Capture"

Fossil fuel burning and agricultural fertilizer use have substantially increased reactive nitrogen in the atmosphere. Under the IPCC B2 and A1FI scenarios, NOx emissions are projected to increase this century by 94% and 254%, respectively. When returned to the surface, atmospheric nitrogen can enhance plant growth. Because carnivorous plants typically grow in nutrient poor habitats, they may particularly benefit from increased nitrogen deposition. The carnivorous purple pitcher plant, Sarracenia purpurea, has adapted to nitrogen-poor soils by evolving modified leaves (pitchers) that capture nitrogen-rich insect prey. Pitcher traits that are positively correlated with prey capture include size, nectar sugar, and amount of red tissue. We hypothesized that, with increased atmospheric N deposition, pitcher plants will invest less in prey capture traits. To test this hypothesis, 90 pitchers in Mud Lake Bog near Pellston MI received either no N addition (control), low N addition (B2), or high N addition (A1FI) weekly for six weeks. Contrary to expectation, N addition did not affect pitcher biomass or redness. However, consistent with expectation, N addition caused a significant decrease in nectar sugar and biomass of prey captured. Low nitrogen addition also enhanced production of new pitchers. Thus, as atmospheric N deposition increases, S. purpurea likely will allocate fewer resources to at least one prey capture trait (nectar sugar) and, as a result, produce more pitchers.

58. Nick Poirier, Grand Valley State University **Biomedical Sciences**

(Co-Authors: Stephen Prior, Rama Koppisetti, and Steven Van Doren)

"Analysis of proMMP-7 Membrane Bilayer Binding Using NMR and Fluorescence Assays"

Matrix metalloproteinases (MMPs) regulate tissue remodeling, inflammation, and disease progression through break down of extracellular matrix components (CS)1. MMP-7, -8, -9, and -12 have been found to be active near cell surfaces with tissue inhibitors of metalloproteinases (TIMPs) present. Previous work in our lab has putatively identified several key residues of proMMP-7 that may play a central role in governing the interaction with the cell surface. These residues are primarily concentrated around the loop connecting beta strands 2 and 3. Located on this loop is the side chain of Trp129, and it is the focus of this current study to determine to what extent this residue is responsible for determining the protein's affinity for lipid bilayers. Fluorescent assays will be performed using DMPC liposomes as a model bilayer. A comparison of W129A/M135C and M135C is expected to show decreased fluorescence relative to W129A/M135C, which would suggest a decrease in membrane binding without Trp129. proMMP-7 has been shown to have an affinity for cholesterol sulfate (CS)2, therefore a second experiment using cholesterol sulfate is expected to yield results which are expected to show W129A/M135C to have close to the same affinity for the lipid bilayer as a wild type (WT). NMR offers an exquisitely sensitive method of analysing the chemical environment of a protein on a by residue resolution. To this end, chemical shift perturbations (CSPs) will be recorded by NMR to analyse the shift changes in W129A/M135C mutant by itself, with the DMPC liposomes, and with liposomes and cholesterol sulfate, in order to gain insight at a high resolution the interaction of proMMP-7 with bilayer components.

59. Dorothy Butler, Grand Valley State University **Biomedical Sciences**

(Co-Authors: A. L. Engerson, D.P. Thomas)

"Analyzing the Roles of Rfg1 and Tup1 in the Interactions Between Candida albicans and Other Microbes"

Nosocomial Candida albicans infections are on the rise in the United States, primarily due to an increased number of invasive procedures, transplants, and use of broad range antibiotics and immunosuppressive agents. One important virulence factor in Candida species is its ability to transition between two morphologies, yeast and filamentous cells. Filamentous formation is controlled by several transcription factors that induce filamentation and several negative regulators that repress filamentation. Rfg1 is one of several partner proteins thought to function in combination with Tup1 to repress genes associated with filamentation and thus potentially influence the virulence of Candida. This study investigates the negative regulators Tup1 and Rfg1 in Candida and their effect on interactions between Candida albicans and various bacteria. In their natural environment, bacteria and unicellular eukaryotes are found together exhibiting both synergistic and antagonistic interactions. Our previous studies have documented decreases in the levels of both RFG1 and TUP1 when wild-type Candida was grown near Acinetobacter baumannii. Interestingly, during such bacterial-fungal coexistence the levels of Rfg1 and Tup1 are not consistent with the action of a repressor of filamentation. These results suggest TUP1 and RFG1 are impacted by cellular signals that form part of the interactions between Candida and other commensals. Here, we look at over-riding such decreases and how this influences the effects of bacteria on the morphology and hyphal specific gene transcription of Candida.

60. Lindsey Lusardi, Grand Valley State University **Biomedical Sciences**

(Co-Authors: Aula Ramo, Lindsey Schroedter, Emma Schroder and Dr. David Linn)

"Can a drug for Alzheimer's disease be of benefit in glaucoma? Results from ACh release and cell culture experiments"

Glaucoma, a neurodegenerative disease, is a leading cause of blindness. It is known that activation of alpha7 nicotinic ACh receptors (nAChRs) on retinal ganglion cells (RGCs) can provide neuroprotection. Theoretically, if one could increase the amount of ACh released, then more nAChRs should be activated and more neuroprotection observed. DMP 543 was originally developed to treat Alzheimer's disease by increasing the release of ACh in the brain. But, will DMP 543 have the same effect in the retina? First, we examined if the release of labeled ACh in the intact porcine eye-cup could be positively affected with DMP 543. Second, we wanted to determine if a dissociated retinal cell culture (including cholinergic amacrine cells and RGCs) could indirectly demonstrate the release of ACh as measured by increased cell survival. DMP-543 appears to evoke a dose-dependent release of ACh from the pig retina. In addition, we saw an increase in the release of ACh evoked by high potassium pulses during continuous exposure to DMP 543. This is consistent with reports examining ACh release from rat hippocampal slices. In addition, DMP 543 has a similar dose-dependent effect on retinal cell survival in a 'mixed' dissociated retinal cell culture. Currently, we are testing the effects of a selective alpha7 antagonist and modulator to confirm a direct effect and determine the extent of basal ACh release in our culture system. Collectively, these results suggest that DMP 543 may be used to stimulate ACh from cholinergic neurons in the retina to affect increased RGC survival. To our knowledge, this is the first time a drug originally developed to treat Alzheimer's disease could be used as a novel therapeutic approach for treating glaucoma.

61. Sarah Craven, Grand Valley State University **Biomedical Sciences**

(Co-Authors: S. Craven, E. Popma-Metsaars, D. Lown, Ph.D., R.D., M. Spolum MPH, MPP, D. Taylor Ph.D.)

"Characteristics and Fruit and Vegetable Intake of Low-Income YMCA Veggie Van Participants in Grand Rapids and Muskegon, MI"

Background: Increased access to affordable produce may increase fruit and vegetable serving intake. The Food Access in Michigan (FAiM) Project is studying the relationship between food insecurity and food environments in Michigan. The objective of this study was to characterize the individuals utilizing the Veggie Van in low-income areas of Grand Rapids and Muskegon, MI including food security status and fruit and vegetable servings. Methods: The participants were residents in Muskegon and Grand Rapids, MI purchasing food from the low-income sites of the YMCA Veggie Van. Demographics, food security, participation in food assistance programs, and income of the participants was collected. Fruit and vegetable servings were measured with three 24-hour recalls. Anthropometric measures (height, weight, and waist circumference) were collected for all eight participants. Three participants completed both the survey and recalls, three completed only the recalls, and two completed only the survey. Results: The majority of participants who completed the survey were of low food security (60%). Some of the respondents participated in food assistance programs such as SNAP (80%), WIC (40%) and Double-Up Food Bucks (40%). The median fruit and vegetable (excluding potatoes) servings of participants that completed the 24-hour recalls was 1.44 (IQR 0.56, 1.46) and 1.46 (IQR .93, 2.83). Conclusion: At low-income sites, the YMCA Veggie Van is reaching primarily low-income individuals with potentially low food security. The fruit and vegetable servings of Veggie Van participants is much lower than the recommendation of 5-7 servings per day, which may suggest that fruit and vegetable intake is influenced by more than increasing access.

62. Jayson Smith, Central Michigan University **Biomedical Sciences**

(Co-Authors: Dr. Anja Mueller)

"Characterization of BSA release as a function of polysaccharide hydrogel skin scaffold degradation"

Third degree burns are characterized by destruction of both the epidermis and the dermis of the integument. Current clinically-used curative methods for 3rd degree burns can involve transmission of viruses from dressings or tissues that do not come from the victim's own body, such as skin grafts from cadavers, and excessive scarring without regeneration of hair and glands (Martin, 1997). A crucial component to the healing process is the delivery of proteins, which act as cell signals to trigger and direct appropriate cellular healing and reduce scarring (Martin, 1997). Biocompatible, biodegradable polysaccharide hydrogels have been developed as an alternative to traditional methods for healing full-thickness burns. These gels avoid virus transmission and have the potential to reduce scarring and allow for the regeneration of hair and glands at the damaged site. They also provide the good hydration required for maximum wound repair (Atiyeh, 2002). Further, these gels have the potential to be charged with the above mentioned healing signals. It is known that not only is the release of the proper signals important, but that they are released at the correct time is of likewise mention (Martin, 1997). The specifics of how well these gels might facilitate protein storage and release is still unclear, and thus this study will investigate degradation of these gels and the subsequent release of bovine serum albumin (BSA) as a model for other proteins. The expected result of the study is that polysaccharide hydrogels will prove to be an effective medium for BSA uptake and release as a function of their general degradation mechanics. If this is found to be true, the implications are that these hydrogels might be also effective at uptake and release of cytokines and other healing protein signals. Ultimately, if the expected results are observed at the end of the study, polysaccharide hydrogels will be closer to use in a clinical setting for application to, and effective healing of, 3rd degree burns.

63. Courtney Cave, Grand Valley State University **Biomedical Sciences**

(Co-Authors: Courtney Cave, Dr. Kevin Strychar)

"Decline of Benthic Amphipod Diporeia caused by the Invasive Zebra Mussel's associated Pathogens"

Populations of the freshwater amphipod Diporeia spp. in the Great Lakes have steadily declined since the late 1980's. Prior studies have provided inconclusive data on possible reasons for their decline, but suggest that factors such as food competition, predation, toxic excretions, and potential diseases associated with aquatic invasive species (AIS), in particular zebra mussels (Dreissena polymorpha), may have caused the collapse of Diporeia throughout the Great Lakes. In this project, the possibility of pathogens as the root cause of Diporeia's collapse is examined. Linear regression modeling showed a significant positive linear association between percent of Diporeia exhibiting a pathogenic infection and year ($r=0.7202264$, p-value≤ 0.0124). Chi-square testing for independence was also used to test if there was an association between year and percent infection. Values obtained were $X2 = 50$, $df = 10$, p-value≤ 0.0001, implying significant association between year and infection. As such, the data indicates that zebra mussels and possibly other AIS (e.g. Quagga mussels; Dreissena rostriformis) may have acted as the vector for pathogen(s) that infected Diporeia and be the cause of their decline. Future research is needed to examine zebra and quagga mussel tissues for similar pathogens, including live studies of potential infection.

64. Alicia Flores, Grand Valley State University **Biomedical Sciences**

(Co-Authors: Chris Reed)

"Determination of Palatal Bone Density to Aid in Oral Mini-Implant Surgical Success"

Mini-implants are titanium alloy rods implanted in the bone of the hard palate to help secure dental prostheses like dentures, fixed crowns, and bridge installations. Recent research suggests presurgical determination of bone density quality provides increased mini-implant surgical success rates. In replication of these methods, we evaluated 19 living individual CT scans from Saint Mary's Hospital, using Osirix 8.5 imaging software. Bone density was recorded at 90 separate coordinates using Hounsfield units, measured at three millimeter intervals (mediolaterally and anteroposteriorly starting at the incisive foramen.) The data was then analyzed for age differences and average bone density throughout different regions of the hard palate including intra- and interobserver analysis. Sex differences were closely investigated in this study because prior research has indicated that women may have a higher palatal bone density than men.

65. Christina Sarkissian, Grand Valley State University **Biomedical Sciences**

(Co-Authors: Douglas Graham)

"Genetic analysis reveals pronounced population subdivision in raccoon roundworm in West Michigan"

Baylisascaris procyonis, a.k.a. raccoon roundworm, is increasingly being recognized as a cause of visceral, ocular, and neural infections in wildlife and humans. Despite its emerging public health importance, very little is known about the population dynamics of this parasite. We analyzed the population genetic structure of this parasite in West Michigan based on DNA extracted from adult worms obtained from euthanized raccoons provided by fur-trappers, animal control operations, and roadkills. Over 200 specimens of B. procyonis were collected from 84 raccoons over a 12 month period. Prevalence of infection showed a pronounced seasonal variation: close to zero during the winter and over 70% during the late summer and fall. Analysis of polymorphism at eight microsatellite loci indicates two nearly distinct subpopulations on either side of the Grand River: an unusually high degree of substructure given the small geographic scale of the region sampled (~150 square miles), and the high vagility of raccoons. Our results also reveal a high degree of relatedness among worms isolated from individual raccoons.

66. Nicholas Huisingh, Grand Valley State University **Biomedical Sciences**

(Co-Authors: Nick Huisingh, Doug Peterson, Jordan Straight, Darcy Kaufman, Elizabeth King, Sarala Sarah, Merritt Taylor)

"Nato3 induces the expression of key DA neuron markers in a regionally and temporally specific manner within the developing CNS"

In the developing stages of the CNS, neural stem cells gradually adopt specific cell fates and differentiate accordingly. The floor plate of the developing midbrain gives rise to dopaminergic (DA) neurons, an important class of neurons involved in Parkinson's disease. Better understanding of the mechanisms by which DA neurons are created is of great interest and would accelerate promising applications such as cell replacement therapies. Nato3, a basic helix-loop-helix transcription factor, is expressed in the floor plate region of the midbrain during development. In vitro studies suggest that Nato3 overexpression is sufficient to promote floor plate and DA neuron marker expression, whereas in vivo studies suggest that Nato3 is not. Here, we show that overexpression of Nato3 in the developing chick produces a regionally and temporally dependent increase in DA neuron markers Nurr1 (an immature DA neuron marker) and tyrosine hydroxylase (TH) (a mature DA neuron marker) within the ventral midbrain. In-ovo electroporation was used for transfection, and Nato3 overexpression was monitored using a bicistronic EGFP reporter expression vector. The observed effects were characterized by immunohistochemistry. The regionally specific action of Nato3 on DA neuron markers suggests that it is regulated by an unknown mechanism that functions early in development within the ventral midbrain. These data provide new insight into the action of Nato3 on DA neuron marker expression in vivo and help to better characterize the role that Nato3 plays in DA neurogenesis.

67. Jack Bontekoe & Veena Janardan, Grand Valley State University **Biomedical Sciences**

(Co-Authors: Dr. Francis Sylvester)

"Physical Endothelial Denudation Techniques of Porcine Mesenteric Arteries"

Vascular reactivity, the constriction and dilation of arteries, is regulated by multiple factors. Arteries have three layers: the tunica intima, an innermost layer including a simple endothelium that defines a lumen; the tunica media, a vascular smooth muscle layer; and the tunica externa, an external connective tissue layer. Prior to 1980, it was thought vascular smooth muscle was solely responsible for mediating changes in vascular reactivity. The work of Furchgott and Zawadzki demonstrated that the endothelium plays a role in modulating reactivity as well. Previous work in our lab utilized porcine mesenteric arteries in which the endothelium was physically removed, a technique called denuding. Only one technique was used and the extent of denudation was not verified. This study employs three techniques: finger denudation, contoured wire denudation, and dissecting probe denudation. The reactivity of denuded vessels is compared to endothelium-intact vessels to determine whether the endothelium is fully removed. Potassium chloride/phenylephrine and acetylcholine (ACh) will be used to induce constriction and dilation respectively. Since ACh-induced dilation is endothelium-dependent, denuded arteries are not expected to dilate in response to ACh while intact vessels should. The most effective physical denuding method found will be used for future studies. We hypothesize this to be the contoured wire technique due to greater denuding replicability regardless of researcher.

68. Merritt Taylor, Grand Valley State University **Biomedical Sciences**

(Co-Authors: Daniel Doyle, Steven Durham, Kristy Rieger, Kasey McKay, Derek Haas, Joshua Lee, Merritt Taylor)

"Role of docosahexanoic acid (DHA) and other Polyunsaturated Fatty Acids on Neural Stem Cell Differentiation in the developing embry"

Long chain fatty acids have been shown to play a role in the generation of new neurons, or neurogenesis, in vitro. In this study, the effects of long chain fatty acids are investigated in vivo. Docosahexaenoic acid (DHA) is a long chain fatty acids that has been shown to promote neurogenesis in vitro. In this in vivo study chicken embryos were injected with docosahexaenoic acid (DHA). After incubation, the tissues samples were analyzed to determine the effect of DHA on neurogenesis. The DHA injected samples in early neurogenesis showed a significant increase in neurons (NeuN+ cells) as compared to the control (BSA only). As neurogenesis progressed, the number of neurons in the control increased, but the number of neurons in the DHA injected samples remained the same. These results suggest that DHA drives differentiation in early neurogenesis at the expense of neural stem progenitor cells in later neurogenesis.

69. Adam McMillan, Grand Valley State University **Biomedical Sciences**

(Co-Authors: Jianshuang Li, Dr. Tao Yang)

"Sclt1: A Key Gene in Ciliogenesis"

Ciliopathies are a broad group of diseases seen in patients who have serious defects of or the complete lack of primary cilia. Primary cilia are antennae-like sensory organelles emanating from the surface of the majority of human cells that facilitate communication between the cell and the outside environment. In the clinical field ciliopathies are seen to affect most of the organs of the body, but especially the kidneys. Polycystic kidney disease (PKD) affects about 600,000 people in the U.S. and accounts for about 5% of all kidney failures. The two hallmarks of ciliopathies are PKD and polydactyly. Sclt1 is one of the genes most closely related to ciliopathies. The truncation of Sclt1 in the mouse model leads to polycystic kidney disease and polydactyly, the two hallmarks of ciliopathies. The role of Sclt1 in the mouse model was examined through cell serum starvation, qPCR, and Western Blot techniques. To show the polydactyly effect of Sclt1 knockout in the mouse model, an improved skeletal staining procedure was developed. We have shown that loss of Sclt1 leads to defects in ciliogenesis, and that Sclt1 is universally expressed in multiple organs but highly expressed in the kidneys. This data directly resembles that of the available clinical data. In addition, it was shown that the loss of Sclt1 blocks PDGF-AKT/ERK signaling. The optimized skeletal stain procedure relies upon heat to perfectly stain the digits and show the polydactyly phenotype.

---

70. Brandy Lancewicz, Alma College **Biotechnology**

(Co-Authors: Mario Soliman, Srini Charyulu, Cameron Danesh-Pajou, Anya Held, Dan Mun, Aabha Vora, Shobha Potlakayala, Theresa Swenson, Sairam Rudrabhatla)

"Biochemical Analysis of Camelina sativa Under Abiotic Stress"

Agricultural production and quality are adversely affected by various abiotic stresses including water deficit conditions (drought), salinity, and extreme temperatures (cold). The amount of crops lost, due to abiotic stress, can amount to billions of U.S. dollars. To prevent such losses, it is necessary to develop stress-tolerant crops. Eight assays were designed and utilized to understand the biochemical, molecular, and physiological changes that are occurring within the biofuel crop Camelina sativa, while subjecting it to drought, salinity, or temperature stresses.

---

71. Rebecca Muriset, Ferris State University **Biotechnology**

(Co-Authors: Dr. Anne M Spain)

"Characterization of Growth and Surface Motility in Soil Isolates Paenibacillus sp., strains A1 and A3"

Soil isolates A1 and A3 were obtained from soil adjacent to the Muskegon River in May, 2012. Both isolates display a unique growth pattern when grown on solid media, in which swarming occurs in a way such that colonies appear "scattered" across the entire surface of a plate. Basic microscopy was performed to reveal A1 and A3 are gram variable, endospore formers. Isolates were identified by amplification and sequencing of the 16S rRNA gene and underwent a series of basic microbiological experiments to determine effects of various environmental factors (temperature, pH, salinity, media type, and agar concentration) on growth rate and pattern formation on solid media. Data showed isolates are Paenibacillus species, as both were most closely related to Paenibacillus taiwanensis (>99% gene similarity), and grow optimally in liquid culture at 35°C, pH 7.0, and 0-0.05% added NaCl. Surface growth pattern was most affected by agar concentration and media type. More work will be performed to determine what factors in media composition may affect surface growth pattern.

72. Nate Buteyn, Calvin College **Biotechnology**

(Co-Authors: Ye In Oh, Herb Fynewever, David Koetje)

"Comprehensive Analysis and Outline of Two Introductory Biology Lab Courses"

Two introductory biology courses were redesigned within the framework of Vision and Change in Undergraduate Biology's five core competencies. We aimed to strike a balance between open-ended inquiry and direct instruction; to engage students in the excitement of authentic research while providing guidance and structure in areas where they needed scaffolding. A broad range of materials including test scores, SALG surveys, focus group interviews, course evaluations, and student notebooks were used to evaluate the labs' efficacy. Differing patterns were found in the two labs. One course observed significant learning gains on compartmentalized, technical laboratory skills, but failed to see evidence of higher order cognitive skill on a challenging problem. This was coupled with negative student dispositions regarding the revision. The other course saw fewer significant learning gains overall but positive student disposition. This contrariety reveals the struggle educators face in achieving an optimal balance between direct instruction and inquiry. Utilizing the principles of scientific teaching, the labs are being continuously refined so as to provide students with a balanced learning environment.

---

73. Calvin VanOpstall, Calvin College **Biotechnology**

(Co-Authors: Dr. Eric Arnoys, Dr. Larry Louters, Dr. Brendan Looyenga)

"Development of Flexible Linker for Validation of NanoLuciferase and mCherry BRET Assays"

GluT1 is a passive transporter of glucose in mammalian cells that has been shown to play a critical role in various diseases including Type I diabetes and several forms of cancer. The mechanism of increased GluT1 activation in mammalian tissue is not yet clearly defined, but may involve the formation of homodimers and homotetramers. In order to investigate the possibility of such oligimerization events, we used Bioluminescent Resonance Energy Transfer (BRET) assays to show the presence of physical protein-protein interactions between GluT1 molecules. Our BRET assay uses the novel BRET pair of Nanoluciferase™ (Nluc) and mCherry, which has the advantage of low background signal due to a large Stokes shift. This BRET pair also has the potential for a longer Förster radius than previously published pairs due to the dramatically increased luminescence of Nluc over the typical Renilla or Firefly luciferases. The work presented here was designed to validate this novel BRET pair by experimentally determining the Förster radius, and applying it to our research involving GluT1 activation models. This approach has allowed us to determine the actual distance between the N- and C-termini of dual labeled GluT1 molecules (Nluc-GluT1-mCh), as well as the threshold of Glut1 expression that is required to induce intermolecular BRET. Together these data provide compelling evidence for the formation of multimeric GluT1 complexes in mammalian cells.

---

74. Emalee Ousley, Alma College **Biotechnology**

(Co-Authors: Advised by: Dr. Brian Doyle)

"Screening of Mid-Michigan Plants for Antioxidant Activity in the DPPH Assay"

Investigation of plants used in Native American traditional medicine has lead to several important pharmaceuticals. Included among these are the anticancer agents, paclitaxel and etoposide. The aim of this study was to screen Mid-Michigan plants for biological activity in order to gain insight into the biochemical basis for their traditional use as well as their potential value in the development of new therapeutics. Alongside other assays such as the brine shrimp lethality assay and cancer cell-based antiproliferative assays, the DPPH assay is being used to determine antioxidant activity of plant extracts. Cellular damage due to the presence of oxidative free radicals has been implicated in various diseases including cancer. It has been hypothesized that antioxidants may provide some benefit by mitigating the effects of damaging free radicals. Our prelimary data indicate that several of the plants studied do have antioxidant activity, and the activity varies widely among species. Future plans for the study include phytochemical investigation of active plant extracts in order to identify active chemical constituents.

75. Katie Uhl, Grand Valley State University **Cell and Molecular Biology**

(Co-Authors: Basma Khudhur, Dr. Robert Smart, Dr. William Schroeder, and Dr. Suganthi Sridhar)

"Biological Testing of Novel Telomerase Inhibitors"

Normal cells are limited in the number of times they can divide by the caps on the ends of their chromosomes, called telomeres. These caps are supposed to become degraded over time, eventually signaling the cell to die when they become too short. During the summer of 2013, three novel compounds were made via synthesis of cinnamoyl chloride derivatives. These three compounds all contain active sites that are identical to those identified on BIBR 1532, a known telomerase inhibitor, with one key difference in the element attached to the aromatic ring. These three compounds were tested for anticancer properties on metastatic prostate cancer cell lines. Their efficacy will be compared against that of BIBR 1532 to determine if this novel compound would prove to be an adequate cancer treatment. If these compounds prove to be telomerase inhibitors, it would be a breakthrough as to how BIBR 1532 functions, and could potentially lead to a more effective cancer treatment. While the compounds were tested using metastatic prostate cancer cells, these potential treatments have applications in both breast and pancreatic cancers as well.

76. Wessel van den Bergh, Hope College **Cell and Molecular Biology**

(Co-Authors: Gloria Chang, Andrew Neevel, Virginia M. McDonough and Joseph Stukey)

"Discovery and functional investigation of cytotoxic mycobacteriophage genes"

The genus Mycobacterium includes species that cause tuberculosis and leprosy as well as the non-pathogenic soil bacterium, M. smegmatis. As part of a national program, Hope College students have isolated and sequenced the genomes of several bacteriophages that infect M. smegmatis. As seen for phages that infect other bacterial hosts, the mycobacteriophage genomes contain many genes of unknown function. We hypothesized that some of those genes encode products that interfere with the normal metabolisms of the host cell, possibly through specific phage-host protein-protein interactions, and thus have a role in enabling the phage infection. We have identified several genes or genomic regions from two different mycobacteriophages that are cytotoxic when expressed alone in M. smegmatis and are taking a multi-prong approach to further identify the specific functions associated with these gene and their products and to determine their roles in the infection process: first, we have identified mutants of M. smegmatis that are resistant to the expression of those genes, second, we are in the process of deleting these genes from the phage genome to determine the effect on infection, and lastly, we are using E. coli-expressed phage genes to screen for interacting host proteins. Preliminary results are presented.

77. Ronald Kamgang, Grand Valley State University **Cell and Molecular Biology**

(Co-Authors: Dr. Margaret Dietrich)

"Assessment of polar growth of a Physcomitrella patens insertional mutant"

Polar (tip) growth in plants is critical for fertilization via pollen tube growth in flowering plants, and it increases the total root surface area for water and nutrient acquisition. Protonemal patterning and developmental timing depend on polar growth in the moss Physcomitrella patens, a model organism for tip growth studies. We have assessed the recovery of polar growth from protoplasts using high and low Ca2+ media, with the aim of determining the effect of the disrupted genome in a mutant strain. Protoplasts from both the wild type and mutant strains are able to recover polar growth within two days on both media. The wild type continues to grow normally in the low Ca2+ environment while the mutant is defective in cell differentiation, a process which occurs in the tip cell. In addition, the filament branching pattern, which requires the establishment of polar growth at new sites, is atypical in the mutant. In contrast, the phenotypes of both strains are affected on the high Ca2+ medium, with the wild type being most severely affected. The wild type is unable to undergo cell differentiation and cell dimensions are very abnormal, while the mutant exhibits more differentiation than is seen on the low Ca2+ medium. These results suggest the mutant requires higher Ca2+ levels to support the cell differentiation process. An influx of calcium ions is required for tip growth in a number of organisms and our results imply that the genome disruption in this mutant has affected tip cell-associated Ca2+ biology.

78. Alexander Fisch, Grand Valley State University **Cell and Molecular Biology**

(Co-Authors: William Schroeder; Robert Smart; Osman V Patel)

"Comparison of nucleoside (AZT) and non-nucleoside (BIBR 1532) reverse-transcriptase inhibitors on triple negative breast cancer cells"

Breast cancer ranks among the most fatal diseases for women in the US. Among the different molecular sub-groups of breast cancer, the most invasive is Triple-Negative Breast Cancer (TNBC). TNBC lacks the over-expression of the often targeted hormone receptors (estrogen, progesterone, and human epidermal growth factor). To treat this particular type of breast cancer, research has shifted towards inhibition of the enzyme called telomerase that is responsible for the indefinite replication of the tumor cells. There are two main classes of telomerase inhibitors known as Nucleoside Reverse Transcriptase Inhibitors (AZT) and Non-Nucleoside Reverse Transcriptase Inhibitors (BIBR1532) based on the method of inhibition. Therefore, the goal of this project was to compare the anti-neoplastic effects of AZT & BIBR1532. Cell viability was measured on days 5, 7, 9, 14, 18 and 27 after treatment with AZT (n=5), BIBR1532 (n=4) or solvent alone (Control, n=3). The number of viable cells in AZT and BIBR1532 treated flasks (T75) fell about 50% (p<.05) and 40% (p<.05) relative to Control by day 14, respectively. Further drops of roughly 15% (p<.05) and 35% (p<.05) were observed on day 27. Our results indicate that the anti-proliferative effects of AZT are lower than BIBR1532.

79. Chelsea Reiber, Grand Valley State University **Cell and Molecular Biology**

(Co-Authors: Alexander J. Fisch1, Robert Smart2, William Schroeder2, Osman V Patel1)

"Comparison of single versus combined therapy on aggressive breast cancer cells"

Triple-negative (TNBC) subtype is the most aggressive form of breast cancer and most difficult to treat. This invasive cancer category also carries a higher risk of recurrence, as well as mortality. Due to lack of specific treatment, TNBC is routinely treated with a higher dose of chemotherapeutic agents that causes a plethora of serious side effects, including multiple organ failures and even death. Therefore, to counteract the side effects of high dose treatments this study's objective was to compare and contrast the effects of continuous low-dose combination treatment of BIBR 1532+ Paclitaxel (PAC) and a novel analogue of BIBR 1532 (GV6) developed at GVSU plus PAC on TNBC (MDAMB 231) breast cancer cells. MDAMB 231 cells were seeded (5.0x105 cells/flask) and supplemented as single treatment with either BIBR 1532 or GV6 or PAC or a combination of BIBR 1532+PAC or GV6+PAC for 21 days (n=4-8). In single treatments, the number of viable cells decreased by about 40% (P<0.05) in GV6 and 50% (P<0.05) in BIBR 1532 and PAC treatments by day 21. In combination treatment, a drop in proliferation rates of approximately 40% (P<0.05) and 55% (P<0.05) was observed in BIBR 1532+Pac and GV6+Pac groups when compared to control at day 21, respectively. Our results indicate that combination of low dose anti-telomerase and paclitaxel does inhibit breast cancer cell proliferation.

80. Claire Schaar, Hope College **Cell and Molecular Biology**

(Co-Authors: Jeremy Van Raamsdonk)

"Defining the mechanisms underlying extended longevity in C. elegans mitochondrial mutants"

Mutations affecting the function of the electron transport chain (ETC) in Caenorhabditis elegans create higher levels of reactive oxygen species (ROS), believed to cause the observed long-lived phenotype. While the exact mechanisms through which ROS increase lifespan are unknown, it has been proposed that both stress response pathways and changes in metabolism are involved. In this study, we sought to determine how the upregulation of stress response pathways and alterations in metabolism contribute to the longevity of three mitochondrial mutants: clk-1, isp-1, and nuo-6. Using reporters to visualize the activation of stress response pathways throughout the lifespan of the worm, we found that the mitochondrial unfolded protein response and the oxidative stress response are upregulated in all three mutants, while the antioxidant defense pathway is most upregulated in isp-1 worms. Since mutations to the ETC likely lead to a deficiency in energy production, it has been hypothesized that mitochondrial mutants may shift toward using glycolysis as a larger source of energy, which may contribute to their longevity. To test this, we used RNAi to knockdown expression of aldo-1, a gene necessary for glycolysis, on the three mitochondrial mutants. We found that aldo-1 is required for the long lifespan of isp-1 and nuo-6 mutants but not clk-1. Overall, this work has provided additional insights into the roles of stress response pathways and metabolism in mitochondrial mutant longevity.

81. Timothy Gilbert, Grand Valley State University **Cell and Molecular Biology**

(Co-Authors: Eric Moore, and Dawn M. Clifford Hart)

"Detection of Novel Associations Between Cell Cycle Proteins Mid1 & Dis2 in the Fission Yeast Schizosaccharomyces pombe"

Protein phosphatases are widely characterized regulatory proteins that have dynamic functions in both single and multicellular organisms. Of present interest are the protein phosphatase 1's, a specialized variant with understood roles in mitosis, cytokinesis, and protein synthesis. Beyond their importance in the cell cycle, this class of protein demonstrates substantial homology across all eukaryotes. Within the fission yeast Schizosaccharomyces pombe is Dis2, a catalytic PP1 subunit. The cytokinetic precursor Mid1, which recruits components of the contractile ring, has atypical localization patterns in Dis2's absence. To ensure offspring viability, it is critical that the plane of division be medial. Current work has shown the Mid1 protein to be a substrate of Dis2. Through lysate binding assays between Dis2-GFP and purified GST-Mid1 present on GST fusion beads, Western blot analysis indicates direct association. This binding event was visualized under IR imaging of fluorescent antibodies. Motifs within Mid1 thought to be important in Dis2 docking were identified. Mutagenesis was then performed on specific phenylalanine residues within those locations in an attempt to abolish binding efficacy. The nature of Dis2's regulatory effect on Mid1 must be further understood if we are to know all the complexities of cell proliferation within eukaryotic systems.

82. Leslie Wyman, Grand Valley State University **Cell and Molecular Biology**

(Co-Authors: Josh M. Mitchell, Rachel A. Powers)

"Discovery of Lead-like Inhibitors of OXA-1 β-lactamase"

β-lactams, like penicillin, are the most clinically prescribed antibiotics. However, due to their overuse, resistance has developed. β-lactamase enzymes are the most common resistance mechanism used by bacteria to combat the effects of these drugs. These enzymes efficiently hydrolyze the β-lactam ring that defines this class of antibiotics. In response, β-lactamase inhibitors were created to disrupt this type of bacterial resistance. Alone, β-lactamase inhibitors have minimal antibiotic activity, but when given in combination with a partner β-lactam, they enable the antibiotic to work by inhibiting the β-lactamase enzymes produced by resistant bacteria. Unfortunately, the structures of the inhibitors also contain a β-lactam ring. The chemical similarity has allowed for resistance to develop against the inhibitors as well. Additionally, these compounds do not inhibit members of the class D β-lactamases. Therefore, there is an urgent need for the discovery of novel β-lactamase inhibitors that do not resemble β-lactams. A structure-based approach was used to discover possibilities for potential novel β-lactamase inhibitors of the class D β-lactamase OXA-1, a key clinical resistance target. The program DOCK was used to screen the ZINC database of commercially available compounds. Thirteen compounds from the lead-like subset were ordered and tested experimentally for inhibition of OXA-1. Of the compounds tested, five inhibited OXA-1 with Ki values < 1 mM. Further work is currently underway to obtain X-ray crystal structures of OXA-1 in complexes with these novel DOCK-predicted inhibitors to aid in optimization efforts.

83. Paul Francoeur, Grand Valley State University **Cell and Molecular Biology**

(Co-Authors: Agnieszka Szarecka)

"Dynamics of Conformational Transition in the Beta-Lactam Receptor Sensor Domain"

Bacterial resistance to antibiotics is a major medical concern. β-lactamases are bacterial enzymes that hydrolyze the most commonly used family of antibiotics: β-lactams. In addition to β-lactamases, bacteria evolved β-lactam receptors (BlaR) whose sensor domains detect the antibiotics and trigger the production of β-lactamases in bacterial cells. BlaR sensor is thus a promising novel drug target as prevention of β-lactamase expression via disrupting the BlaR signal would have the potential to render resistant strains of bacteria susceptible to β-lactam antibiotics again. The sensor domain undergoes a conformational change upon ligand binding. This conformational change transmits the signal to the transmembrane domain of the protein, which ultimately triggers the transcription of β-lactamase genes. The exact atomistic mechanism of the conformational transition and the transmission of the signal remains poorly understood. In this study, we sought to identify the conformational states induced by ligand binding to the extracellular domain of the BlaR sensor protein. We employed a coarse-grained model of the protein structure and Normal Mode Analysis to study the internal dynamics of BlaR, with and without ligands bound. We calculated mode shapes and cross-correlations to identify the modes that are likely involved in the conformational transition. We have found several low-frequency modes to be affected by ligand binding. Our motional cross-correlations data indicate that a dynamic pathway exists that connects the binding pocket to the transmembrane domain via α-helix 5, β-strands 7 and 8, and α-helix 10 at the C-terminus of the sensor domain.

84. Zachary DeBruine, Hope College **Cell and Molecular Biology**

(Co-Authors: Dr. Maria Burnatowska-Hledin)

"Endothelial Cell Growth In Vitro Regulated By Resveratrol is Dependent on VACM-1/CUL5 and NEDD8 Colocalization"

Expression of the VACM-1/CUL5 gene, a component of an ubiquitin E3 ligase, inhibits cellular proliferation in endothelial and cancer cell lines in vitro through a mechanism that involves its post-translational modification by an ubiquitin-like protein, NEDD8. We have shown previously that Resveratrol, a naturally occurring phytoalexin, enhances the antiproliferative effect of VACM-1/CUL5 in Rat Adrenal Medullary Endothelial Cells (RAMEC) and breast cancer T47D cells. The mechanisms underlying this activity have not been elucidated. Thus, in this study, we investigated whether Resveratrol affects VACM-1/CUL5 and NEDD8 expression and localization in RAMEC and Human Umbilical Vein Endothelial Cells (HUVEC) using immunocytochemistry techniques. In addition, an inhibitor of the de-NEDD8ylation process, NEDD8-aldehyde, was used to control the NEDD8ylation cycle. Our results showed that when RAMEC and HUVEC were treated with Resveratrol and NEDD8-aldehyde, the proliferative effect of NEDD8-aldehyde was attenuated by Resveratrol ($p < 0.05$, $n = 3$). Immunostaining data shows that Resveratrol increased expression of VACM-1/CUL5 and decreased expression of NEDD8 after 4 hours in both RAMEC and HUVEC ($p < 0.05$, $n = 3$). In HUVEC, NEDD8-aldehyde had no effect on total NEDD8 or VACM-1 but decreased nuclear localization of both NEDD8 and VACM-1/CUL5 ($p < 0.05$, $n = 3$). In cells treated with both NEDD8-aldehyde and Resveratrol, VACM-1/CUL5 expression was increased and the effect of NEDD8-aldehyde on decreasing nuclear NEDD8 was attenuated ($p < 0.05$, $n = 3$). In conclusion, the antiproliferative effect of Resveratrol which involves VACM-1/CUL5 may be dependent on its NEDD8ylation. This work was supported by the Hope College Departments of Biology and Chemistry Summer Hope Academic Research Program.

85. Gabrielle Foxa, Grand Valley State University **Cell and Molecular Biology**

(Co-Authors: Gabrielle Foxa, Patrick Schneider, Ashley DeWitt, Dawn M. Clifford Hart)

"Establishing the importin protein Imp1 as significant nuclear transporter of Mid1 and its subsequent effects on cell division in the fission yeast"

An essential process that organisms undergo in order to develop is cell division. Fission yeast, Schizosaccharomyces pombe, grow by elongating at the cell tips then divide medially. During this process a cytokinetic ring forms in the center of the cell. Where the ring forms is where the new cell wall material is constructed and where the cell divides. The protein responsible for placing the ring is Mid1. As a result, the localization of Mid1 throughout the cell cycle is paramount. Previous research from our lab indicates that Mid1 localization is regulated through phosphorylation. When serine residues that are targeted for phosphorylation are mutated to non-phosphorylatable alanine residues, Mid1 is primarily found in the cytoplasm. Our prior research also demonstrates that in the absence of the transport protein Imp1, Mid1 is incapable of nuclear localization and remains cytoplasmic. To further investigate Mid1 transport, we combined the phosphosite mutant with a strain lacking Imp1. Fluorescence microscopy of cells during various cell cycle stages reveals that Mid1 phosphorylation and Imp1 control Mid1 localization. Mid1 is not detected in the nucleus and remains cytoplasmic. Furthermore, mutants display severe cell division and polarity defects that result in bulging cells that do not complete cytokinesis. These results identify a previously uncharacterized role for Imp1 in cytokinesis, which merits further investigation.

86. Bill Thompson, Grand Valley State University **Cell and Molecular Biology**

(Co-Authors: William Thompson 1, Derrick Kroodsma 1, Aik Choon Tan 2, Stephen K. Obaro 3, Sok Kean Khoo 1)

"Gene Expression and Pathway Analysis of Host Response in Children with Typhoid Fever Infection"

The rate which a commutable disease can travel around the world is at an all-time high. To compound this problem we also see a rise in resistance to common treatment methods, mainly due to the use of broad spectrum antibiotics to treat unspecific/general infections. Typhoid fever causes by Salmonella Typhi is one such communicable disease: in 2013, CDC reported ~21.5 million cases worldwide resulting in 200,000 deaths. Most of these cases took place in poor, undeveloped countries where there is little to no testing performed and antibiotic treatment is administered for an infection. Therein lies the problem, how can we quickly diagnose the infection so that a more narrow/effective treatment can be administered? Here, we used microarray technology to determine the gene expression in S Typhi infected children during acute, convalescent, and recovery phases of infection. We found upregulation of many genes related to immune system (eg. AIMS, CD274, HELLS) in acute phase. Interestingly, IL5RA is down-regulated in acute phase. It may be explained by the young age of patients (ave 30.6mo); innate response is not fully effective during acute phase and will only "kick-in" later and extend to the convalescent/recovery phase. We also found chromatin organization pathway enriched in the recovery phase. Defining the gene expression signature and its pathway may facilitate the diagnosis and stage stratification of typhoid fever infection for better management of the disease.

87. Veena Janardan & Justin Shady, Grand Valley State University **Cell and Molecular Biology**

(Co-Authors: Shambhavi Singh, Dr. Suganthi Sridhar)

"Identifying the c-MET Phosphorylation Site Regulated by CD82 in Prostate Tumor Cells"

CD82 (KAI), a metastasis tumor suppressor protein is under-expressed in prostate as well as several other types of metastatic cancers. It inhibits cancer metastasis, but the mechanism through which regulation happens remains unclear. Various pathways are being explored in this lab, including regulation of c-MET, a growth factor receptor observed to have increased activation in tumor cells. CD82 and c-MET do not co-localize, suggesting that CD82 indirectly downregulates c-MET. To be expressed, c-MET first needs to bind to its ligand, HGF. This growth factor encourages phosphorylation of c-MET, consequently activating it. C-Met has four tyrosine phosphorylation sites that include p-Tyr 1003, p-Tyr 1234/1235, p-Tyr 1349 and p-Tyr 1365. Knowing how each phosphorylation site of c-Met affects downstream signaling event, our lab is focused in identifying which site is regulated by CD82. Another tetraspanin, CD151 that promotes tumor progression and metastasis has been shown to associate with c-Met and the integrins, CD82 associates with. We are currently exploring the levels and expression of CD151 and its association with c-Met in the presence and absence of CD82. This we believe will provide additional insight into how CD82 overall regulates c-Met and prevents prostate tumor metastasis.

88. Elliot Ensink, Grand Valley State University **Cell and Molecular Biology**

(Co-Authors: Dave Cherba, Huiyuan Tang, Brian Haab)

"Microarray Processing System: A novel thresholding algorithm for automated image analysis"

Microarrays are a high-throughput experiment platform which generate large amounts of data. Accurate analysis of the fluorescence images created by these experiments is a difficult and time consuming process. Current manual analysis methods are also subject to bias and inconsistency due to human interpretation. To solve this issue we created an automated image analysis tool using the Matlab® programming environment. This tool uses a unique sampling method to distinguish between regions of background and true signal. The algorithm developed reduces the analysis time by about 90%. This method also improves the data quality by more accurate signal determination from background compared to the manual analysis method.

89. Barrett Kyle, Grand Valley State University **Cell and Molecular Biology**

(Co-Authors: Dr. Mark Staves)

"Quantification of light and gravity effects on the giant internodal cells of Chara"

Light and gravity have a profound effect on plant development. The goal of this study was to observe the effects of light and gravity on the growth response of the large internodal cells of the plant, Chara. Time lapse video was used to monitor the effects of light and gravity on these plants. Blue light at a light intensity of 2.4 uE induced the strongest phototropic response. When the plants were observed in red light at 0.10 uE, no response was shown. This light source was used to observe the gravity response in the plants. Gravitropic curvature was slower than light-induced curvature and had to be observed over 20 hours instead of the 10 hours in the light experiments. This is the first time light- and gravity-induced growth responses were observed on a single cell. A medium-term goal is to isolate RNA from single cells to determine the different genes expressed during the light and gravity responses. We show that we are able to isolate RNA from a single cell.

90. Dallas Rohraff, Grand Valley State University **Cell and Molecular Biology**

(Co-Authors: William Schroeder, Robert Smart, Roderick Morgan)

"The Evaluation of Essential Oils as Antibiotics"

The emergence of antibiotic resistant bacteria is of pressing concern as health care associated infections kill 99,000 people a year in the United States alone. Researchers are currently looking for new antibiotics in alternative sources. Essential oils are traditionally known to have medical benefits, and cinnamon bark (Cinnamomum cassia Blume), tea tree (Melaleuca alternifela), and eucalyptus (Eucalyptus globulus) oils have shown antibiotic activity. Initial testing via standard microbiological protocols found minimum inhibitory concentration (MIC) values of 0.0391% for cinnamon bark, 1.25% for tea tree, and 0.313% for eucalyptus. All three oils proved effective against both Gram-positive and Gram-negative bacteria, Staphylococcus aureus and Escherichia coli, respectively. As cinnamon bark oil had the lowest MIC, a more thorough microbiological analysis was performed. Cinnamon bark oil retained antibacterial activity in the presence of 10.0% human serum protein, and results of a time kill assay indicated cinnamon bark oil had bactericidal activity. Results suggested that cinnamon bark oil may contain a promising novel antibiotic.

91. Kimberly DeGlopper, Hope College & Megan Kwiatkowski, University of Michigan **Chemistry**

(Co-Authors: Jeffrey B. Johnson)

"Promoting Catalysis and Expanding the Scope of Organometallic Nucleophiles Utilized in the Nickel-Mediated Decarbonylative Cross-Coupling of Substituted Phthalimides"

A new method for synthesizing ortho-substituted benzamides has been developed through the nickel-mediated decarbonylative cross-coupling of substituted phthalimides with various diorganozinc reagents. This reaction demonstrates broad substrate scope, including both electron-rich and electron-poor aryl phthalimide substituents and a variety of commercially available and in situ generated diorganozinc reagents. However, this reaction suffers from two key limitations. First, it requires a stoichiometric equivalent of nickel, which limits its application in synthesis. Second, diorganozinc reagents are either pyrophoric or must be synthesized in situ. Efforts to promote catalysis include altering the phthalimide substituent, ligand, solvent, and catalyst used. Recent work has also focused on expanding the scope of nucleophiles to include boronic acids, which are safer and more commercially available, while optimizing reaction conditions of this new system.

92. Allison Fields, Alma College **Chemistry**

(Co-Authors: Dr. Jeff A. Turk, Allison E. Fields)

"Buchwald-Hartwig Reactions on Solid Support"

Solid-phase assisted procedures are often used in organic syntheses, and while the Buchwald-Hartwig reaction is commonly performed in solution, it is not often performed with the use of solid support. The use of a palladium catalyst allows this reaction to be done under mild reaction conditions, suggesting it may be favorable in this particular research study. The starting materials will be resins with various linker groups. These undergo a reaction to link aromatic iodides to the resin followed by cleavage from the resin to yield anilines. Kaiser tests, a colorimetric assay, are performed in order to qualitatively determine the success of the coupling reaction, and purity is determined by high performance liquid chromatography (HPLC). A library of starting materials will be used to explore the broad applicability of this research.

93. Joy Christopher & Brian Heidmann, Calvin College **Chemistry**

(Co-Authors: Dr. Carolyn Anderson)

"Efforts Towards the Synthesis of β- and γ-Amino Acids Containing N-Alkyl Pyridones"

N-alkyl pyridones are an interesting functional group found in a series of pharmacologically active and naturally occurring compounds. Due to their medicinal potential, incorporation of N-alkyl pyridones into interesting chemical motifs, such as unnatural β- and γ-amino acids, is an important synthetic goal. Utilizing a β-iodo N-alkenyl pyridone intermediate that was discovered in our laboratory, preparation of these unnatural amino acids is underway. Evaluation of a number of different protected propargylic amino alcohols in route to the required substrates will be presented, as will efforts to optimize the formation of the required nitrogen containing β-iodo N-alkenyl pyridones.

94. Andrea Bootsma, Calvin College **Chemistry**

(Co-Authors: Dr. Carolyn Anderson)

"Exploration into Rotationally Restricted N-Alkyl 2-Quinolones"

We are investigated rotation barriers using a combination of computational and synthetic approaches, with the goal of developing and axially chiral system.

95. Heidi Conrad & Talon Kosak, Grand Valley State University **Chemistry**

(Co-Authors: Dr. Richard Lord, Dr. Andrew Korich)

"How Does BBr3 Cyclize o-Akynylanisoles to Form Benzofurans"

Nature provides us with a wide array of chemicals that have beneficial uses. Cyclization reactions are important in the man-made creation of these chemicals. Past research by S3 scholar Samantha Ellis in Prof. Korich's lab showed an unexpected cyclization reaction with o-alkynylanisoles in the presence of BBr3 instead of the expected demethylation reaction. We sought to understand this unusual reactivity using computational chemistry by comparing the energies of these competing pathways. However, we discovered that previously considered mechanisms for BBr3 assisted ether demethylation are incomplete. In this work we present an alternative mechanism for ether demethylation that has implications in a number of different reactions involving boron-containing reagents.

96. Alyssa Kulesza & Erin Leach, Grand Valley State University **Chemistry**

(Co-Authors: Shannon M. Biros)

"Investigation of the Placement and Modification of Aromatic Groups for Sensitizing Lanthanide Luminescence"

Our research is focused on the area of increasing the sensitivity of lanthanide luminescence. This had been achieved with the synthesis of several new carbamoylmethylphosphine oxide (CMPO) ligands. Through substitution and modification of the carbonyl and phosphoryl groups of the ligands, we can investigate the different effects the aromatic groups have on the sensitization of the complexed lanthanide metals. Our group of CMPO ligands have been successful at sensitizing terbium, europium, dysprosium, and samarium. Detailed fluorescence data has been taken of the complexes and crystal structures of the modified CMPO ligands will be presented.

97. Joseph Dennis, Hope College **Chemistry**

(Co-Authors: Zachary G. Brill, Yu-Ming Zhao, and Thomas J. Maimone*)

"Investigations into the Ring-Opening and Functionalization of Cyclopropyl Amines"

Increasing interest in the vast synthetic applications of substituted cyclic amines has prompted the investigation into developing novel ring-opening and functionalizations of cyclopropyl amine moieties. Stemming from the electrophilic nature of pyridinium salts, various activated π-systems and enolates were employed to promote the formation of new ortho-substituted pyridinium species, subsequent ring opening, and recyclization of various cyclopropyl amine derivatives. Current pyridinium functionalizations neglect pendent nitrogen substituents, and the incorporation of these groups in cross-coupling reactions holds potential to form highly substituted ring systems that are analogous to the Securinega alkaloids, an antimalarial and anticancer class of compounds. Concurrently, electron rich, aryl-substituted cyclopropyl amines were subjected to single-electron oxidation conditions to promote the tandem ring-opening and double oxidation to prepare substituted quinoline derivatives. This method overcomes issues of current techniques as it proceeds without metal catalysis and incorporates a more diverse substrate group. Currently, strides have been made to develop a substrate scope to prepare quinoline derivatives. The work of developing these methods, as well as those relating to cyclopropylpyridinium salts, represents ongoing effort to provide new avenues to obtain biologically relevant species via synthetically amenable pathways.

98. Connor Reidy, Calvin College **Chemistry**

(Co-Authors: Dr. Carolyn Anderson)

"Microwave Assisted Gold(I)-Catalyzed Rearrangement of N-Propargyloxypyridines"

N-alkylpyridones appear in many naturally occurring and pharmacologically significant compounds, and the formation of these scaffolds has been of interest to the synthetic community in recent years. The Anderson Lab previously found O-propargyloxypyridines can be transformed into N-alykylpyridones under LiO and gold(III) catalysis in high yield. Focus changed to Gold(I) catalysis in order to produce the desired 5-exo cyclization product. Initial gold(I) catalysis of O-propargyloxipyridines revealed the formation of three distinct products, two of which that can be synthesized in high yield by gold(III) catalysis. This past summer, further optimizations of the gold(I) catalysis were conducted using a microwave reactor with the goal of synthesis of the ether product in high yield. Optimization reactions were done on the basis of: temperature, silver salt, reaction time, and additives. Currently, the Anderson lab has made significant improvements with gold(I) optimization, however, more work must still be done in order to isolate the desired product in high yield.

99. Nick Pierce, Aquinas College **Chemistry**

(Co-Authors: Dr. Timothy Henshaw)

"Mutagenesis of Bordetella pertussis"

α-Ketoglutarate- (αKG) dependent dioxygenases are mononuclear non-heme Fe(II) enzymes that couple the oxidative decarboxylation of αKG to substrate oxidation. TdfA is an Fe(II)- and αKG-dependent dioxygenase that initiates the biodegradation of the widely used herbicide 2,4-dichlorophenoxyacetic acid (2,4-D). A TfdA-like sequence has been identified in Bordetella pertussis, however this organism is not known to metabolize 2,4-D, and the purified protein has no identifiable TfdA activity. It is hypothesized that this B. pertussis gene shares a recent common ancestor with TfdA. Using a 3D model, we have identified amino acid residues seem to be important in determining the specificity of the B. pertussis TfdA-like enzyme. Our project this summer will be to change these residues to the corresponding sequence in TfdA. We will then test our mutant proteins for TfdA activity.

100. Kyle Disselkoen, Calvin College **Chemistry**

(Co-Authors: Dr. Mark Muyskens)

"Quantum Yield and Rate Constants for H/TFAA"

Gas-phase hexa/trifluoro-acetylacetone exists in the enol form with a strong intramolecular hydrogen bond. The compound reacts to close a ring and eliminate HF in a remarkable UV-photochemical pathway. We measured the relative efficiency of this pathway and determined a rate constant and lifetime for both molecules. The relative quantum yield is established by dividing IR absorption (measured by peak area) by the UV laser light absorbed. We scaled our relative quantum yield values to be consistent with a low pressure asymptote of 1 because the HF elimination channel is assumed to be the only significant pathway at low pressures. From the curvature parameter and the collision rate constant calculated from mean relative speed, we calculate the dissociation rate constant.

101. Catherine Duke, Grand Valley State University **Chemistry**

(Co-Authors: William R. Winchester)

"Synthesis and Investigation of Sila-allyl Anions"

Resonance has a central role in organic chemistry as it is used to understand the relative reactivity and selectivity of many intermediates in reactions. We are investigating the relative importance of resonance to silicon versus resonance to carbon by synthesizing and investigating sila-allyl anions. In this poster we will present our efforts at preparing two new precursors to the sila-allyl anion, a vinyl silole and a vinyl-dimesitylsilane. We will also present the results of our calculations of the structures of these molecules.

102. Sean Sullivan, Alma College **Chemistry**

(Co-Authors: Sean Sullivan, Sienna Pieprzyk, Jeffrey Turk)

"Synthesis of Group-1 Neuraminidase Inhibitors"

Tamiflu is a common inhibitor of group-1 neuraminidase (NA), and is used to treat highly virulent instances of human influenza, including swine and avian influenza. We are using microwave-assisted organic synthesis to functionalize a known aromatic inhibitor to NA in an attempt to optimize inhibitor/NA interactions. Our goal is to explore the possibility of replacing the known methyl-amide pharmacophore of most known NA inhibitors with a more optimized functionality.

103. Alan Lear & Andrew VanderWeide, Grand Valley State University **Chemistry**

(Co-Authors: Shannon M Biros)

"Synthesis, characterization and extraction studies of CMPO analogs for nuclear waste remediation"

Rising energy demands and a high dependence on finite amounts of fossil fuels have been a major concern of the modern age. As a viable alternative to carbon based power sources, nuclear fuel generates vast amounts of energy and is becoming more widely utilized. However, the hazardous waste produced can have serious and long-lived environmental consequences. The goal of our research group is to design CMPO analogs for selective actinide extraction from high-level nuclear waste. Sequestration of these heavy metals will not only decrease the volume of nuclear waste, but will also allow for recycling of spent nuclear fuel. The synthesis of new CMPO ligands for the study of selective metal extraction will be presented. Two similar CMPO ligands have been successfully synthesized and characterized via X-ray crystallography. As a prediction of the efficacy of these ligands for nuclear waster remediation, the extraction efficiencies have been determined using Arsenazo III assays.

104. Brian Rawls, Grand Valley State University **Chemistry**

(Co-Authors: Jeremy Cunningham, Paul Morse, Dr. Shannon Biros)

"The Change in Extraction Efficiency with the Variation of Electron Donor Atoms in Bidentate Ligands"

The coordination geometry of lanthanide and actinide rare earth metals is of great importance when separating f-block metals in aqueous solutions (for example, nuclear waste remediation). Soft election donor atoms such as sulfur and selenium have demonstrated a high affinity for actinide metal ions due to their disperse electron cloud. Our research group has modified pre-existing bidentate ligands by increasing the distance between chelation sites and optimizing the stereochemistry for chelation of f-elements. Useful information involving extraction efficiencies and x-ray crystallographic data will be presented that has revealed the interesting properties of these novel ligands.

105. Niecia Flikweert, Calvin College **Chemistry**

(Co-Authors: Abbegail Bell, Dr. Micheal Barbachyn)

"The Iodocyclocarbamation Reaction of N-Arylcarbamates: Scope and Limitation"

The 5-substituted 3-aryl-2-oxazolidinone ring system can be considered a privileged chemical scaffold by virtue of its being a core structural feature of marketed therapeutic agents such as linezolid (antibacterial agent), rivaroxaban (anticoagulant) and toloxatone (antidepressant), among others. The iodocyclocarbamation reaction of allylated N-arylcarbamates, available in two steps from commercially available aromatic amine precursors, provides ready access to racemic 5-(iodomethyl)-3-aryl-2-oxazolidinones. These advanced intermediates should have utility in allowing access to the aforementioned privileged substances. To our knowledge, there is only one published example of this variation of the classic iodocyclocarbamation reaction and much more work remains to be done in order to establish the scope and limitations of this synthetic approach. The research described in this poster examines >12 preliminary examples of this chemistry, including a concise application to the total synthesis of racemic linezolid.

106. Jared Weidman, Calvin College **Chemistry**

(Co-Authors: Roger L. DeKock)

"Theoretical Interpretation of Atomic and Ionic Size"

Central to an understanding of electronic behavior upon ionization in atoms is the concept of atomic and ionic size. This concept is qualitative, resulting in many different ways of calculating the "radius" of an atom. Our lab has utilized the quantum chemistry software GAMESS to model the electron densities of atoms and their ions in order to calculate theoretical radii. We are interested in two groups of these radii, those that align more closely with covalent radii, and those that align with van der Waals radii, both of which are derived from experiment. Our results show that a single theoretical calculation method does not correlate with both experimentally-derived atomic and ionic radii.

107. Rebekah Newman, Grand Valley State University **Computational Biology / Bioinformatics**

(Co-Authors: Agnieszka Szarecka, Suganthi Sridhar, Robert Smart, William Schroeder)

"Towards Understanding the Mechanism of Non-Competitive Inhibition of Telomerase"

Telomerase reverse transcriptase (TERT) is responsible for maintaining the integrity and length of chromosome ends. Telomerase activity is low or undetectable in normal somatic cells, but is overexpressed in the majority of cancers. This makes telomerase a promising anti-cancer drug target. Several inhibitors of telomerase are currently being studied, but the mechanism of their interactions with telomerase remains poorly understood. The goals of this study are to better understand the telomerase intrinsic dynamics, to identify putative binding pockets for a group of novel inhibitor candidates, and to elucidate potential pathways of non-competitive inhibition of TERT. We have combined Normal Mode Analysis to study the domain motions within TERT with ligand docking simulations to explore the protein's surface for putative binding pockets for potential inhibitors. We have used X-ray structures of TERT from T. castaneum, apo and bound to a DNA/RNA substrate mimic. We have identified several low-frequency vibrational modes of TERT that are sensitive to substrate binding, in particular modes 7 and 9 affecting the Fingers domain. These modes may be involved in the enzyme's native dynamics. Moreover, one of the studied ligands binds to TERT with high affinity, occupying unique pockets in the Fingers domain, namely β3-loop-β4 motif and α-helix 8. This study will aid efforts to design new, more effective and more specific inhibitors of TERT for anti-cancer therapies.

108. Patrick Crain, Calvin College **Computer Science**

(Co-Authors: Patrick Crain, Professor Joel Adams)

"Open Source Continuum Crowds on the CPU & GPU"

Pathfinding is a very important subfield of AI, with applications in physics, robotics, simulations, searching, and navigation. Since its inception, A* and its variants have been the standard algorithms for pathfinding, due to their relative simplicty and efficiency. Even so, most variants of A* fall short when it comes to long term dynamic planning and local collision avoidance. The continuum crowds algorithm offers significant improvements over the A* family concerning planning and collision avoidance; addtionally, it can handle tens or even hundreds of times more agents with little penalty to speed, and no penalty to accuracy. Despite this, the algorithm sees less widespread use due to its relative complexity and the lack of source code to build from. Our project aims to supply well-documented source code for others to reference and build upon, in hopes that continuum crowds are further improved and explored as an alternative to the A* algorithms.

109. Mark Vander Stel, Calvin College **Computer Science**

(Co-Authors: Patrick Crain, Joel Adams)

"TSGL: A Thread-Safe Graphics Library for Creating Multithreaded Visualizations"

Thanks to the ACM/IEEE CS Curriculum 2013 recommendations, parallel computing is now in the undergraduate core computer science (CS) curriculum. CS educators thus face a new challenge: teaching parallel computing concepts to undergraduates. One way to meet this challenge is to create parallel programs that use real-time graphics to help students visualize the program's underlying parallel behavior. TSGL is a free, platform-independent C++ graphics library designed to make it easier for anyone to create visual representations of multithreaded behavior. The library provides 2D Canvas classes within which different threads can safely manipulate different parts of a digital image, and/or draw shapes using different colors. The library can thus be used to extend a multithreaded application with a visualization that shows what each thread is contributing to the problem's solution. The library includes several examples (e.g., image-processing, the Mandelbrot set, etc.) that illustrate its use.

110. Breanna Gould, Grand Valley State University **Ecology and Evolution**

(Co-Authors: Jennifer A. Moore)

"Fine-scale spatial genetic structure in Eastern box turtles (Terrapene carolina carolina)"

Understanding spatial genetic structuring of a population across a landscape can provide insight into relationships between spatial processes and microevolutionary change. Environmental changes, whether natural or anthropogenic, can ultimately affect the pattern-process relationship between dispersal and population connectivity. Using eleven microsatellites, we genotyped individuals to investigate the spatial genetic structure of Eastern box turtles (Terrapene carolina carolina) occurring within the northernmost peripheral geographic range of this species. Eastern box turtles are listed as a species of special concern in Michigan, where they have experienced both regional and local declines. We found evidence of locally restricted gene flow and dispersal of individuals, likely being driven by female philopatric behavior. Our results will inform conservation management of these turtles by providing information on functional population connectivity. High fidelity and recurrent use of nesting sites by female box turtles underscores the importance of protecting and maintaining these nesting habitats over the long term.

111. James Jensen, Grand Rapids Community College **Ecology and Evolution**

(Co-Authors: Dr. Pam Laureto – GRCC Professor)

"Ordination and Classification of Mesic Hardwood Forests at Pierce Cedar Creek Institute, Barry County, Michigan"

Essential to the preservation of natural areas is a thorough knowledge of the communities within the area. We examined 30 stands within the second-growth mesic hardwood forests at Pierce Cedar Creek Institute in order describe their vegetation patterns and associated environmental parameters. Within each stand, species composition data was obtained for six forest strata: overstory trees, understory trees, saplings, shrubs/vines, and ground vegetation (separating out herbaceous plants and tree seedlings). Environmental data, including the physical and chemical characteristics of the soil, topographic parameters, and disturbance history, were also collected for each stand. Total species composition, as well as species composition of each forest stratum, was analyzed with the environmental variables using cluster analysis and non-metric multidimensional scaling ordination. One hundred forty-two species were identified from the 30 forest stands. Species richness, evenness, Shannon's and Simpson's diversity indices all indicate that the Institute's hardwood forest is diverse. Cluster analysis of species composition data from the 30 stands identified 4 groups which corresponded to 4 community types. Ordination indicated the individual stands were correlated with three important environmental gradients: a soil pH-nutrient gradient, a soil-texture and slope gradient, and a soil moisture gradient. We describe the vegetation and environmental patterns of the 4 community types providing the baseline data that will be useful in the management of the mesic hardwood forests.

112. Isaac Zylstra, Calvin College **Economics**

(Co-Authors: Student Andrew Hayes, Professor John Ferdinands)

"Sets of Selective Sums of Infinite Series"

This poster explores the relationship between infinite series, and their set of selective sums. The topics explored include: a useful construction of the set, the ratios between terms, alternating series, representations of each individual selective sum. Further questions are also asked.

113. Nathan Terschak, Calvin College **Engineering**

(Co-Authors: Yoon G. Kim)

"Developing Solar Simulator Modules Based on High Power LEDs"

This research project focused on developing an LED based solar simulator. A solar simulator is a device that emits light matching the spectrum of the sun. By designing intensity-control electronics, combining LEDs of different wavelengths, and experimenting with methods to diffuse light, we made significant improvements in spectrum match and light uniformity as well as integrating together the various components of the system. Moving forward, we hope to perfect these parameters within a more sophisticated prototype.

114. Carl Cooper, Calvin College **Engineering**

"Development of Wireless Monitoring Systems and Smartphone Apps"

As renewable energy systems are becoming more and more popular and accessible to individual users, there arises a need to monitor these systems. There are many different aspects that we would want to measure data on these systems, such as power, energy generated, solar intensity, winds speeds, ambient temperature, and more. However, these systems do not come equipped to measure such data; much less display them for the user. The goal of this project was to develop a wireless system that will be able to monitor these kinds of systems and for convenience send data to an Android app. To achieve this goal, a microcontroller was programmed to create a WiFi network and send data to clients, namely Android devices, that connected to it and an Android app was designed to store and display this data.

115. Jeremiah Rocha, Calvin College **Engineering**

(Co-Authors: Julie Swierenga, Prof. David Wunder)

"Impact of Antibiotics on Denitrifying Biofilm Bacteria"

Low concentrations of antibiotics are found in surface waters worldwide, but the impact of antibiotics on biological drinking water treatment processes is largely unknown. This research investigates the effects of low µg/L concentrations of antibiotics on the denitrifying ability of biofilm bacteria used in drinking water treatment. Experimental runs were performed by running untreated drinking water, acetate (as a carbon source), and antibiotics through a Continuous Rotating Annular Bioreactor (CFRAB). The viability of the bacteria was analyzed by performing volatile solids tests and live/dead staining. Using ion chromatography, the nitrate utilization rate of the biofilm in the reactor was evaluated for differing concentrations of antibiotics in the feed stream. Real-time PCR was used to analyze the relative quantities of the denitrifying genes present with each run. The PCR analysis showed that the genes associated with denitrification were present in the biofilm and responded appropriately to the increasing antibiotic concentration. Viability analysis shows that biomass increases in the presence of antibiotics, and denitrification data indicates that the presence of low concentrations of antibiotics (3.44 µg/L and 34.4 µg/L) decreases the denitrification rate of biofilm bacteria by nearly 50%.

116. Hezkiel Nanda, Calvin College **Engineering**

(Co-Authors: Ayooluwa Ayoola, April Si)

"Magnetic Focusing"

Drug delivery via nasal cavity is becoming more prevalent. This reduces the amount of medication lost to the body, targeting the brain directly and by-passing the blood-brain barrier. This research evaluates the feasibility of controlling the moving path of charged particles and ferro-fluids with magnetic fields. The study was done on COMSOL, a multi-physics software. In the study, a magnetic field created by multi-turn coils and one created by permanent magnets was evaluated. By looking at a 2-dimensional side-view of the nasal cavity, we were able to conclude that for the multi-turn coils, the magnets on top of the nose ought to increase from 10 turns and 10 Amps to 20 turns and 600 Amps, the maximum magnetic flux density was approximately 0.35 Tesla. While for the permanent magnets the two magnets closest to the target zone had a magnetization of 1 x 10^5 A/m.

117. Chloe Chapman, Ferris State University **Forensic Biology**

(Co-Authors: Bridget Lorenz Lemberg, Piyadarsha Amaratunga)

"Screening of Nicotine in Oral Fluid ELISA Assay"

The purpose of this experiment was to test the ELISA plates to determine their ability to detect the drug under analysis. Different companies plates were compared and tested numerous ways for the drug metabolite cotinine. Nicotine is not secreted through the body's fluids but the metabolite cotinine is and that is why we measured the plates ability to detect cotinine within a sample.

118. Brian Hilbrands & Audrey Hughey, Calvin College **Geography**

(Co-Authors: Dr. Johnathan Bascom)

"A Digital Atlas for Ethiopia: "A Contemporary Geography of Ethiopia""

This poster demonstrates the capability of Esri's Map Journal app to construct a web-based academic textbook. The project relies on three features available with Esri's ArcGIS Online – intelligent web maps, templates for storytelling with maps and the new Map Journal app – to construct a geography textbook for the harmonized curriculum of the 30 geography departments in Ethiopian universities. It is the first college textbook built and delivered with Map Journal.

119. ABSTRACT WITHDRAWN

120. Kyle Jansens, Aquinas College **Mathematics**

(Co-Authors: Dr. Michael Mcdaniel)

"Squaring the Circle"

Lindemann proved that constructing a circle and square with the same area was impossible in 1882. But that was in Euclidean geometry. In 2014, we found the construction for squaring the circle in Elliptic Geometry. We also prove that the square and the circle must be constructed separately. That is, we cannot build one object from the other. Our poster summarizes squaring the circle in Euclidean, hyperbolic and elliptic geometry.

---

121. Krystin Dreyer, Aquinas College **Mathematics**

(Co-Authors: Joseph Fox)

"The Mathematics of Citation Networks: Analyzing the Spread of Influence"

A citation network is a directed graph that encodes citation relationships among a collection of items. We present here some properties of one particular citation network, namely the one that arises from Euclid's famous text, The Elements of Geometry. In particular, we use Google's PageRank algorithm to compute an importance ranking for the network, and we allude to possible topological investigations that could be undertaken.

---

122. Clare Laut, Michigan State University **Microbiology**

(Co-Authors: Robert Parker, Joshua Herr, and Shannon D. Manning)

"Acidic Exposure and Enhanced Colonization in Group B Streptococcus"

Group B Streptococcus (GBS) is a, gram-positive bacterium responsible for the majority of cases of neonatal meningitis and sepsis and is an emerging pathogen in immunocompromised adults. Present as a commensal in the lower gastrointestinal tract of ~40% of the population, identification of bacterial factors driving pathogenesis remains a significant public health challenge. Previously, a multilocus sequence typing strategy identified phylogenetically distinct lineages associated with human colonization and human disease, such as ST-23 and ST-17, respectively; however, underlying phenotypic and transcriptomic differences affecting infection outcomes remain obscured. Previously published literature has proven a connection between levels of biofilm formation, among other factors, and virulence levels in similar bacterial species. Within strains of GBS, our lab has shown that there is consistent variation in the isolates biofilm formation strength ranging from strong to weak. Despite this differentiation, the molecular factors underlying these pathogenic factors such as biofilm production and association levels remain unknown. It has been shown that a lower pH may lead to increased levels of attachment to host cells, which could be key to pathogenicity. Performing the experiments in acidic conditions can serve to replicate the infection site in the host vaginal tract. The specific aim of the project will be to use a biofilm assay, eukaryotic cell-association assay, and RNAseq data to compare weak and strong biofilm isolates of GBS under acidic stress to identify phenotypic and transcriptomic differences which could play a role in and pathogenicity of GBS.. It was originally hypothesized that an acidic treatment leads to increased cell association in strong-biofilm forming samples, but based upon preliminary testing pH leads to relatively increased attachment in both strong and weak biofilm formation isolates.

123. Alana Beamish, Sean Justice, Jason Peet, Lansing Community College **Molecular Biotechnology**

(Co-Authors: Erika J. Christian, Kacie L. Henrys, Molly J. Pouch, George K. Van Norman, Melinda R. Wilson)

"DNA Barcoding analysis of Mahi-Mahi: A Fish by any other name?"

Many news sources, such as the NY Times, have reported that 25 to 70 percent of seafood examined in Europe and North America are mislabeled. For instance, it has been reported that Yellow Tail (*Caranx heberi*) and Tilapia are common substitutions for Mahi-Mahi (*Coryphaena hippurus*), although the percentage of mislabeling is not well documented. To investigate the local supply of Mahi-Mahi, we obtained samples from various grocery stores and restaurants in and around the Lansing area. We PCR amplified DNA isolated from the samples using primers specific for the fish Cytochrome Oxidase 1 gene. DNA was then sequenced by GENEWIZ, Inc. and bioinformatic analysis was performed on the sequence data using the DNA Subway computational tools of the iPlant Collaborative. Our results showed that all samples were closely matched to database DNA sequences of Mahi-Mahi. However, none of the Lansing area Mahi-Mahi samples were a 100% match to DNA sequences in the database.

124. K. Henrys, M. Pouch, G. Van Norman, Lansing Community College **Molecular Biotechnology**

(Co-Authors: Alana S. Beamish, Erika J. Christian, Sean C. Justice, Jason W. Peet, Melinda R. Wilson)

"DNA Barcoding Analysis of Meat and Poultry: What's for dinner?"

Most families in the United States rely on the meat industry as a major food source. Several investigations have uncovered evidence concerning the mislabeling of meats and poultry in the food industry. As a result, some meat suppliers have been faced with felony charges and paid hefty fines. The purpose of our research was to determine if a variety of meats and poultry from a local store were labeled accurately, including the less common seasonal meats. We gathered 12 samples from a local meat distributor and PCR amplified DNA isolated from the samples using primers specific for the mammalian Cytochrome Oxidase 1 gene. DNA was then sequenced by GENEWIZ, Inc. and bioinformatic analysis was performed on the sequence data using the DNA Subway computational tools of the iPlant Collaborative. We found that 7 out of 12 samples showed a close match to database DNA sequences indicating that they were correctly labeled. However, 5 samples matched database entries that were inconsistent with labeling. Interestingly, both Cornish game hen (a genetic hybrid) and domestic chicken showed 100% match to *Gallus gallus*. In addition, two meat samples labeled as Elk showed a close match to Red Deer.

125. Erika J. Christian, Lansing Community College **Molecular Biotechnology**

(Co-Authors: Alana S. Beamish, Kacie L. Henrys, Sean C. Justice, Jason W. Peet, Molly J. Pouch, George K. Van Norman, Melinda R. Wilson)

"DNA Barcoding Analysis of Tea Ingredients: What's in that Cup?"

In 2012 Americans consumed over seventy nine billion servings of tea, equal to over 3.6 billion gallons. Interest in research concerning the health benefits of tea ingredients has led to increased tea consumption in the United States. Therefore, it is important to verify that tea ingredients are labelled correctly. To investigate labeling integrity, ten random samples of loose ingredients used in making tea were taken from a local organic food supplier and then sequenced using a DNA barcoding approach. PCR amplification was obtained using the Ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit (RuBisCO) chloroplast gene. The DNA was then sequenced by Genewiz, inc. and bioinformatics analysis was performed using DNA Subway. Using DNA sequence comparison, four of the tea samples were consistent with the retail supplier's labeling, whereas three of the samples showed close matches to the retail supplier's labeling. Interestingly, 2 samples showed DNA sequence similarity to the mammalian mitochondrial gene region Cytochrome Oxidase 1.

126. Tibin John, Kalamazoo College **Neuroscience**

(Co-Authors: Tibin John, Tamás Kiss, Zoltán Somogyvári, Laszlo Zalanyi, Péter Érdi)

"Cell and Network Level Changes Related to Overproduction of Alzheimer's Amyloid-β Cause Altered Synchronized Activity in Model of Hippocampal Theta Rhythm Generation"

Understanding hippocampal network dysfunction can lead to better understanding of the pathophysiology and progression of Alzheimer's disease (AD). Recent observation of reduced amplitude in total synaptic current in the hippocampus of mice models overexpressing the amyloid-β peptide has not been explained in terms of cell and network level changes, and such mechanisms should reconcile reduced synchronous activity with the observed cell and network hyperactivity. This study, using the tools of computational and mathematical modeling, suggests such cell and network level changes in the hippocampal populations that contribute to the observed age-dependent reduction of elicited theta power in local field potential. These include CA1 pyramidal cell ion channel conductance changes and selective oriens lacunosum-moleculare interneuron loss, implementing increases in both cell and network excitabilities. In the theta generating spiking neural network model, these changes also implied reduction in synchrony, loss of period stability, and progressive violation of analytical network synchrony requirements on post-synaptic potential and refractory behavior dynamics at firing times. Altered synchronized activity through cell and network level mechanisms has been suggested to play a role in hippocampal network dysfunction potentially mediating cognitive decline, with electrophysiological implications for the eventual development of AD biomarkers and therapeutics involving correlated firing times amongst neurons.

127. Delia Chapa, Grand Valley State University **Neuroscience**

(Co-Authors: Glenn Valdez Ph.D.)

"Kappa Opioid Regulation of Acute and Protracted Alcohol Withdrawal"

Almost every American is affected directly or indirectly by alcohol abuse. It takes the lives of friends and family, and costs our society billions of dollars each year. Many individuals who are alcohol dependent are unable to break the chains of the disease. When individuals are able to abstain from using alcohol, it is rarely for an extended time. The negative emotional states caused by alcohol withdrawal such as anxiety and depression can last for an undetermined amount of time. The severity of these negative emotional states may drive a person to self-medicate to avoid experiencing these symptoms. One system that has been linked to this inability to manage stress-related symptoms experienced during withdrawal is the dynorphin/kappa opioid receptor (DYN/KOR) system. This research investigated the role of the DYN/KOR system in regulating alcohol self-administration during acute withdrawal and protracted abstinence in alcohol dependent rats. Male Wistar rats were trained to self-administer ethanol using a saccharin fading procedure. Following this training procedure, rats were fed an ethanol liquid diet to induce physical dependence. The control group was given the average consumed by the experimental group in the previous day in order to control for caloric intake. After removal of the diet, rats were then allowed to once again self-administer ethanol and the ability of the KOR antagonist nor-binaltorphimine (nor-BNI) to reduce increases in self-administration was examined. We hypothesized that nor-BNI would reduce ethanol self-administration as a means to manage the stress-related symptoms associated with alcohol withdrawal. We found that although rats did not show increased ethanol self-administration during acute and protracted withdrawal following saline injections, nor-BNI selectively decreased self-administration in ethanol dependent animals during both the acute and protracted time frame. This gives further evidence that the DYN/KOR system has a significant role in the elevated risks of relapse. These results along with further research into other key factors of relapse may one day help to develop treatment for those dependent on alcohol.

128. Jacqueline Tieu, Ferris State University **Neuroscience**

(Co-Authors: M.Beth Zimmer)

"The Effect of Spinal Cord Injury on Learning and Memory in Rats"

The effects of spinal cord injury (SCI) below the site of injury are well known. Changes above the site of injury, however, are not well described. Several studies have indicated significant changes in brain regions far removed from the site of injury, including cortical reorganization and neuronal loss in the hippocampus. A recent study showed reduced memory after T9 contusion injury and attributed the loss of function to increased inflammation. Another study showed that BDNF message and protein are also reduced in the hippocampus after T9 contusion injury. We hypothesized that learning and memory would be impaired after an upper cervical hemisection injury in young adult male rats and that reductions in serotonin may also be an underlying cause. C2 hemisection and sham surgeries were performed under aseptic technique, the rats were allowed to recover for 2 weeks and the Morris water maze and object recognition tests were performed to measure learning and memory. Tissues were collected for analysis. We found that SCI rats showed impairments during the acquisition phase of learning; they were slower at learning a task, but that they could still form memories over 5 days. We are currently looking at the possible involvement of serotonin as an underlying cause of the impaired learning.

129. Mason Molesky, Alma College **Physics**

(Co-Authors: M. C. Rausch, A. S. Hussey, H. M. Valente, S. J. Jack, and M. M. Strait)

"Asteroid Impact Variable Speed Detector Simulation"

Studies of asteroid impact simulations in this lab have been done for a number of years. There are questions of whether particles with different compositions have different velocities when disrupted. We report on ways particles with different velocities could be detected. To develop reliable and effective simulations, a variety of designs were hypothesized and tested. In our version of the gun range experiments, we looked at an air-soft gun, sling shot, portable air-compressor, and high-pressure air-compressor for disruption methods. Projectiles tested include marbles, BBs, and small rocks. Fruit, real eggs, plastic eggs, ping pong balls, water balloons, and Christmas ornaments were used as targets. Many collection methods were tested in order to capture the spray of particles produced in the disruption including hair gel, honey, fly-paper, and tape. The gun, bullet, meteorite sample, and foam core collection device used at the NASA Ames Vertical Gun Range (AVGR) were successfully imitated in our lab using an air compressor attached to a PVC pipe, marbles, hollow Christmas ornaments filled with sand, and hair gel spread over plastic lids, respectively. With the ability to simulate the AVGR, testing of variable speed detectors is possible without the necessity of traveling to California.

130. Andrew Johnson, Hope College **Physics**

(Co-Authors: Joshua Veazey, Ryan Cottier, Nikoleta Theodoropoulou)

"Ferroelectric and Conductance Characterization of SrTiO3 on Silicon"

Thin-film ferroelectric/semiconductor heterostructures are regarded as potential platforms for high-density data storage. In certain structures, the local ferroelectric polarization state of the film has been shown to modulate conductivity with nanoscale precision. Thus, information could in principle be encoded into the local polarization states of the thin film, creating nanoscale bits. SrTiO3 (STO) thin films exhibit epitaxial strain-induced ferroelectricity when deposited directly onto the surface of n-type Si(001). In the work presented here, local probes were used to investigate the nanoscale ferroelectric and conductive properties of STO thin films (thicknesses ranging t = 2-10 nm) deposited on p-type Si(001) via molecular beam epitaxy, with a SrO interfacial layer. We observe classic signatures of ferroelectricity for samples having STO thicknesses of t < 5 nm. We patterned ferroelectric domains lithographically by applying voltages via a conductive-atomic force microscopy (c-AFM) tip. Domains were subsequently imaged with piezoresponse force microscopy (PFM), which indicated the ability to pole ferroelectric features with length scales of order 100 nm. Ferroelectric hysteresis loops revealed stable switching characteristics, with coercive voltages Vc≈1-2 V. In addition, preliminary evidence suggests a correlation between polarization direction and conductivity (determined via current-voltage, I-V curves) through the sample. Conclusive evidence of such ferroelectric-modulated conductivity, however, would require simultaneous measurement of conductivity and ferroelectric switching. Current work is focusing on this prospect.

131. Danielle Harris, Grand Valley State University **Physics**

(Co-Authors: K. J. Kihlstrom, W. K. Kwok)

"Increasing Critical Current of Iron-based Superconductors Through Compound Defects"

High temperature superconductors offer solutions to many of industries greatest energy needs with their ability to carry high amounts of lossless current. However, within all discovered high temperature superconductors, the need for strong vortex pinning to maintain these critical currents has become evident. A mixed pinning landscape allows for strong pinning at both high and low magnetic fields without strongly affecting the superconducting transition temperature. We pre-characterized FeSeTe and BaKFeAs samples for proton irradiation at Western Michigan University and heavy-ion irradiation at the ATLAS at Argonne National Laboratory. After proton irradiation, we increased the critical current by a factor of 14 in low .2 T fields, up to 0.126 MA/cm^2, and by 5 in high 6 T fields, up to 0.07 MA/cm^2.

132. Sean Hamilton, Grand Valley State University **Physics**

(Co-Authors: Dr. Stephen Remillard)

"Second and Third Order Intermodulation Distortion in Superconducting Passive Circuits"

The mechanism by which high temperature superconductor (HTS) materials work is still not well understood. In particular, the distinct origins of even and odd order nonlinear behavior associated with these materials have yet to be explained. Using a three-tone method, we have investigated a particular kind of nonlinear phenomena called intermodulation distortion (IMD). Both 2nd and 3rd order IMD were analyzed within a YBCO thin-film hairpin resonator, and the measurement technique made use of a spectrum analyzer, three signal generators, and a liquid nitrogen cryostat. Results demonstrate that the nonlinear Meissner effect is responsible for the increase in IMD close to TC. Furthermore, static magnetic field measurements support the notion of flux trapping within a superconducting resonator. We suspect that this work could help distinguish the origins of even and odd nonlinearity in superconducting devices, and provide assistance in creating a working theory for type II superconductors.

133. Jonathan Shomsky, Calvin College **Physics**

(Co-Authors: Prof. Matt Walhout)

"Trapping Krypton and Argon Atoms With Laser Beams"

Our research aim is to study molecular interactions between krypton and argon atoms. In order to do this, we need to be able to trap both types of atoms simultaneously and then to probe and monitor the trapped cloud. The first step in trapping atoms in our system is to decelerate a stream of atoms with an opposing infrared laser beam. We then use magnetic coils and more lasers to form an atom trap. This is known as a Magneto-Optical Trap (MOT). Once the atoms are trapped, we probe the trap with another laser to induce the molecular interactions. In order to slow and trap atoms, the laser photons must have an energy which precisely matches the energy between two atomic states. This requires a precise stabilization of the laser frequency, which we accomplished using a standard technique called "saturated absorption." Molecular interactions are expected to result in a loss of atoms in the trap. So to detect these interactions, we use two methods of characterizing the number and density of atoms in the trap. The first is to count the number of ions produced by atomic collisions within the trap. Ion counts increases as the number or density of the atoms increases. The second is to use a very sensitive camera to take a picture of the fluorescence from the trap. The brightness of the trap gives us the number, while we can look at the picture to determine the size.

134. Michael Bischak, Hope College **Physics**

(Co-Authors: S.K. Remillard)

"Two Dimensional Intermodulation Distortion Scanning of Superconducting Filter Resonators"

Superconductor nonlinearity, manifest through non-Ohmic conductivity, is not fully understood. In the past global methods, or a weighted average of an entire sample, have been used. But in order to fully understand where the nonlinearity comes from, one must use local methods or measurements that look at a specific point in the sample. Ohm's law for a nonlinear sample, V=IR(I), includes a current effect in the resistance. One local method consists of raster scanning samples with a magnetic loop probe. A problem encountered in doing this was that the probe resolution was too inadequate to image details across the width of a transmission line. This limitation was addressed in this work by reducing the size of the dipole loop on the magnetic loop probe. Using the electromagnetic field solver, Sonnet, two dimensional current simulations of superconducting microwave filters composed of Tl2Ba2CaCu2O8 or of YBa2Cu3O77reveal microwave current which is bunched up at the corners and sides of the sample. Two dimensional images of third order intermodulation distortion made with the magnetic probe at the same corners and edges reveal elevated distortion in the same places. Using the magnetic probe, third order intermodulation was seen to come from the same corners and edges where the current is bunched.

135. Lauren Merz, Calvin College **Pre-Medicine**

(Co-Authors: Daniel E. Michele, Ph.D)

"Post-Exercise Fatigue in Duchenne Muscular Dystrophy"

Duchenne muscular dystrophy (DMD) is an X-linked recessive genetic disease characterized by degeneration of the skeletal muscle as well as cardiac dysfunction. DMD patients exhibit elevated blood levels of asymmetric dimethylarginine (ADMA), an endogenous inhibitor of nitric oxide synthase (NOS), that may contribute to impaired nitric oxide (NO) production and the subsequent excess post-exercise fatigue seen in these patients. We tested the hypothesis that reducing ADMA levels in dystrophin-deficient mdx mice would relieve NOS inhibition and reduce post-exercise fatigue. We generated male mdx and female mdx carrier mice that express a transgene encoding dimethylarginine dimethylaminohydrolase (DDAH), an enzyme that degrades ADMA. A 6-minute walk test was used to measure spontaneous activity in transgenic (TG) and non-TG mdx mice before and after treadmill running to assess exercise-induced fatigue. We observed no difference in pre- or post-exercise activity between TG and non-TG male mdx mice. However, TG female mdx carriers showed a significantly higher level of post-exercise activity than non-TG female mdx carriers, suggesting that DDAH overexpression rescued the dystrophin-deficient cardiac muscle of the female mdx carriers and protected them against exercise-induced fatigue.

136. Aaron Zebolsky, Ferris State University **Pre-Medicine**

(Co-Authors: Dr. James Hoerter)

"Use of a Notch Pathway Inhibitor to Maximize UVA Damage to Melanocyte Stem Cells"

The study of how melanocyte stem cells (MSC) contribute to the initiation of malignant melanoma is aided by the use of neocuproine (NCP), which ablates adult melanocytes allowing radiation to reach MSC DNA. The purpose of this experiment was to use the notch pathway inhibitor LY411575 to increase the melanocyte ablation by NCP and then use UVA radiation to damage MSC DNA. MSC damage is displayed by abnormal melanocyte regeneration or nevi formation. Three groups of zebrafish were used in this study: (1) only NCP exposure, (2) NCP, LY411575 exposure, and (3) NCP, LY411575, 3 weeks of UVA exposure. Comparing groups 1 and 2 displayed if LY411575 improves melanocyte ablation by NCP. At the end of the experiment, group 2 showed more ablation than group 1. LY411575 appears to assist NCP in melanocyte ablation. Comparing groups 2 and 3 displayed if this is an effective mechanism to induce MSC DNA damage with UVA irradiation. Group 3 did not show abnormal growth as hypothesized compared to group 2. MSC DNA did not appear to be permanently damaged. Future experiments will continue to investigate how MSC contribute to abnormal growth and development of malignant melanoma.

137. Isaac Simon, Grand Valley State University **Psychology**

(Co-Authors: John K. Hessler, Michael B. Wolfe, Todd J. Williams, Marisa Simoni)

"I can't remember: The effects of lying and Machiavellianism on people's ability to recall past events"

Past research has demonstrated that lying about an event interferes with one's later recall of that event (Pickel, 2004; Chrobak & Zaragoza, 2008). This study examined the extent that individual differences in Machiavellianism (Christie & Geis, 1970) moderated the effect of lying on memory bias. Participants were asked to either truthfully recount or lie about the events depicted in a film clip. One week later, participants recalled the actual events of the film clip. Results showed that lying led to a decrease in the number of events and details that participants were able to recall. This effect was moderated by participant's level of Machiavellianism such that low levels of Machiavellianism were associated with less memory bias whereas higher levels of Machiavellianism was related to increased memory bias. These suggest that low Machiavellian individuals are better able to differentiate between self-generated fabrications and actual events than their more manipulative counterparts.