September 20, 2010

Ohio Wesleyan University

Patricia Belt Conrades
Summer Science Research Symposium

Herbert DuPont. M.D. ’61 >>

Director, Center for Infectious Diseases, Professor of Epidemiology, The University of Texas-Houston School of Public Health

“Research is the basis of all new knowledge, and all students should experience the exhilaration of making original observations through scientifically based research. During the last three years, I have enjoyed working with two OWU students in our summer research program in Mexico and Houston, and this small sample tells me that our school is attracting the right kind of students!”

The Patricia Belt Conrades Summer Science Research Symposium

Science, mathematics, and technology continue to increase in importance as the world becomes smaller and more interdependent. Through ongoing research, scientists can help solve global problems—from eradicating infectious diseases to discovering new sources of clean, safe energy.

Now it its eighteenth year at Ohio Wesleyan, the Summer Science Research Program, which culminates in today's Patricia Belt Conrades Summer Science Research Symposium, encourages our students to tackle tough research issues by offering them an intensive 10-week opportunity to work with seasoned, accomplished mentors both on and off campus. The posters you see here today depict their research results. Please ask the students any questions you wish; they are proud and happy to tell you what they learned and why it matters.

Contents >>

Atrium, Conrades Science Center

Monday, September 20, 2010 at noon

Opening remarks by President Rock Jones followed by student poster presentations

Thoughts from the Director

Ohio Wesleyan University encourages students to take the theory learned in the classroom and put it into practice in the real word.

While many curricular initiatives are providing these opportunities for all OWU students, the Summer Science Research Program (SSRP) has been modeling this concept for almost two decades. In this rich and varied program, students spend ten weeks in the summer working side by side with faculty mentors on research projects that are connected to the students' particular scientific interests.

At larger institutions, undergraduate students join an existing research group consisting of graduate students and post-doctoral fellows. That's not the case at Ohio Wesleyan. Here, students are the central researchers in their projects. They participate in all the steps of the research process, taking ownership of the successes, the failures, and the knowledge gained. Throughout this process, they grow into mature, self-directed, confident investigators who add their own pieces of knowledge to the greater body of scientific understanding.

Today, the students participate in another very important part of scientific work: explaining their research to scientists and nonscientists alike. As you talk with the students, you will appreciate the depth of their understanding. They can explain their work because they understand the fundamentals of the project and have recognized and pondered its nuances.

It's probable that many of these students will present again at major meetings of national scientific societies, learning from some of the most prominent scientists in their fields of interest and making the connections that will help them as they further their work in graduate school or in an immediate scientific career. Today may mark the first step in a long lifetime of professional achievement. We are grateful to Dr. Nancy Reynolds Schneider '64 for providing the endowed funds that make this celebration of scholarship a reality each year.

In the following pages, you'll meet Ohio Wesleyan students who conducted research both on and off the campus, as well as students from other colleges who carried out research on our campus under a National Science Foundation Research Experiences for Undergraduates (REU) Grant awarded to our faculty in physics, astronomy, computer science, and mathematics.

Congratulations to all who participated in this exceptional research program.

Barbara Andereck
Summer Science Research Program Director
Associate Dean for Academic Affairs, Professor of Physics and Astronomy

The Making of a Scientist

In Ohio Wesleyan's Summer Science Research Program (SSRP), students learn quickly that authentic research is quite different from classroom labs—more challenging, more creative, more frustrating, and, ultimately, more rewarding.

Since arriving at OWU 14 years ago, I have involved students in my research projects during the academic year and during the summers. The most rewarding part is watching the students grow as scientists, seeing them take command of a research project, and knowing that they are gaining the confidence to speak and act as scientists. Science cannot be learned solely from a book. Science must be experienced through research, and at OWU, we encourage students to plunge in, preparing them to be successful researchers both at OWU and at other universities. Many first-year students are surprised to learn that they may participate in substantive scientific research from the moment they arrive on campus. At Ohio Wesleyan, research is not just for the few.

During the Symposium this afternoon, you will have the opportunity to interact with 19 students who performed research at OWU this summer mentored by OWU faculty members, seven students from universities other than OWU who worked on campus with OWU faculty, and 16 OWU students who performed research off-campus at other universities or in other countries. There is no doubt that the results presented here today are exciting and novel. However, equally exciting is the opportunity for you to speak with each of these 42 young scientists about what discoveries they have made.

Enjoy the Symposium—and be sure to learn something new!

Laura Tuhela-Reuning
Department of Botany-Microbiology
Department of Zoology
Scanning Electron Microscopist
Summer Science Research Program Assistant Director

The Patricia Belt Conrades Summer Science Research Symposium Endowment

In 2006, Dr. Nancy Reynolds Schneider '64, established an endowment to name the Summer Science Research Symposium after her good friend and fellow OWU alumna, Patricia Belt Conrades '63.

Mrs. Conrades is a volunteer registered nurse and homemaker, and a member of Ohio Wesleyan's Board of Trustees. She regularly assists in the operating room of Boston's Mt. Auburn Hospital. Dr. Schneider is a highly regarded Professor of Pathology and Director of the Cytogenetics Laboratory on the faculty of the University of Texas Southwestern Medical Center in Dallas. She is also a member of Ohio Wesleyan's Board of Trustees.

Mrs. Conrades and Dr. Schneider share a commitment to the sciences, and are both examples of individuals who have enjoyed successful careers in science. The support of Mrs. Conrades and her husband, George Conrades '61, a member of the OWU Board of Trustees, and Dr. Schneider and her husband, John Schneider, continues to strengthen the science and mathematics programs at OWU.

Special Acknowledgments

Sources of Support for the 2009 Summer Science Research Program

Harry Phillip Bahrick Summer Research Fund
Joseph H. '30 and Elizabeth Brant Collaborative Research Fund
Herbert L. '61 and Margaret Wright '61 DuPont Collaborative Summer Research Fund
Ferry Family Foundation
Robert V. '71 and Alice C. Kail Summer Science Research Internship
National Science Foundation
David H. Smith '53 Fund for the Sciences
The Student-Faculty Endowed Research Fund in Chemistry
Ohio Wesleyan University Provost and Academic Affairs Office
Marcia Kunstel '69

Support for the Patricia Belt Conrades Summer Science Research Symposium

Dr. Nancy Reynolds Schneider '64



Board 1

Laura Bowes and Yan Dong

Faculty Mentors: Harry Bahrick, Melinda Baker, and Lynda Hall
Department of Psychology

Older people are often temporarily unable to recall names of people they know. We tested recall of younger and older adults for names of famous individuals. By giving the test twice, we could examine fluctuations in recall and find out whether increasing the number of cues associated with each name could diminish age-related differences in instability of recall.

Recall of Famous Names: Effect of Cueing and Age on Fluctuations in Semantic Memory

We know that temporarily being unable to recall a person's name is a frequent memory problem for older adults. Increasing the number of cues associated with a name stabilizes recall and diminishes such temporary recall failures. The goal of this study is to find out whether increasing the number of cues helps older adults more than it helps younger adults to stabilize name recall and thereby diminish age-related differences of instability of recall. Older adults also process information more slowly and have more difficulty learning new information. In this study, we studied whether these changes influenced age-related instability of recall.

We tested college students and older adults (ages 65 to 85). The tests consisted of recalling the names of 150 famous people. One-third of the names were cued with a single cue (either a portrait or a one-sentence statement about them), one-third of the names were cued with two cues (both a picture and a one-sentence statement), and one-third were prompted with three cues (a picture, a one-sentence statement, and the initials of the name). Participants returned for a second test either 30 minutes or 1 day later, with the second test consisting of the same questions as the first. Participants also took tests of speed of processing information and their ability to learn new names. We plan to compare stability of recall for young and old participants by counting their number of fluctuations in recall access between the first and second test. We will compare fluctuations for the two age groups separately for names that were prompted with one, two, or three cues.

Board 2

Nasie Constantino and Sarah Hayduk

Faculty Mentors: Laura Tuhela-Reuning and Jerry Goldstein
Department of Botany and Microbiology

Every year, 800,000 tons of feathers clog the landfills. We are trying to find efficient and inexpensive ways to identify bacteria from soil found around the world that can help degrade these feathers. Different bacteria use different energy sources and, we use these differences to identify the bacteria. The degraded feathers then can be potentially used as a supplement in animal feed.

Native Bacteria of Birds and Soil and Their Worldwide Distribution

The bacterial genus *Bacillus* consists of 34 species. Of these species, *B. cereus*, *B. licheniformis*, *B. pumilus*, and *B. subtilis* have been shown to degrade feathers by producing the enzyme keratinase. Keratinase is an enzyme produced by microbes that is able to break down the highly stable feather protein, β-keratin, into small peptides and amino acids. Research efforts at other institutions are being carried out to utilize the bacteria's ability to degrade the feathers to turn them into a nutrient supplement for animal food. The main purpose of this research project wa to find an efficient and inexpensive way to identify the bacteria using six metabolic tests including glucose and mannitol fermentation, β-galactosidase production, nitrate reduction, starch hydrolysis, and arginine decarboxylase. Polymerase chain reaction (PCR) and BIOLOG plates were used to confirm the identities of the bacteria that were determined using the metabolic tests. Feather degrading rates also were measured using a spectrophotometer to determine which bacteria can degrade feathers at the fastest rate. The results of the metabolic tests used were successful identifying the four species of *Bacillus* that were isolated from feathers and from soil. Other *Bacillus* species that were isolated from feathers and soil were able to be identified using the BIOLOG system. Of the 438 species that were cultured and identified, 181 (41.6%) were *B. cereus*, 125 (28.5%) were *B. laevolacticus*, 37 (8.5%) were *B. subtilis*, 35 (8.4%) were *B. thuringiensis*, 28 (6.4%) were *B. amyloliquifaciens*, 16 (3.7%) were *B. circulans*, 14 (3.6%) were *B. licheniformis*, and 1 (0.2%) was *B. maroccanus*.

Board 3

Rachel Bowes

Faculty Mentor: Shala Hankison
Department of Zoology

A major question in animal behavior today is whether or not animals have personalities, also known as behavioral syndromes. I am studying group and individual behavioral syndromes of a small fish found all over the northern hemisphere—the three-spined stickleback. I tested fish multiple times across various situations to see if individuals showed consistency or the group showed repeatability—in effect a behavioral syndrome or personality. By studying personalities in animals, we can study the evolution of personality, all the way up to humans.

Fishy Personalities: Repeatability and Consistency in the Three-spined Stickleback

A major question in the field of animal behavior is whether or not animals have behavioral syndromes, or animal personalities. Here we found that a particular Californian population of three-spined sticklebacks does not have an individual or a group personality. Group repeatability and individual consistencies across three situations (exploration, activity, and schooling levels) and over a three-week period were measured. Although behavioral syndromes have been seen in other populations of sticklebacks, the lack of personality in this population could be because it is a low predation population. New evidence suggests that an increase in predation pressure causes an increase in behavioral syndromes and behavioral correlations.

Board 4

Rebecca Robinson[1] and Amit Roy[2]

[1]Michigan State University
[2]Ohio Wesleyan University

Faculty Mentor: Robert O. Harmon
Department of Physics and Astronomy

Many stars have dark starspots, similar to sunspots, on their surfaces which are regions of strong magnetic fields. LO Pegasi has large starspots that cause its brightness to change as the spots rotate into and out of view. We measured and analyzed the brightness variations of LO Pegasi from May – July 2010 using a computer program that generates a map of the star's surface based on these variations

Images of Starspots on LO Pegasi, May—July 2010

Starspots, like sunspots, are dark regions on the surface of a star where a strong magnetic field is present. As starspots are carried into and out of view by the star's rotation, the overall brightness of the star varies. Digital images of the star LO Pegasi through standard B, V, R and I photometric filters were obtained during the months of May through July of 2010 using a 0.2-m Meade Schmidt-Cassegrain telescope and a Santa Barbara Instruments Group ST-8XE CCD camera. LO Pegasi was chosen because of its short rotational period, favorable location in the sky during this interval of time, and the presence of large starspots on its surface. The images were analyzed using differential aperture photometry, which compares the brightness of LO Pegasi to a star with known constant brightness in order to generate a light curve showing the variation with time of the brightness of LO Pegasi. The light curves were processed through a light-curve inversion algorithm that generates a map of the surface of the star showing the locations of the starspots. In addition to mapping the surface, we determined that the rotational period of LO Pegasi should be modified from the accepted value of 10.17 h to a new value of 10.153 h.

Board 5

Hengzhi Chen

Faculty Mentor: Robert Kaye
Department of Astronomy and Physics

A nucleus has multiple different excited energy states and will "relax" from higher energy states to lower ones by emitting γ-ray photons. Each nucleus tends to form its own unique sequences of γ-ray photon emissions as it releases energy, and thus these emissions form a kind of "fingerprint" for a particular nucleus. In our research, we studied the odd-odd Arsenic-70 (^{70}As) nucleus based on the information from the emitted photons during the decay of the nucleus as it relaxed from states of high energy and angular momentum to states of lower energy and angular momentum. The level scheme of this nucleus, which is a "map" depicting the energy states and the γ-ray transitions between them, has been further analyzed and some changes have been made based on the analysis of the patterns formed by the observed γ-rays. Additionally, the discrete angular momentum (or spin) values of several excited energy states were measured.

Spin Assignment in ^{70}As

Our research was focused on the odd-odd Arsenic-70 (^{70}As) nucleus, which was produced by a fusion reaction at Florida State University involving a beam of ^{23}Na accelerated to a kinetic energy of 80 MeV and a thick target foil of ^{54}Fe. This research is the continuation of a study that began in the summer of 2008 and left lingering questions about the angular momentum (or spin) values of several excited energy states. The goal of this research was to confirm the existence of all the γ-ray transitions found previously, measure the spin values of as many excited energy states as possible, and verify that the pattern of the observed excited states in ^{70}As is more like the heavier isotope ^{72}As than the lighter isotope ^{68}As. Gamma-ray transitions between the excited states were collected in coincidence using a high-resolution array of 10 Ge detectors. Using these coincidence relationships, most of the transitions found previously have been confirmed, although some belonging to a recently proposed decay sequence could not be observed in this work. For some of these "missing" transitions, alternative transition energies have been proposed. Using the directional correlation of oriented nuclei (DCO) ratio method, two new spin values have been assigned, and most of the previously assigned spin values have been verified. Despite the suggested changes to the ^{70}As decay scheme proposed in this work, ^{70}As continues to show more similarities to ^{72}As than ^{68}As, indicating the sensitivity of neutron number on nuclear structure among the proton-rich arsenic isotopes.

Board 6

Xituo Meng

Faculty Mentor: : Kim Lance
Department of Chemistry

We currently use chlorine to purify water. The methods are effective; however, byproducts such as dioxins that can cause multiple health issues are produced, and chlorine is left over in the environment. Our compound would purify water continuously without producing any harmful byproducts. The compound mimics the body's ability to oxidize toxins in the liver and kidneys via cytochrome P-450.

Preparation of Complexes as Robust Catalytic Oxidants

The concepts of green chemistry are applied in our experiment. Green chemistry states that chemical processes that carry environmental negatives can be replaced with less polluting or nonpolluting alternatives. The catalytic complexes we are synthesizing mimic already occurring reactions in the body. During our synthesis of our catalytic oxidants, no byproduct was produced and no side reactions occurred. The catalytic oxidant was a robust macrocyclic complex with a high oxidation state iron center. The oxidant is theoretically highly resistant to self-oxidation because it lacks weak bonds where oxygen could be inserted. Previous works had been done on producing a 12-member macrocycle using 1,2-phenylenediamine. Variations in macrocycle size might give a different stability of the oxidation complex. 1,8-naphthalenediamine was chosen as the starting material.1,8-naphthalenediamine and acetone cyanohydrins were initially reacted at room temperature to produce a dinitrile. Large excess of Acetone Cyanohydrins was found necessary to push the reaction into completion. The dinitrile was then heated to reflux with concentrated hydrochloric acid to produce a diacid. The diacid finally could be used to react with 1,8-naphthalenediamine, or with 4-diamino-2,4-dimethylpentan-3-one, or with 1,2-phenylenediamine to make a 12-, 13,- or 14-member ring to test the stability and effectiveness of the variations.

Board 7

Marina Metzler

Faculty Mentor: Kim Lance
Department of Chemistry

Access to potable water is a world-wide problem. Replacing chlorination processes to purify water with a catalyst synthesized using green chemistry will eliminate the formation of hazardous byproducts. The catalyst mimics a catalyst used in the body, but will be more stable for repetitive use.

Synthesis of a Robust Ligand System for Oxidative Catalysis

Using green processes a two step synthesis has produced 2,2'-(1,2-phenylenebis(azanediyl))bis(*N*-(*tert*-butyl)-2-methylpropanamide). O-phenylenediamine was reacted with acetone cyanohydrin to produce a dinitrile, which reacted with t-butanol in phosphoric acid to produce the diamide product. In another synthesis, the dinitrile secondary amine was protected with Fmoc to prevent an attack on the hydrogen. Spectroscopic data confirm successful synthesis, but further purification is needed.

Board 8

Bennett Thompson

Faculty Mentor: Kim Lance
Department of Chemistry

Modern chlorination technologies, which produce dangerous by-products such as dioxins, are not an ideal solution to water purification. The goal of water purification is to transform impurities into substances that are more benign. Certain iron compounds modeled after nature's own cytochrome P-450 enzyme have the potential to catalytically improve water purification efforts everywhere by allowing the use of O_2 and hydrogen peroxide to oxidize impurities. These iron compounds in tandem with naturally occurring oxidants replace chlorination and do not form harmful byproducts. This project integrates sustainable chemistry at all levels by establishing syntheses of these catalysts that utilize established green methods.

Synthesis of Diamine-Diamide Ligand Systems for Robust Oxidative Catalysts

A facile synthesis of 2,2'-(1,2-phenylenebis(azanediyl))bis(*N-tert-butyl-2-methylpropanamide*) was approached utilizing green and easily scalable synthetic steps. The work herein represents significant progress toward the synthesis of robust ligand systems for high-valent iron complexes that can catalyze oxidations with benign oxidants such as dioxygen and hydrogen peroxide.

Board 9

Anna Spencer

Faculty Mentor: Kim Lance
Department of Chemistry

Currently, the most common method of water purification involves the use of chlorine to oxidize harmful substances in the water, which then allows the body to process and excrete these items without harm. However, this method can create harmful byproducts, such as dioxins that can cause birth defects and damage to sexual organs. We are working on synthesizing a catalyst, based on one used by the human body, that will allow us to purify water without using chlorine.

Using Di-Substitued Starting Material in the Synthesis of an Iron Diamine-Diamide Catalyst

In an attempt to change the electronic environment on the final Diamine-Diamide (DADA) ligand and prevent autoxidation, new di-substituted starting materials were used in the three-step synthetic scheme used by previous Lance group researchers. One of the new starting materials, 1,2-diamino-4,5-dimethoxybenzene, was synthesized in situ due to its instability, while the other, 4,5-dichloro-1,2-phenylenediamine, was obtained at purity from Sigma Aldrich.The mono-nitrated product was obtained at 67.8% yield. Neither of the new starting materials reacted with acetone cyanohydrin to yield nitriles. Further experimentation with freshly distilled acetone cyanohydrin in the presence of solvents may yield more desirable results.

Board 10

Jarrod Uhrig

Faculty Mentor: Tami Panhuis
Department of Zoology

The placenta is a site of nutrient and waste exchange between the mother and developing embryo. Although this intimate link between mother and child is commonly expected to be cooperative, there is evidence suggesting this may also be a site where the mother and offspring attempt to compete for resources. This competition has been linked to problems such as gestational diabetes, pre-eclampsia, and even miscarriages. To study this phenomenon, we are looking at the placenta of *Poeciliopsis* fish, which have developed differently between closely related species. We are studying the expression of placental genes in hopes to determine their role in placental evolution.

Identification and Characterization of Placenta Genes in *Poeciliopsis* Fish Species

The development of an embryo within the placental structure of its mother may be subject to evolutionary pressures selecting for fetal genes that are harmful to its mother, allowing it to acquire additional resources. This can lead to the mother's attempting to limit this invasion, resulting in an evolutionary arms race between the two genomes. Recently, a placental cDNA library analysis of two Poeciliopsis species (*P. turneri* & *P. presidionis*), performed by the Panhuis lab, revealed several candidate genes that may be involved in this maternal-fetal conflict. One putative gene, α-2 macroglobulin (*A2M*), was found to be highly redundant in the placenta cDNA library for both species. *A2M* codes for a protein that is important in the innate immune system, implicated in mammalian pregnancy and in limiting fetal trophoblast invasion of the maternal decidual tissue, and appears to be rapidly evolving in Zebrafish (Danio rerio). These features make *A2M* an excellent candidate gene for future functional and comparative analyses. The goal of this research project was to verify the expression of *A2M* in the placenta tissue of *P. turneri* and *P. presidionis*. I also looked for tissue-specific *A2M* expression by examining the liver, heart, muscle and ovary tissues for both species. Expression of *A2M* was analyzed with a two-step reverse transcription PCR (RT-PCR) reaction. Total RNA was extracted from each tissue, DNase treated the RNA to remove genomic DNA contamination, and used RT-PCR to generate cDNA. Then, using primers designed to amplify a 271bp segment of *A2M*, we performed gene specific PCR using the cDNA as a template. We visualized the PCR product with a 2% agarose gel stained with ethidium bromide. We found expression of *A2M* in the placenta of both species as predicted from the cDNA library results, and also expression in all other tissues. These results suggest that the *A2M* gene region we amplified is not tissue specific. Future work using quantitative RT-PCR will examine the degree to which this gene is expressed in the placenta compared to the other tissues.

Board 11

Jack Schemenauer

Faculty Mentor: David Walker
Department of Geography

The Morse Road Corridor of Columbus has undergone transformations by both immigrant entrepreneurship and money spent by the city of Columbus; these transformation are evident by walking or driving through the area. Immigrantification is the process by which immigrants economically revitalize an area and is also a key component in the changes along the corridor. This study helps to understand how citizens of Northland, both long-term and recent immigrants, use and think about different aspects of space within the city of Columbus, specifically the Morse Road Corridor.

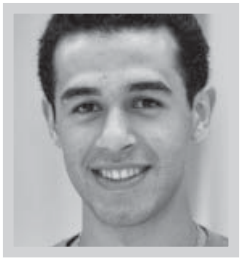
Immigrantification: Global Immigration and Landscape Changes—Somali and Latino Immigrants and the Revitalization of Columbus Neighborhoods

Our research and field studies analyze how Latino and Somali immigrants participated in the revival of the Morse Road Corridor in Columbus, Ohio; how the city decided to invest $29 million into the Morse Road Business Improvement District; and how these two factors are affecting socioeconomic urban space. Our study focuses on the economic revitalization of the Morse Road Corridor: a process we have termed immigrantification. This project maps long-term Northland residents' views of the spatial changes that are occurring juxtaposed to how immigrants view the changes in the community—especially how the city spends the $29 million toward beautification. In this study we examine how immigrant revitalization is affecting how long-term residents are using urban space in Northland and how the beautification program is perceived by the immigrants. The study helps to understand how citizens of Northland use and think about space within Columbus. The study also indicates how different cultures value street, consumer, and public spaces. Also, we examine how different cultures perceive their own neighborhood. The qualitative methods make use of interviews, archival research, and participant research/observation to gather information from Mexican and Somali immigrants and from city officials. The quantitative method includes the Q method. This method is a form of factor analysis that seeks to identify commonalities of opinion from sorted textual statements or pictures. Long-term white or African-American Northland residents, Somali immigrants and Latino immigrants all have different and overlapping opinions, and therefore, ways of viewing urban space. Through the Q method we will identify and map these differences and commonalities with ArcGIS mapping software to strengthen existing spatial data on immigrantification and perceptions of urban space in Northland. Our Q method study design uses photographs to learn how long-tern residents, Somalis, and Latinos perceive socio-spatial changes in Northland and the use of space.

Board 12

Sharif Kronemer and Kellie Gross

Faculty Mentor: Jennifer Yates
Department of Psychology



To develop new therapies for spinal cord injury in humans, animal models must first be used. The purpose of our research this summer was to determine the best behavioral measures for evaluating injury in the guinea pig model. We will use these new measures in future projects to test new therapies.

The Assessment of Spinal Cord Injury in the Guinea Pig Model

Secondary damage after spinal cord injury (SCI) is caused by the body's immune response. Pharmacological therapies that target specific aspects of this response may reduce damage and improve function after injury. By performing assessments of hind limb function before and after injury, the effectiveness of possible treatments can be determined in the guinea pig model. Assessments common to the rat model were tested in the guinea pig model and include contact righting, air righting, and the Photobeam Activity System (PAS) open field. A dorsal laminectomy at thoracic vertebra 12 (T12) was performed on female Hartley guinea pigs followed by compression of the spinal cord to 1.2 mm over a length of 5 mm. Before injury, baseline data were gathered using the new assessments. After injury, at 5 hours, 1, 2, 3, 7, 12, 14, 21 and 28 days, the new assessments, along with measures used in previous research (*cutaneus trunci* muscle reflex, proprioceptive placing response, and toe spread reflex) were performed. When compared to previous assessments, preliminary evaluations show that air and contact righting scores differentiate among levels of injury severity as well as track improvement over the 28-day period. However, the PAS open field appears to be a less useful measure. Future research will include the reevaluation of these assessments, evaluation of additional assessments such as the incline plane, and the development of a scale similar to the rat Basso, Beattie, Bresnahan locomotor rating scale.

Board 13

Robert E. Anthony and Alex R. Howe

Faculty Mentor: Robert Kaye
Department of: Physics and Astronomy

Atomic nuclei consist of protons and neutrons. The lightest stable nuclei, many of which are found in the atoms of materials we interact with in everyday life, generally have an equal number of protons and neutrons. However, by colliding particles at extremely high speeds, nuclei that have an excess number of neutrons can be created. Such nuclei almost immediately "relax" toward a more stable configuration by throwing off at least one extra neutron. This summer, we built detectors to detect and measure properties of these neutrons in order to learn more about the exotic nuclei from which they were emitted.

Assembly and Testing of LISA Neutron Detectors*

Ohio Wesleyan University is part of a collaboration of nine eight undergraduate institutions assembling neutron detector bars for Michigan State University's renowned National Superconducting Cyclotron Laboratory (NSCL). This summer, each institution assembled and tested sixteen detector bars that will comprise the Large-area multi-Institutional Scintillator Array (LISA), consisting of 144 bars. Once coupled with the existing Modular Neutron Array (MoNA) at the NSCL, the combined MoNA-LISA array will significantly enhance both the efficiency and resolving power for detecting neutrons emitted from very short-lived, strongly neutron-rich nuclei created at the NSCL. The detectors built this summer will be employed to measure both the energy and trajectory of these emitted neutrons, which gives valuable information about the structure of exotic nuclei from which they were released.

Each detector consists of an approximately 2 m long bar of scintillating material with a photomultiplier tube (PMT) attached to each end. The incoming neutron interacts with the scintillating material and causes a flash of light to be emitted. This flash is then amplified and converted to an electric signal by the PMT. By looking at the amplitude and arrival times of signals from the PMTs, the energy of the neutron, as well as the position where it struck the detector can be estimated. During the course of this project, 33 base assemblies for the PMTs were assembled (two for each of 16 bars and one spare), and the completed PMT assemblies were attached to the 16 detector bars. Each completed bar underwent rigorous testing to determine the voltage required to drive each PMT and the light attenuation properties of each bar. The bars also were tested to ensure that they were completely light tight, as the only light in the PMT must come from scintillations and not from the outside environment.

*Work supported by the National Science Foundation through grant no. PHY-0922409.

Board 14

Iftekhar Showpnil

Faculty Mentor: Chris Wolverton
Department of Botany/Microbiology

Root architecture is vital to plant growth, as roots provide the plant with nutrients and water. In addition to internal developmental cues, roots grow in response to environmental stimuli such as light, gravity, and touch. This summer, we studied the effects of a class of proteins (PINs) on the root's growth response to gravity in the model plant *Arabidopsis*. By understanding the role these proteins play in the root's gravitropic response, we hope to identify master regulators of root architecture that could prove useful in improving crop plants.

Gravitropic Response of the Root Tip in PIN Mutants of *Arabidopsis thaliana*.

Gravitropism is a plant's growth or movement response to gravity. The roots of plants orient themselves at a preferred angle in the gravitational field known as the gravitropic set point angle (GSA). It has previously been shown that gravistimulation of a plant leads to asymmetric distribution of the plant hormone auxin, which leads to differential growth in the plant. When the root is gravistimulated, the deviation from the GSA is detected by the root and it responds accordingly to reorient itself, resulting in tip curvature. The PIN family of proteins is thought to act as auxin efflux carriers in the root cap. The objective of this experiment is to understand the role of these PIN proteins in the polar transportation of auxin in the root cap. Four-day-old seedlings of pin mutants were gravistimulated at 90 degrees and allowed to respond freely; *pin4* mutants responded closely to wild types, while the response rates(deg/h) of *pin3* and *pin7* mutants were lower, and of *pin3pin7* and *pin4pin7* double mutants were higher than wild type response. Another treatment being performed is to mount the seedlings on a rotating stage to keep the root tip stimulated at a constrained angle. Data collected so far on several pin mutants suggest that the response rate of the *pin3* and *pin4* mutants are similar to each other and slower than wild type response, all with peaks at 120 degree. However, the response rate of the *pin7* mutants vary significantly from any of the other mutants or the wild type with its peak at 60 degrees, suggesting a different role for the PIN7 than PIN3 and PIN4. Analysis of the double mutants (*pin3pin7* and *pin4pin7*) is underway, which will shed more light on the role of these PIN proteins as auxin efflux carriers.

Board 15

Bhavna Murali

Faculty Mentor: Chris Wolverton
Department of Botany and Microbiology

Roots can change their angle based on a variety of environmental variables, including the levels of various soil nutrients. We are looking for mutations in known phosphate transporters to probe the signaling pathway that connects phosphate sensing and root architecture.

Probing Root Architecture Using Phosphate Transport Mutants

Plant roots are adapted for the uptake of water and minerals from the soil. Phosphate is one of the most limiting nutrients for plant growth due to the fact that it is often bound to immobile cations in the soil. As a result, plants alter their root architecture in response to phosphate levels.We are interested in understanding how plants sense phosphate levels and adjust the orientations of lateral roots to optimize uptake of this important nutrient. Toward that end, we have begun characterizing putative mutants in phosphate transporter genes obtained from theArabidopsis Biological Resource Center using a PCR-based screen. Here we report the successful identification of a homozygous T-DNA insert at the PHT1;1 locus, but no success as yet in identifying a homozygous insert at the PHT1;4 locus. Results will be discussed in the context of ongoing work in our lab aimed at understanding how root systems adapt to low-phosphate conditions.

Board 16

Sean Williams

Faculty Mentor: E. H. Burtt, Jr.
Department of Zoology

A bird's bill has a hard, polished surface. The surface can reflect sunlight into the bird's eye. We predict that species that forage in the sun should have dark bills, since a dark color absorbs light. We looked for correlations between bill color and the amount of time species forage in the sun among temperate and neotropical birds.

Glare as a Selection Pressure on Bill Color in Temperate and Neotropical Birds

Glare as a selection pressure on avian bill color was compared between temperate and tropical avian species. The bill has a hard polished surface that is in the field of vision. Sunlight can reflect from the bill and into the eye as an intense beam of light. A dark upper mandible can absorb sunlight better than a light bill. The lower mandible is out of the field of vision and thus is not exposed to the selection pressure of glare. Upon spotting a bird, we counted to ten and noted whether the head of the bird was in sun, shade, or mixed lighting. We used museum specimens and Munsell-value color cards to determine bill color. Temperate birds that forage in the sun have dark upper mandibles and birds that forage in the shade have light to dark upper mandibles. The lower mandible has a wider range of color than the upper mandible. Birds with a visually demanding foraging task such as insectivores have darker upper mandibles than birds that have a non-visually demanding task, such as frugivores or granivores. Tropical birds differ from temperate species in numerous ways such as nest predation rate, adult survival, and extent of migration. We observed use of sunlight, foraging behavior, and bill color in tropical species and compare them to our data for temperate species.

Board 17

Meredith S. Palmer

Faculty Mentor: Karen Warkentin
Department of Biology, Boston University

Many organisms have complex life cycles characterized by ontogenetic switch points, such as hatching, where different developmental stages occur in different environments. The timing of these switch points can be plastic; that is, an organism can shift when this developmental change occurs in response to environmental variation. Red-eyed tree frog eggs can hatch early if threatened by predation, flooding, or fungus, but fall into the water as less-well developed larvae. We examined the trade-offs of hatching early by studying survivorship of hatchlings over the first part of the larval stage when faced with three types of tadpole predators.

Fear & Death: The Cost of Hatching Early

Red-eyed treefrog (*Agalychnis callidryas*) eggs hatch early in response to egg predators and later if undisturbed. Tadpoles therefore enter the water at different times and in different developmental stages. Previous experiments done over the first 24 h after hatching suggest that early tadpoles, which are less well developed, suffer higher mortality from most tadpole predators. However, early tadpoles spend a longer period in the water before they are joined by the remainder of their cohort. We examined the cost of early hatching over this entire period, termed the "plastic hatching window." We raised tadpoles that were hatched at either 4 (early) or 6 (late) days since oviposition with one of three common species of larval predator that differed in feeding morphology, including giant water bugs (*Belostoma sp.*), and two species of dragonfly larvae (*Anax amazili* and *Pantala flavescens*). We followed tadpole survival, growth, and activity. Mortality for early tadpoles was higher than that of late tadpoles for all three predators over the plastic hatching window, with overall rates of mortality being highest in Anax ($P<0.01$). Early tadpoles grew longest in the Belostomatid experiment ($P=0.002$). In the *Belostoma* and *Pantala* experiments, all tadpoles started off attaching themselves to substrates and remained in these positions over time. With Anax, early tadpoles began attached to substrates but over time positioned themselves primarily at the top of the water. Late tadpoles also positioned themselves at the top by the end of 24 h. Early tadpoles were more active than late tadpoles at age 7 days with *Belostoma* and *Pantala* ($P<0.001$); in *Anax*, the number of movements/tadpole remained low over time. This provides evidence that position, movement, and growth may be influenced by predator cues and that mortality for all tadpoles varies between predators, yet there is no survivorship compensation to hatching early.

Board 18

Allison Kolbe

Faculty Mentor: : Jose M. Alonso
Department of Genetics, North Carolina State University

Recombineering is a new molecular biology technique that allows large fragments of DNA to be modified easily and efficiently. This technology can be applied to *Arabidopsis thaliana* to tag genes using improved fluorescent markers, enabling us to visualize exactly where a gene is being expressed in the plant. Using recombineering, we have tagged several genes involved in the synthesis of auxin, an important plant hormone. These tags will ultimately allow us to generate a detailed map of how and where auxin is being produced.

Recombineering: A New Strategy for Efficient Gene Tagging in *Arabidopsis*

Recombineering, a recombination-based system of genetic engineering, allows for efficient and precise modification of large fragments of DNA. Recombineering is also very versatile, and has a number of advantages over traditional cloning methods. This technology, applied to *Arabidopsis thaliana*, allows for the generation of whole-gene translational fusions and therefore will be essential for the construction of a high-resolution spatiotemporal map of gene expression and protein localization. Such maps will be invaluable for the study of gene function in *Arabidopsis*. Here we applied this technology to tag three genes involved in auxin biosynthesis, WEI8, WEL1, WEL2, using the improved markers YPet and mCherry. These new markers will be able to visualize gene activity in specific cell types, enabling future research to better address the question of where auxin is synthesized.

Board 19

Chloe Hamrick

Faculty Mentors: Herbert L. DuPont and Zhi-Dong Jiang
The University of Texas School of Public Health, Center for Infectious Disease

Traveler's diarrhea and pediatric diarrhea in developing countries are caused by variety of bacteria, which explains why antibiotics work in treatment and prevention of the disease. Diffusely adherent *E. coli* (DAEC) has been recovered in both populations but has not yet been studied for its disease-producing potential. This is the first systematic study of DAEC strains from subjects with travelers' diarrhea. Based on these studies, we believe that DAEC should be considered a human pathogen.

Virulence of Diffusely Adherent *Escherichia coli* (DAEC) Isolated from International Travelers with Diarrhea

Escherichia coli isolated from stools of subjects with traveler's diarrhea (TD) that diffusely attach to intestinal epithelial cells are called DAEC. These strains are currently of uncertain etiologic significance. Thirty-nine strains of DAEC isolated from stools of subjects with TD acquired in Mexico, Central America or Asia were included in this study. The DAEC strains were first examined in an established model of inflammation for induced production of interleukin (IL)-8, a precursor of polymorphonuclear leukocytes, when the bacteria were exposed to intestinal HCT-8 cells. IL-8 concentration in supernatant was quantified by enzyme-linked immunosorbent assay (ELISA). Secondly, presence of well-established *E. coli* plasmid-borne virulence genes *aap*, *afa/dr*, *daaC* and *aafC*, was sought in the strains. PCR and gel electrophoresis was used to detect the presence of the virulence genes. Thirty-seven (95%) DAEC strains possessed ≥1 virulence gene, of which *aap* (dispersin) was the most commonly found, occurring in 36 (92%) isolates. Twenty-eight (72%) DAEC strains induced moderate to high levels of IL-8 production, compared to avirulent *E. coli* controls. There was no relationship between possession of virulence genes and production of IL-8. The study provides evidence that DAEC strains isolated from persons with TD should be considered virulent enteropathogens. We believe that DAEC strains are potentially important causes of TD. Further studies will compare the pattern of virulence factors of DAEC strains with those found in other diarrheagenic *E. coli*, including enterotoxigenic *E. coli*, enteroaggregative *E. coli* and enteropathogenic *E. coli* to better define EAEC as a human pathogen.

Board 20

Rachel Spetrino

Faculty Mentors: Deepak Kumar, Robert Moore, and John Moore
Department of Pediatrics, MetroHealth Campus of Case Western Reserve University School of Medicine, Cleveland, Ohio

The mechanism of premature birth is still currently unknown. Preterm premature rupture of the fetal membranes (amnion and choriodecidua) initiate about one third of all preterm deliveries, which results in extensive infant complications and death. The amnion over the placental disc does not endure the same physical stressor that the amnion surrounding the fetus does, nor does it come in contact with the choriodecidua and therefore has a different physical and biochemical make up. By studying the strength of these membranes as well as the upregulation of extracellular proteins such as Tenascin-c and Fibulin 3 in the amnion surrounding the fetus, we can begin to identify causes for weakening of the fetal membranes and premature birth.

Biomechanical and Biochemical Properties of Placental Amnion versus Reflected Amnion

Premature rupture of the fetal membranes (PPROM) results in premature births with consequential mortality or subsequent infant morbidity. The amnion is the major strength bearing component of the fetal membranes. Anatomical location of the amnion - placental, adherent to the placental disc, versus reflected, in direct contact with the choriodecidua - defines the extent of mechanical stretch and the biochemical exposure during late gestation. We hypothesized that the placental amnion is mechanically stronger than the reflected amnion and that biochemical changes initiated by the choriodecidua, impacting the adjacent, reflected amnion, effect said weakening. Fetal membranes were obtained from uncomplicated patients undergoing repeat cesarean section at term and term vaginal delivery (37-42 weeks). FM were first examined to determine whether the FM components (amnion and choriodecidua) remained adherent after delivery or had spontaneously peeled apart. Spontaneously and manually separated amnion fragments from the placental and reflected regions were strength tested using our published methods. After testing, samples were homogenized, extracted and selected proteins analyzed by western blot. 23 FM were strength tested and analyzed by western blot. Amnion manually peeled from the placental disc (MD) was significantly stronger than manually peeled amnion from the reflected FM (MO) (p-value <0.001). MD had significantly lower levels of Tenascin-C than MO (p-value 0.0050). The difference between the levels of Fibulin 3 found on the placental amnion versus the disc amnion was not significant although there was a trend toward increased fibulin 3 protein levels associated with decreased amnion strength. Spontaneously peeled amnion (SD, SO) showed similar but less pronounced differences. Amnion from the placental disk is stronger than amnion from reflected FM adjacent to choriodecidua at term. Elevated levels of Tenascin-C in reflected amnion may indicate changes in cellular adherence or distribution relative to cells comprising amnion adherent to the placental disc.

Board 21

Andrea Hatfield

Faculty Mentors: Robin Kowalski and Gary Giumetti
Department of Psychology, Clemson University, Clemson, SC

Workplace cyber-incivility is disrespectful office behavior that is facilitated through technology. To determine the impact of incivility on performance and mood, the current study gave participants math tasks to complete over email and accompanied the tasks with either uncivil or supportive comments. We found that uncivil comments caused performance to worsen, willingness to continue working to decrease and experience of negative emotions to increase. These results highlight the importance of addressing online incivility in the workplace to promote employee productivity and well-being.

Effects of Experiencing Cyber-Incivility in the Workplace

Survey research has found correlational relationships between experiencing cyber-incivility and adverse work and health outcomes. The current study experimentally tests the causal nature of these relationships. Thirty-nine undergraduate students completed a series of graphical analysis questions assigned over email, once with supportive comments and once with uncivil comments from the supposed supervisor. In the uncivil condition, the percent of correct answers and willingness to continue working with the supervisor decreased and self-reported state negative affect increased, among other significant findings. These results suggest that experiencing online incivility in the workplace weakens performance, increases negative affect and has serious implications for the work environment.

Board 22

Lindsey Aurora

Faculty Mentors: Nitin Walyat, Monica Fundzak, Julie Medas, M.J. Novosel, and Deepak Kumar
MetroHealth Campus of Case Western Reserve University School of Medicine, Cleveland, Ohio

Central lines such as umbilical and peripherally inserted central catheters are a significant source of infection related to morbidity and mortality in Very Low Birth Weight (VLBW; 1000-1500 g) babies due to their immature immune system. At the same time, multiple peripheral IV (PIV) attempts have a significant component of associated pain, stress and temperature instability, and sometimes each PIV placement may require more than 10-20 attempts. This may also potentially increase their risk of acquiring infections. This study was designed to determine whether multiple peripheral IV (PIV) use or central catheter placement increases the risk of bacteremia in VLBW infants after birth.

Does Peripheral IV Versus Central Catheter Use Increase The Risk of Bacteremia In Very Low Birth Weight (VLBW; 1000-1500 g) Premature Infants

Objective: To determine whether multiple peripheral IV (PIV) use or central catheter placement increases the risk of bacteremia in Very Low Birth Weight (VLBW) (1000-1500 g) infants after birth.

Methods: Electronic patient medical records were used to collect clinical data including demographics, clinical characteristics, number of PIV inserted and attempts, Umbilical Venous Catheter (UVC) and Peripherally Inserted Central Catheter (PICC) placement. Babies with birth weight 1000-1500 g born from July 2009 to July 2010 were studied. Cases were defined as symptomatic patients with positive blood cultures or presumed sepsis (negative blood culture) with antibiotic treatment ≥ 7 days. Controls were defined as asymptomatic infants or infants with transient mild nonspecific symptoms with negative blood cultures deemed rule out sepsis with antibiotic treatment less than 3 days. Each case was matched with two controls based on closest birth date. Statistical analysis was performed using SPSS for Windows, Version 13.

Results: Compared to controls, babies with sepsis had more central line days but no difference was seen in the number of PIV inserted and attempts in the two groups. Septic babies had lower birth weight, longer length of stay, and took longer to reach full enteral feeds. Babies with central lines, compared to those without central lines, had less number of PIV inserted.

Conclusion: There was no association of sepsis with number of PIV inserted or PIV attempts. A longer duration of central line placement was associated with sepsis.

Board 23

Maisha S. Rashid

Faculty Mentor: Mark Rance
Department of Molecular Genetics, Biochemistry and Microbiology, University of Cincinnati

Pitx2 is a transcription factor that regulates the expression of genes in the pituitary gonadotroph. The Pitx2 homeodomain (where it binds DNA for regulation) is known to be mutated in the disease Axenfeld-Rieger Syndrome. This disease causes developmental defects in humans. I studied the thermal stability and DNA binding affinity of the Pitx2HD to characterize its biophysical characteristics and define its role as a transcription factor which contributed towards understanding the functioning of the wild type protein. Similar experiments were conducted with a K50E mutant construct and compared with the wild type protein, as Pitx2HD is a K50 class homeodomain (it has a lysine residue at position 50 and this is a key residue for DNA binding) and the K50E mutation had been identified in clinical cases of the disease.

Biophysical Characterization of the Pitx2 Homeodomain

Pitx2 is a homeobox gene that is known to be mutated in Axenfeld-Rieger Syndrome. This autosomal dominant disorder affects the development of the teeth, eyes and abdominal region. The homeodomain (HD) of the Pitx2 transcription factor is known to bind DNA and has further been identified as a mutational hot spot. In our studies we aim to understand the nature of these mutations and how they impact the homeodomain's stability and DNA-binding ability. The impact of the K50E point mutation on homeodomain – consensus DNA-binding was compared with the binding characteristics of the wild type protein using Isothermal Titration Calorimetry (ITC). K_D and ΔH values were measured for the reactions between the wild type and mutant protein with DNA, and this data was used to compare the binding affinity of the wild type protein with the mutant construct. To complement the DNA-binding experiments, Circular Dichroism Spectroscopy was used to analyze the thermal stability of the wild type and mutant proteins. It was found that the wild type protein showed greater stability when exposed to thermal stress as opposed to the mutant construct. It was further demonstrated that binding between the protein (wt and mutant) and DNA occurs, as indicated by a significant shift of the melting temperature upon binding of DNA. This binding was analyzed in detail by ITC and our findings suggest that most mutations significantly reduce DNA-binding affinity. The findings presented here are important for the understanding of differential DNA binding and subsequent differential regulation of homeodomain target genes and may further shed light on clinical manifestations associated with mutations in the Pitx2HD.

Board 24

Cailee Smith

Faculty Mentors: Glen Hood and Jeffrey Feder
Department of Biological Sciences, University of Notre Dame

Differences in physical features are favored for better adaptation to a wide range of environments. The ovipositor, a female reproductive appendage, is of particular importance to parasitoid wasps that lay eggs into the larvae of the fruit fly *R. pomonella*. We measured the ovipositors of three species of parasitoid wasps derived from hawthorn and apple fruits to compare lengths of ovipositors across host fruits. Our measurements show the ovipositors of parasitoid wasps that attack earlier stages of *R. pomonella* larvae to be shorter than those attacking more developed larvae.

Morphological Variation Between Three Species of Parasitoid Wasps Attacking Apple and Hawthorn Races of *Rhagoletis Pomonella*

Natural selection can favor variation in morphological traits that allow a species to exploit a wide range of environmental conditions. Three host-specific parasitoid wasps (Hymenoptera: Braconidae) attack apple and hawthorn derived host races of the fruit fly *Rhagoletis pomonella* (Diptera: Tephritidae) in the mid-western United States. Two of the parasitoid species, *Diachasma alloeum* and *Diachasmimorpha mellea*, attack larval instars of *R. pomonella* feeding deep within the fruit while a third species, *Utetes canaliculatus*, attacks fly eggs deposited just underneath the surface of the fruit. In the present study we test the following hypotheses: (1) apple-derived parasitoids will have significantly longer ovipositors than hawthorn-derived parasitoids given differences in fruit size and (2) the egg-attacking parasitoid will have a significantly shorter ovipositor compared to larval attacking parasitoids given the life stage of the fly it exploits. Ovipositor lengths of apple- and hawthorn-derived parasitoids from central Michigan, USA, were measured to the nearest µm using a dissecting microscope fitted with an ocular micrometer. Ovipositor length varies between species. Egg-attacking parasitoid ovipositors are >5 times shorter than ovipositors of larval-attacking parasitoids. However, no significant difference was found between host association or the interaction between species and host association. These results are discussed in light of parasitoid (1) niche partitioning, (2) host shifting and race formation and (3) the potential tradeoffs between ovipositor-body size and ovipositor-flight capability.

Board 25

Emily Stinemetz

Faculty Mentor: Richard B. Pyles
Department of Pediatrics and Microbiology and Immunology, University of Texas Medical Branch, Galveston

Lactobacillus are common bacteria found in the vaginal cavity. Prior to this study, a new model of the human vaginal cavity was developed and different mixtures of *Lactobacillus* were placed on the vaginal epithelial cells to model the interaction of the bacteria with the cells. *Lactobacillus jensenii* and *crispatus* were able to reach a steady state in the model that is consistent with human data. This suggests that effective model was produced.

Interaction Between the Commensal Bacteria, *Lactobacillus jensenii* and *Lactobacillus crispatus*, and the Vaginal Mucosa

Commensal bacteria colonize many human mucosal surfaces to help defend against pathogens. To model the interaction between two common commensal bacteria and the vaginal mucosa, mixtures of *Lactobacillus jensenii* and *crispatus* were studied in vaginal epithelial cell transwells. Bacteria colonized the apical, air-interfaced surface of the vagina multilayer cultures established by placing 10^5 human vaginal cells in a transwell insert with a top liquid medium layer. After two days, the top liquid layer was removed and the apical layer was not disturbed for eight days. Bacteria (grown from frozen stocks) then were placed on the apical surface (10^3 colony forming units) and allowed to colonize for two days. Bacterial titers were determined by viable plating and PCR for bacterial genomes. The optimized PCR assays used *L crispatus* or *L jensenii* specific primers to quantify the number of bacterial species present through SYBR green incorporation followed by melt temperature analyses. Viable bacteria were counted by serial dilution in liquid cultures in 96-well format. Both *L jensenii* and *L crispatus* grew to a steady state of 10^5-10^6 colony forming units on the vagina multilayer consistent with estimates for human vaginal colonization suggesting that an effective model has been produced. The bacterial mixing studies also allowed us to evaluate which species was more robust in the culture environment. Current results indicated that *L crispatus* is more robust than *jensenii* consistent with the prevalence in humans. These studies also provided a comparison of growth kinetics in nutrient broth and the air-nterface environment that indicated both species double more quickly in the vaginal environment.

Board 26

Kristen M. Lear

Faculty Mentors: Elizabeth Braun de Torrez1, Thomas H. Kunz[1], and Edward H. Burtt[2]
[1]Boston University, Department of Biology
[2]Ohio Wesleyan University, Department of Zoology

Attracting bats by installing bat houses on farmland may reduce the need for pesticides, as many species of bats are insectivorous and can consume agricultural pest insects. To determine if bats have species-specific preferences in bat house design, I built and installed eight pairs of bat houses, each with one rocket box and one standard house, in three pecan orchards in central Texas. I monitored general and feeding activity near to and far from each house site both before and after installation in order to determine if activity in the area increases after installation of a bat house, as this is directly related to potential pest control. I also monitored each house for bat exploratory behavior, occupancy, and species composition. By determining the most effective design for bat houses, we can determine how best to attract different species of bats in central Texas, which can also maximize the bats' potential benefit to pest control.

Species Preferences in Bat House Design: Implications for Bat Conservation and Ecosystem Services

Since the early 20th century, people have used bat houses to attract bats. Many species of bats are insectivorous and can consume agricultural pest insects. Attracting bats by installing bat houses on farmland may reduce the need for pesticides. Because of growing demand for chemical-free methods of pest control, farmers may be interested in attracting bats to their farms by using bat houses. Factors that increase bat house success include larger landing areas and mounting on buildings in areas with low disturbance and low canopy cover. Internal temperature can also affect occupancy, therefore the color of a bat house should be considered during construction. However, little research has been done to determine the most effective bat house design for attracting different bat species. To determine if bats have species-specific preferences in bat house design, I installed eight pairs of bat houses in three organic pecan orchards in central Texas. Each pair consisted of one two-chamber rocket box and one standard medium three-chamber house. I monitored general and feeding activity near to and far from each site both before and after installation in order to determine if activity in the area increases after installation of a bat house, as this is directly related to potential pest control services. I also monitored each house for bat occupancy and species composition by documenting the presence of guano beneath the roost, visually monitoring the bats inside the house during the day, conducting hand counts and thermal imaging censuses during evening emergences, watching exploratory behavior at night with a thermal camera, and recording calls during emergences. By determining the most effective design for bat houses, we can determine how best to attract different species of bats in central Texas, which can also maximize the bats' potential benefit to pest control.

Board 27

Tammy Winkler

Faculty Mentors: Eunjin Lim and Marc E. Rothenberg
Department of Allergy and Immunology, Cincinnati Children's Hospital

Eosinophilic Esophagitis (EE) is an emerging worldwide disease characterized by inflammation of the esophagus. EE is associated with the overproduction of interleukin-13, a Th2 cytokine and an important regulator of allergic disease and inflammation. The gene most highly induced by IL-13 with the greatest over-expression in EE patients is eotaxin-3. Herein, we identify the contribution of epigenetics in the regulation of eotaxin-3 gene expression.

Histone Modifications Affect IL-13 Driven Eotaxin-3 Production in Esophageal Epithelial Cells

Eosinophilic Esophagitis (EE), an inflammatory disease of the esophagus, is associated with the overproduction of interleukin-13, a Th2 cytokine, and eotaxin-3, an eosinophil-specific chemoattractant. Herein, we identify the contribution of epigenetics in the regulation of eotaxin-3 gene expression. Specifically, we focus on the roles of histone acetylation and methylation in the regulation of IL-13 driven eotaxin-3 production of esophageal epithelial cells. IL-13 induced eotaxin-3 production was enhanced by the histone deacetylase (HDAC) inhibitor trichostatin A (TSA). Chromatin immunoprecipitation revealed that stimulation of esophageal epithelial cells with IL-13 increased histone 3 acetylation of the eotaxin-3 promoter. TE-7 cells were incubated with (IL-13 continuous group) and without (IL-13 medium group) IL-13 for 2, 4 and 6 days. Following cessation of IL-13 exposure, eotaxin-3 mRNA levels were continuously detected at 4 days (IL-13 medium group), and was ~30 fold greater than eotaxin-3 levels at 2 days. Western Blot analysis of IL-13 treated esophageal epithelial cells further revealed that IL-13 increases global histone 3 acetylation specifically at Lys 23 and Lys 56, but not at Lys 9, Lys 14 or Lys 27. IL-13 treatment for 24 hours also increased histone 3 methylation of Tri Methyl Lys4, a marker for transcriptional activation, and Tri Methyl Lys 27, a marker for transcriptional repression. However, IL-13 did not affect the acetylation of histone 4. These results indicate that histone 3 modifications are affected by IL-13 and affect the induction and maintenance of eotaxin-3.

Board 28

Tristan V. Browne

Faculty Mentors: Daniel Hasset and Shengcheng Su
Department of Molecular Genetics, Biochemistry and Microbiology,
University of Cincinnati College of Medicine

Activation Conditions of Bacteriophage Genes within Mucoid *mucA* Mutant *Pseudomonas aeruginosa*: Implications for Treatment of Cystic Fibrosis Airway Disease

Mucoid Cystic Fibrosis (CF) isolates of *Pseudomonas aeruginosa* harbor mutations within *mucA*, encoding anti-sigma factor critical for alginate production. These bacteria are extremely antibiotic resistant and, as such, are highly problematic from a clinical treatment perspective. The genome of many strains of *P. aeruginosa* harbor genes encoding one or more bacteriophages. These inserted genes (e.g., prophage) can become active, resulting in the eruption of virus particles that can infect other bacterial cells in the immediate vicinity (.e.g., biofilms). Given the possible therapeutic benefits of the activation of the bacteriophage in the treatment of *P. aeruginosa* infections, we tested the effects of conditions relevant to CF airway disease including pH (~6.5), the presence of NO_3-, and, above all, NO_2-. Cultures were then plated in a top-agar format and grown in order to observe plaque count as an indicator of phage presence. Using this method, we have found multiple conditions that could contribute to expression of the **Pf**4 (pillus, flagellum) prophage. Little is known about the activation signals of this phage, but a greater understanding of prophage activation could lead to new treatment therapies for patients suffering from *P. aeruginosa* infections in CF airway disease.

Board 29

Greylyn Hydinger

Faculty Mentor: Dr. James K. Bissell
Department of Botany at the Cleveland Museum of Natural History

The plant community at Mentor Marsh in Mentor, Ohio was destroyed 50 years ago by salt contamination. The Cleveland Museum of Natural History has been tracking the swamp forest's recovery for 30 years; this years study shows that salt contamination is still a deterring factor for recovery. Furthermore, the shrub and herbaceous layers of the swamp have been ravaged by deer and insect herbivory. Recovery is possible if the ecosystem is maintained properly.

2010 Mentor Marsh Vegetation Study: Tracking Swamp Forest Change

The Mentor Marsh ecosystem is an abandoned river meander located in Mentor, Ohio; it is filled with up to 35 feet of peat. Historically, a Maple-Ash-Elm forest was the dominant community; however, this was damaged by a salt mine accident. Only 9 of 860 acres remain swamp forest. The Cleveland Museum of Natural History has two transects in this ecosystem: a 220 meter transect in the marsh (since 1980) and an 80 meter transect in the swamp (since 2000). Plant community and soil studies are done every decade at the marsh. Canopy, shrub, and herbaceous layers were sampled in both transects. Little change occurred in the canopy since 2000. Shrub and herbaceous layers have been decimated by deer and Viburnum Leaf Beetles. In 2000, over 200 *Viburnum* shrubs existed in the swamp transect. Now, there are none. Other shrub species have undergone similar declines. If the canopy is damaged, recovery will be difficult because of the ravaged understory. Several species present in 1980, 1990, and 2000 are no longer present. More species were found this year than ten years ago. Unfortunately, specimens of these different species were fewer in quantity and lower in quality. Herbivory and altered ecosystem chemistry are the cause. *Phragmites australis* is the dominant species. It has been successful because of hyper-saline conditions in the marsh; these conditions are likely due to salt-mine tailings dumped into a tributary in the 1960s. Deer and insect herbivory, in combination with hyper-saline conditions in this ecosystem pose great difficulties for the recovery process of the swamp forest. A strong seed bank and proper management still provide hope for the marsh's recovery.

Board 30

Vanisha Devi Bisnath

Faculty Mentor: Petya Campbell
Department of Hydrospheric and Biospheric Sciences Laboratory, NASA-Goddard Space Flight Center

With the ongoing increase in population density and urbanization, the urban heat island effect and the increasing differences in land cover types and land surface temperature across urban and rural boundaries have become problems of critical importance. To address the impacts of those changes on the environment, the National Research Council recommended the HyspIRI satellite mission. In order to identify some of the parameters that this proposed mission will use, we processed thermal images from an airborne instrument called MASTER.

Assessment of Ecosystem Diversity and Urban Boundaries: Using Spatial and Spectral Scales to Simulate HyspIRI (Hyperspectral Infra-Red Imager)

In 2007, the National Research Council recommended the HyspIRI (Hyperspectral Infrared Imager) satellite mission in its *Decadal Survey on Earth Science and Applications from Space* in order to assess the impacts of urbanization on the environment; predict the likelihood of natural hazards; map the mineralogical composition of earth and assess ecosystem biodiversity, vegetation and health. The current study focused on the anthropogenic effects on the ecosystem, with particular emphasis on the urban heat island (UHI) effect and the variation of land surface temperature (LST) with respect to land cover type. The technique that HyspIRI will use to discriminate land cover types and monitor the ecosystem is to combine a high spectral resolution in the range of 350-2500 nm and thermal infrared imagery. To prepare for HyspIRI data use and to contribute toward the development of the mission's concepts, the research involved assembling existing data sets covering both rural and urban environments from MASTER airborne instrument. The goals were to: 1) generate HyspIRI-like data sets; 2) characterize the ecosystems biodiversity composition and functional groups; 3) delineate urban and rural ecosystems; 4) determine the relationship between spectral and thermal properties of urban and rural ecosystems and of individual functional types within an ecosystem; 5) assess the bio-physical properties and health of the vegetation cover; and 5) assess the sustainability of the ecosystems. HyspIRI images were simulated by identifying the appropriate spectral bands, performing spatial aggregation of pixels to 60 m and 90 m, performing atmospheric correction of the aggregated images and converting emissivity data to temperature. The results helped us identify the 8 spectral bands relevant to HyspIRI. They also showed that the 60 m resolution works best for atmospheric correction and the difference in thermal radiance across rural and urban regions is more accentuated in the 8-9 µm range.

Established in 1994, this award is presented to students interested in health-related careers.

Board 31

Ahlam Awad

Faculty Mentors: Nancy Murray[1] and Amenu Wessen[2]
[1]Pre-health Advisor, Ohio Wesleyan University
[2]Public Health at Jhpiego

Jhpiego-Ethiopia works directly to reduce the prevalence of HIV in Ethiopia and also offers technical and financial support to local organizations. I worked as an intern with this group to train health care providers in HIV counseling and testing, family planning, and prevention of mother-to-child HIV transmission as well as in the efforts to increase the availability of anti-retroviral drugs in several clinics. During my internship, we were able to persuade regional health bureaus to approve the release of anti-retroviral drugs to some non-governmental clinics who had trained health care providers, increasing access for patients.

HIV Counseling and Testing, Prevention of Mother-to-Child Transmission, and Family Planning in Ethiopia

Ethiopia is the second most populous country in Africa (with an estimated current population of 74 million) and has a population that is extremely vulnerable to disease. The current national prevalence rate for HIV is estimated to be around 2.3% (with 7.7% in urban and 0.9% in rural areas). Ethiopia's lack of human resources and an insufficient knowledge and skills foundation among care providers challenge the country's goals to expand the access to HIV/AIDS prevention care and treatment services. During my internship period with Jhpiego-Ethiopia, a non-profit health organization affiliated with Johns Hopkins University and funded by the President's Emergency Plan for AIDS Relief through the Centers for Disease Control and Prevention, I was able to work with the HIV Counseling and Testing and Prevention of Mother-to-Child HIV Transmission teams. The organization implemented Family Planning and Prevention of Mother-to-Child HIV Transmission trainings to Family Guidance Association of Ethiopia health care providers in all regions. During my time in Ethiopia, we were also able to negotiate with the regional health bureaus to give Family Guidance Association model clinics access to anti-retroviral drugs to make them available to HIV-positive patients rather than having to refer the patients to governmental hospitals. We also assessed the quality of work and the materials available in the clinics then provided direct feedback to the health workers working at the model clinics and youth centers that we visited in several cities around Ethiopia. During the supervision, we also were able to assess the possibility of integrating voluntary counseling and testing and family planning services in most of the health centers. I gained an invaluable experience during my internship, where I had direct exposure to services provided to HIV-patients and the efforts made to reduce the prevalence rate. I attended several day trainings, traveled to different regions, compiled reports, assisted trainees during practical sessions, visited several clinics and hospitals that have the knowledge and facilities to accommodate HIV-patients, and attended family planning and peer counseling sessions. Jhpiego's efforts in relation to HIV, by training HIV-positive mother mentors (Mothers Support Group) to counsel other pregnant mothers, training health care providers and community counselors in HIV counseling and testing or by helping non-governmental clinics so they get access to anti-retroviral drugs, have shown tremendous achievements and clients satisfaction throughout my short internship period but also throughout the years since it began working in Ethiopia in 2003.

The NSF-funded REU/RET (Research Experience for Undergraduates/Teachers) program at Ohio Wesleyan makes it possible for students from universities across the country, as well as one or two high-school science teachers from central Ohio, to do research in the fields of astronomy, computer science, mathematics, and physics on the OWU campus.

Board 32

James Broberg
Benedictine College

Faculty Mentor: Gregory Mack
Department of Physics

Almost 85% of the matter in the universe we have never seen or detected; it has only presented us with evidence for its existence because of its gravitational effects. Knowing just how weakly it interacts with regular matter could open up answers to the questions of how the particles composing the universe work at a basic level, shedding light on the fundamental nature of reality deeper than our current understanding. Our research has set limits on the maximum scattering probability a dark matter particle could have for collisions with ordinary matter. The first constraint we set by showing that strongly-interacting dark matter would be captured in the interiors of the cores of giant planets (Jupiter, Saturn, Uranus, and Neptune), giving them as much or more heat as their actual internal heats caused by known astrophysical processes. The second constraint considers the case of a dark matter particle losing the energy it had in the "halo"-shaped cloud surrounding the Milky Way, slowing down and falling into the flat galactic disk—an event that does not happen to a noticeable degree.

Constraining the Particle Nature of Dark Matter

Since the only evidence we have for dark matter is from its gravitational effects, the most reasonable assumption is that dark matter is composed of particles called WIMPs (weakly interacting massive particles) that do not noticeably interact with ordinary matter. Our research tightens the window on strong interaction probabilities by placing astrophysical constraints based on both planetary heating and on infall into the galactic disk. In the first step of our project we found the minimum interaction cross section for a WIMP being captured by the interior of the planets Jupiter, Saturn, Uranus, and Neptune, taking the most conservative approximation where the fastest particles are considered (500 km/s) and 90% of the possible path lengths are used. The internal heating by planetary capture was found to be on the same order of magnitude as the observed planetary heat, posing the argument that since sufficient explanation has been given for much or most of that heat, this scenario is unphysical. In the second step of the project we found the minimum interaction cross section for a WIMP losing energy from elastic scattering and collapsing from the dark halo into the galactic disk, expanding on a crude approximation carried out in a 1990 paper by Starkman and Gould, looking at collisions from four different angles. Since the density distribution of the dark halo is observed to be spherical, such a cross section must be a maximum constraint on its actual cross section. We considered the presence of helium as well as hydrogen in the galactic disk and used more recent estimates for the number densities of hydrogen and helium in the galactic disk. We present updated results using a more rigorous approach than the previous approximation.

Board 33

Nicole Peterson
Ashland University

Faculty Mentor: Sean McCulloch
Department of Mathematics and Computer Science

Shared Shortest Paths in Graphs

The shortest path between two points in a weighted graph can be found with Dijkstra's algorithm. We have been investigating a similar problem in which multiple source and destination pairs (called journeys) must be routed within a graph, and these journeys equally share the costs of edges that they mutually traverse. Each journey's individual cost can depend on the routings of other journeys. Therefore, we view each journey as an individual, strategically choosing a path that minimizes its cost. We then employ game theory to analyze the problem. Recently, we have been developing a way to help guide the heuristic toward a strong Nash equilibrium. A strong Nash equilibrium occurs when no journey has the potential to improve its cost by collaborating with other journeys, and sharing the cost of their common path. In order to accomplish this, we form groups of common sub-paths between the Dijkstra paths of every journey. Then we attempt to extend these sub-paths by determining which journeys in each group can improve their costs by extending the shared component to a new vertex. We repeat the process over again with new adjacent vertices, until no extension of the sub-paths will improve the cost of any journey. Our hopes are that this algorithm will direct journeys toward a mutually beneficial collaboration of two or more journeys. This collaboration will be more resistant to defecting coalitions, and will thus be more comparable to a strong Nash equilibrium.

Board 34

Matthew Mansell
Alma College

Faculty Mentor: Brad Trees
Department of Physics and Astronomy

The behavior of classical damped, driven oscillators is well understood, but that is not true for the microscopic (quantum) limit. With modern advances in the fabrication of nanometer-sized electromechanical devices, the dynamics of quantum oscillators are of more than just theoretical interest. In this project, the quantum Duffing oscillator (a nonlinear oscillator) is studied in the presence of environmental dissipation and periodic driving by obtaining a numerical solution of Schrödinger's equation.

Periodically Driven and Damped Quantum Duffing Oscillators

We study the dynamics of a periodically driven, damped, weakly nonlinear, quantum Duffing oscillator in an attempt to further understand Josephson junctions in the quantum limit. Schrödinger's equation for the quantum oscillator is solved numerically in the basis of eigenstates of the harmonic oscillator. Oscillator damping is modeled using the Quantum State Diffusion method to simulate irreversible energy transfer to the environment. The time dependence of the expectation values of oscillator properties, such as position and momentum, are calculated and compared with their classical analogs. The goal is to use this approach to study two coupled oscillators and to search for evidence of oscillator synchronization. This would provide new insight into the dynamics of coupled quantum oscillators, which would provide information relevant to the study of Josephson junctions.

Board 35

Marc Khoury
The Ohio State University

Faculty Mentor: Craig Jackson
Department of Mathematics and Computer Science

Quantum Braid Group Representations

Braid groups have been an interesting field of study for over the past one-hundred years because of their applications to knot theory and theoretical physics, most notably quantum mechanics and conformal field theory. Two recent developments in the representation theory of braid group are the work of Lawrence, Krammer and Bigelow, proving the existence of a faithful linear representation of the braid groups and the existence of families of braid group representations arising from quantum algebras. The Lawrence-Krammer-Bigelow representation is the degree two case of an infinite family of representations constructed via the homology of a certain configuration space. (The degree one representation is the famous Burau representation.) Recently, Jackson and Kerler constructed a separate family of braid group representations using the action of the quantum group on a Verma module, and showed that in the first two cases these representations were identical to the homology representations. Our work focuses on deriving explicit equations for case three, for both the homology and quantum representations, and showing that they are equivalent up to reparameterization.

Board 36

Stephen Kuhn
Earlham College

Faculty Mentor: Robert Kaye
Department of Physics

Currently, there is no single model to describe nuclear structure. We are looking at the Selenium-71 (Se-71) nucleus which is partially described by the collective behavior of many nucleons and partly described by individual nucleons moving in discrete orbits organized into “shells” analogous to the different layers of an onion. Analyses of gamma ray decays (radiation emitted as a nucleus relaxes to a lower energy) enable us to study the basic structure properties of ^{71}Se. Comparisons between the structure of ^{71}Se to nuclei with a similar atomic mass help us understand when each model is more effective.

Spin Assignments in Selenium-71

Se-71 shows signs of moderate collectivity by having both organized behavior of excited states (grouped into rotational bands) at high spin (or angular momentum) and an irregular pattern of excited states at low excitation energy. Previous research at Ohio Wesleyan suggests that adjustments should be made to the level scheme of Se-71 by changing a positive-parity band to a previously “missing” negative-parity band. This reorganization of the level scheme, however, opened new questions about the discrete spin values of the excited states belonging to this band. The primary goal of this research was to measure the spins of the energy levels in the new negative-parity band using data collected from a fusion-evaporation reaction at Florida State University that populated high-spin states in ^{71}Se. The analysis techniques used were comparisons with similar nuclei, structural arguments, and directional correlation of oriented nuclei (DCO) ratios. DCO ratios compare γ radiation intensity at different angles to show whether quadrupole or dipole radiation is emitted, and thus determine how much spin is carried away by the γ photon in a transition between two energy states. Thus if the spin of one of the states involved in the transition is known, then the spin of the other state can be determined. The experimental DCO results were compared against theoretical DCO ratio predictions in order to infer the change in spin involved with as many transitions in ^{71}Se as possible. The spins of 18 excited states were measured. The results show that Se-71 is similar to its next lightest isotone ^{69}Ge at low excitation energy, but is more similar to its heavier neighbors ^{73}Se and ^{73}Kr at high spin, indicating the transitional nature of this nucleus. Also, a re-investigation of the γ-ray coincidence data revealed new transitions in ^{71}Se that extend the level scheme to higher spins.

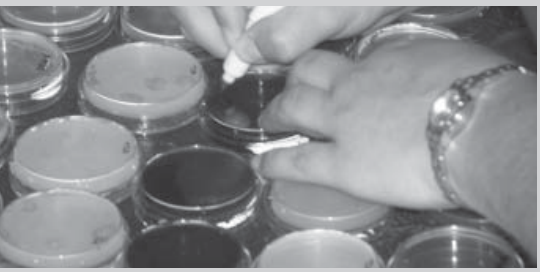
Lawrenzo Moses
The University of Akron

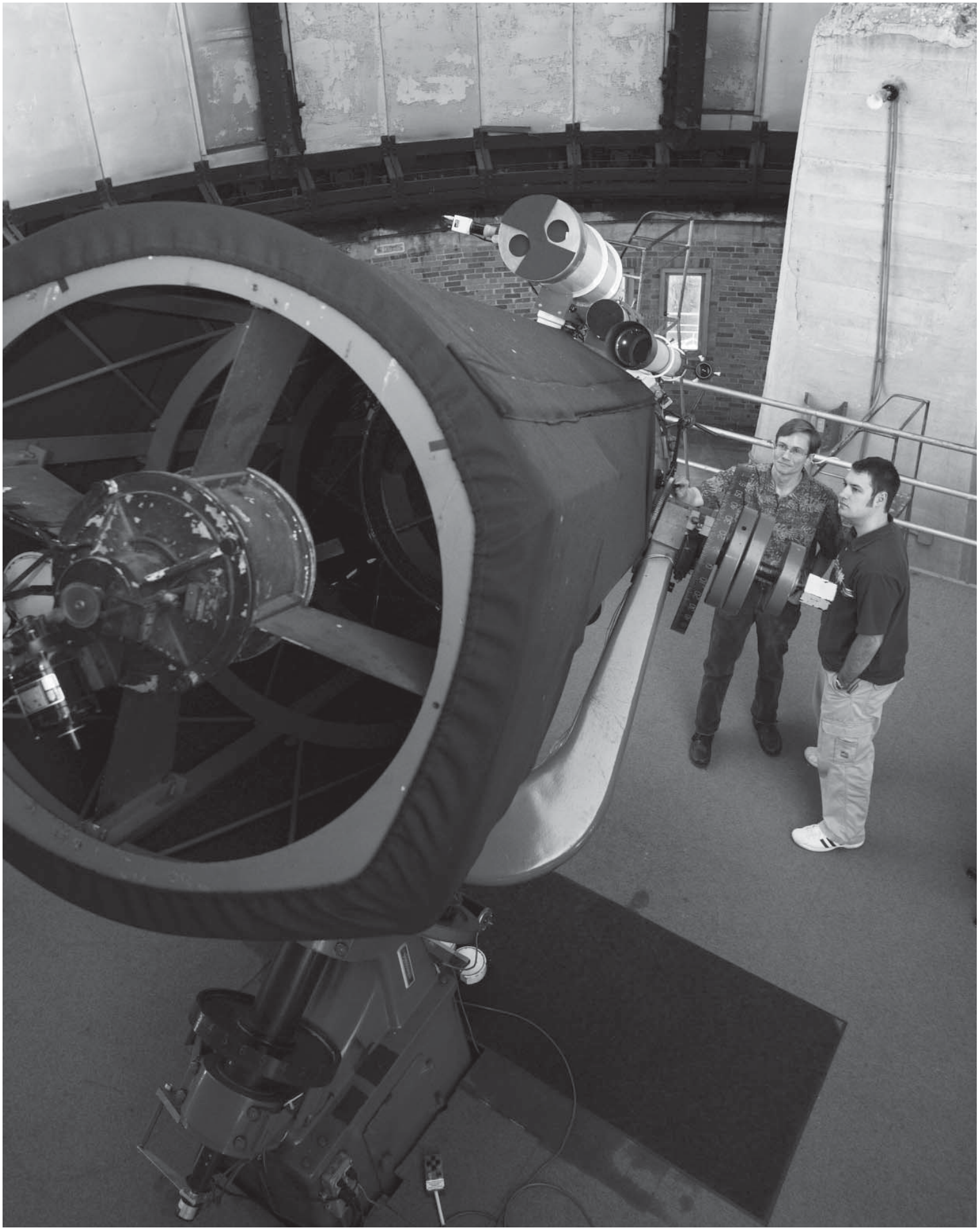
Faculty Mentor: Brad Trees
Department of Physics and Astronomy

Classically, synchronization is a well-understood phenomenon in the case of coupled, damped, driven nonlinear oscillators. Synchronization of oscillators in the quantum regime, however, has been less thoroughly studied. As an initial step in the study of quantum synchronization, we study the dynamical behavior of two quantum-mechanical rotors that are nonlinearly coupled. We look for evidence of a variation of the standard phase synchronization, known as measure synchronization, which is signaled by the angular momenta of both oscillators exhibiting the same range of values.

Searching for Evidence of Measure Synchronization in a Quantum Mechanical System

Josephson junctions are superconducting devices with a variety of potential applications in developing technology. The equations describing coupled Josephson junctions are identical to those of coupled pendula. We report the results of a less complicated but related problem of the quantum mechanical dynamical behavior of a pair of nonlinearly coupled rotors. The wavefunction for the two-rotor system is obtained by solving the Schrödinger equation numerically by means of the fourth-order Runge-Kutta method. The expectation value of each rotor's angular momentum is plotted as a function of time for different amounts of rotor coupling. We search for evidence of measure synchronization of this Hamiltonian system, which is signaled by the two rotors exhibiting the same range of angular momentum values for sufficient coupling. The next step will be to add gravity and environmental damping to the system and to search for evidence of traditional synchronization in coupled quantum systems.





Departmental Honors 2009-2010 >>

Graduation with Departmental Honors requires an independent project, an oral exam on the project, and a comprehensive exam in the student's major department during his or her senior year. The program is open to students who have attained cumulative grade point averages of 3.5 in their majors after fall semester of the junior year, as well as overall grade point averages of 3.0 or the support of their academic major departments, and have successfully petitioned the Ohio Wesleyan Academic Policy Committee.

Student Name	Department	Supervising Professor	Title
Katherine Alexander	Theatre/Dance	Elane Denny Todd	Prevention of Injury & Analysis of Health Concerns in Modern Dance
Julia Blyth	English	Joe Musser	Writing about Environmental Issues
Sarah Bonnet	Zoology	Danielle Hamill	Characterization of a Cell Division Mutant in *C. elegans*
Samuel Chesser	Religion	Blake Michael	Early Mediterranean Mystery Cults
Jesse Chiero	Physical Education	Chris Fink	Golf Swing Biomechanics: Rationale for Sequential Periodized Training for Elite Golfers
Michael Doherty	Women's and Gender Studies	Richelle Schrock	The History of Coeducation at Ohio Wesleyan
Julia Ellis	Sociology/Anthropology	Mary Howard	Factors Affecting a Neighborhood's Health: An Environmental Analysis
Adrienne Found	Psychology	Vicki DiLillo	What's Standing in Their Way?: Examination of Barriers to Healthy Eating and Other Health Behaviors in the College Population Using the Theory of Planned Behavior
Kristin Kovach	Zoology	Jennifer Yates	Interspecific Learning Mechanisms in *Rana sylvatica* and *Pseudacris triseriata*
Sarah Marous	Psychology	Richard Leavy	College Athlete Drinking: Sensation Seeking, Reward Seeking, and Sport Type
Melody Maxwell	Zoology	Ramon Carreno	Parasite Community Analysis in the Sunfish Population of the Delaware Run
Tayler O'Connell	Psychology	Jennifer Yates	Is Chinese Food the Next Clozapine? The Role of a Monosodium Glutamate-Rich Diet in Resistance to Psychotic Episodes
Laura Pickens	Computer Science	Alan Zaring	Intelligent Movement in Disorganized Environments
Lily Strumwasser	History	Jeremy Baskes	American Imperialism in South America, post 1850

2009 SSRP Participants

Evan Bai '11
Presented Research: American Society of Plant Biologists Mid-Western Conference; American Society of Plant Biologists National Conference
Currently: Summer Undergraduate Research Experience at Ohio State University Department of Plant Molecular Biology & Biotechnology.

Meredith Palmer '11
Presented Research: Ohio Academy of Sciences 2010 meeting
Currently: Island Biology class; two month position in Panama studying tree frogs; and three weeks in Borneo on conservation Theory-to-Practice grant.

Jessie Miller '10
Presented Research: American Astronomical Society; Ohio-Region Section of the American Physical Society
Currently: The Ohio State University Ph.D. program in Geological Sciences with GTA appointment.

Sarah Marous '10
Currently: Seeking master's in counseling at Methodist Theological School in Ohio.

Ahlam Awad '11
Currently: Internship in HIV/AIDS intervention programs in Ethiopia with jhpiego, an international non-profit organization affiliated with Johns Hopkins University.

Lindsey Aurora '11
Currently: Chester Summer Scholars Program at Case Western Reserve University; clinical research.

Chloe Hamrick '11
Presented Research: Ohio Branch American Society for Microbiology. Will present in 2011 at the American Society for Microbiology national meeting.
Currently: American Society for Microbiology Undergraduate Research Fellowship.

Alex Howe '11
Presented Research: Ohio Five REU Research Symposium; Ohio-Region Section of the American Physical Society; joint meeting of the American Physical Society Division of Nuclear Physics and the Physical Society of Japan in Hawaii.

Virginia Jaquish '10
Currently: Field work in New Jersey.

Yan Dong '11
Currently: Summer Science Research Program project in the OWU Memory Lab.

Sarah Bonnet '10
Currently: Medical school at West Virginia University.

2008 SSRP Participants

Randi Amstadt '10

Currently: Finishing work with AmeriCorps, applying to medical schools.

Rob Anthony '10

Presented Research: American Physical Society meeting in Denver; won award for outstanding undergraduate presenter.

Currently: Ph.D. program in geophysics at New Mexico Tech Institute of Mining and Technology with full RA support.

Andrew Riley '10

Currently: Ph.D. program in organic chemistry at University of Kansas.



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Campus and Off-Campus Researchers

NSF-REU/RET Researchers

Special Thanks

Rock Jones
David Robbins
Charles L. Stinemetz
Karen McNeal
Laurie Patton
Ohio Wesleyan University Buildings and Grounds Staff
Chartwells Dining Services
Faculty supervisors and student volunteers
Parents and guardians of student researchers

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