“It is through the wonders of science and technology that we can solve environmentally-related problems and provide much-needed solutions. This requires an ongoing program of education, training and research for our students, and facilities that meet the needs of young scientists.”

—F. Sherwood Rowland ’48
1995 Nobel Prize Winner, Chemistry

The Patsy Belt Conrades Summer Science Research Symposium

Science, mathematics and technology touch all of our lives. Through ongoing research and discoveries concerning worldwide problems such as infectious diseases, air pollution, gene therapy and global warming, we can tackle such issues and train today's students to be tomorrow's accomplished scientists.

Now in its 14th year at Ohio Wesleyan, the Patsy Belt Conrades Summer Science Symposium—so named just this year to honor long-time OWU alumna and Trustee Patsy Conrades '63—encourages engaged research and learning which culminates in a symposium allowing students to proudly present their research in poster format at a gala event in the atrium of our Conrades-Wetherell Science Center.

During summer 2006, a total of 30 OWU students participated in research with their faculty mentors on OWU's campus or in off-campus research opportunities at other universities. We present these special students and their research within this booklet.

Contents

(Gene—you might use this with a nice photo???)

NEED PHOTO

Thoughts from the Director

Now into the 14th year of our Summer Science Research Symposium at Ohio Wesleyan University, the program offers, I believe, an exceptional opportunity for students to work closely for a 10-week period, with faculty mentors on cutting-edge research. Students then are asked to present posters during the fall symposium, that represent summer research while providing those students with experiences which are comparable to those they will experience in the future at national scientific meetings.

Besides the one-day symposium, students also are encouraged to present their research findings in podium talks within departmental seminar sessions throughout the academic year, as well as at organized summer luncheons during the summer—yet additional opportunities to gain valuable experience in presenting data at scientific venues.

While our Summer Science Research Symposium students receive stipends for their work, it is the one-on-one contact with faculty mentors and fellow researchers that is of ultimate value and importance as our students' science educations develop and unfold.

In the pages which follow, you will meet several of our Symposium researchers as well as several students who conducted science research at off-campus locales during the past summer. Celebrate with us the accomplishments and discoveries of our students—our scientists of tomorrow.

David Robbins
Provost, Ohio Wesleyan University
Director, Patsy Belt Conrades Summer Science Research Symposium

Mentoring Matters

My participation in the Summer Science Research Symposium began nine years ago upon my arrival at Ohio Wesleyan University, and I have directly mentored 12 students during that time.

After a summer's worth of research, my students then presented their work at meetings such as the American Society for Microbiology general meeting and the Microscopy and Microanalysis meeting, and most of these students have gone on to graduate schools or medical schools.

Although I find my research exciting and interesting, I also enjoy the challenge of working with a student on a research project and seeing the student eventually take ownership of the project. During this process, the student becomes a *scientist*—thinking, acting and speaking like a scientist. Research is an essential part of being a scientist, and Ohio Wesleyan prepares our students for research success in both on campus research opportunities and conducting research at other universities.

During the Patsy Belt Conrades Summer Science Research Symposium this afternoon, you will have the opportunity to discuss the research of 20 students who performed research at OWU this summer, mentored by faculty members and 15 students who performed off-campus research at other universities or in other countries. There is no doubt that the research results presented here today are exciting and novel. Equally exciting, however, is the opportunity for you to speak and interact with these 35 young scientists.

Enjoy the Symposium and be sure to learn something new!

Laura Tuhela-Reuning
Department of Botany and Microbiology and Department of Zoology
Scanning Electron Microscopist
Summer Science Research Program Events Coordinator

About Our OWU Alumni

Dr. Nancy Reynolds Schneider '64 is a Phi Beta Kappa graduate of Ohio Wesleyan, and has been 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 has published broadly, with emphasis on the cytogenetics of childhood cancer. Dr. Schneider has been an invited member of the Pediatric Oncology Group Cytogenetics Committee, a consortium of about 100 major childhood cancer treatment centers.

Dr. Schneider majored in psychology while at Ohio Wesleyan and went on to receive her M.A. in clinical psychology from the University of Michigan, and her Ph.D. in human genetics and an M.D. from Cornell University. She began her professional career as a clinical psychologist, and following graduation from medical school, Dr. Schneider did her pathology residency at the University of Texas Southwestern Medical Center. Her research interests focus on constitutional and acquired chromosome abnormalities of neoplastic cells.

A loyal and caring alumna of Ohio Wesleyan, Dr. Schneider is a member of Ohio Wesleyan's Board of Trustees, and received the Distinguished Achievement Citation award from OWU in 1999. To recognize the university's strong science and mathematics program, acknowledge the importance of women in the sciences, and in honor of special friend and fellow OWU alumna Patsy Belt Conrades '63, Dr. Schneider contributed $100,000 to permanently endow the **Patsy Belt Conrades Summer Science Research Symposium** at Ohio Wesleyan. Says Dr. Schneider:

"It is most appropriate that this symposium, which so importantly exhibits and encourages student development and achievement, should be named for Patsy, whose energy, courage, devotion, and seriousness of purpose inspire all who know her."

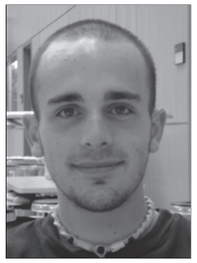
Patsy Belt Conrades '63.....
(Gene—I'll send a couple of paragraphs yet today to go here, and I have photos of both women.)

Board 1

Alex Paya

Faculty Mentor: Chris Wolverton
Department of Botany and Microbiology

Project Title: Auxin flux in Starchless mutant pgm1-1



Primary roots maintain a vertical orientation by constantly sensing and responding to gravity. There is strong support for the hypothesis that gravity is sensed in roots by starch-filled plastids, which sediment to the lower surface of cells in the tip of the root. Previous work has characterized roots of a mutant with no starch biosynthesis (pgm1-1) as agravitropic, or lacking a gravity response. In this study we utilized image analysis software to characterize the growth rate and gravitropic response of pgm1-1 with much greater precision than previous studies. We found that pgm1-1 is not only responsive to gravity, but that its response is significant. Following a 90 deg reorientation, the average time for pgm1-1 to attain 30 deg of overall curvature was 230 +/- 12 min, while wild- type roots achieved the same curvature in 99 +/- 5 min. The average vertical growth rate over a 30 min period for pgm1-1 was 210 µm/hr whereas WT had an average growth rate of 258 µm/hr, indicating that the mutant roots were not impaired in overall growth relative to wild- type. To test whether pgm1-1 roots establish an auxin gradient in the root cap following reorientation in a manner similar to that observed previously in wild-type roots, we introduced a promoter-reporter fusion gene (DR5:GFP) into the pgm1-1 mutant background. Confocal laser microscopy demonstrated that wild-type roots established an auxin gradient across the root cap upon reorientation, confirming previously published reports. However, pgm1-1 failed to establish such a gradient despite the fact that the roots were undergoing gravitropic curvature. The results of this study are consistent with the classic plastid sedimentation model of gravity perception in that reduced plastid sedimentation was linked with failure to establish an auxin gradient. However, the significant gravitropic response of pgm1-1 in the absence of both plastid sedimentation and auxin gradients suggests that there are other key mechanisms behind gravity perception and signal transduction in roots.

Board 2

Liz Calhoon

Faculty Mentor: Chris Wolverton
Department of Botany and Microbiology

Project Title: Image Analysis of the Gravitropic Responses of Starchless Lateral Roots

It has been thought that starch-filled statoliths play a major role in the gravitropic responses of both lateral and primary roots. In fact, most of the literature on root gravitropism cites the pgm1-1 strain of Arabidopsis, which lacks starch statoliths, as completely lacking in gravitropic responses. This study examined the gravitropic responsiveness of lateral roots. Lateral roots are roots that come off the primary at an angle, which allows these roots to forage for different minerals in the soil than the primary roots. We used approximately 10-day-old plants and tracked the growth and curvature of the lateral roots. Cameras took pictures of the plants every 45 seconds and these pictures were processed using software to find the growth rate and curvature. Roots of starchless mutants and wild-type controls were rotated so that the lateral roots were about 40∞ up or down from their starting position. It was found that the starchless lateral roots showed about half the response shown by the regular strain after 100 minutes, though this result was only statistically significant in the roots that were rotated down. However, there was no significant difference between the curvature of the regular and starchless roots after 200 minutes. This is starkly different from starchless primary roots, which have been reported to show little gravitropic sensitivity. Further research will look examine the gravity signaling pathway in starchless lateral roots using a reporter gene for the plant hormone auxin. This will help us determine what mechanisms are used in lateral root gravitropism. Then, we can compare the mechanisms involved in primary and lateral root gravitropism, which will, in turn, allow us to better understand gravitropism in the plant as a whole.

Board 3

Ashley Peele

Faculty Mentor: Edward H. Burtt Jr.
Department of Zoology

Project Title: Albino feathers provide insight into the mechanisms of feather strength

Melanic feathers resist abrasion by airborne particles (Burtt 1986, Bonser 1995, Schreiber et al. 2006) and degradation by bacteria (Goldstein et al. 2004, but see Grande et al. 2004) better than white feathers, which lack melanin. Dark, melanic feathers also have greater tensile strength than white, non-melanic feathers (Bonser and Witter 1995). Albinistic feathers are considerably less durable than typical white feathers. We review possible structural explanations for the greater durability of melanic feathers by examining their structure compared to that of typical white feathers and by comparing those feathers to albinistic feathers.

Our comparison is based on detailed measurements of the rachis, barbs and barbules of dark feathers containing melanin from a typically colored, juvenile Great Frigatebird (*Fregata minor*) and typically colored Eastern Bluebird (*Sialia sialis*); white, but normal feathers, that lack melanin from a juvenile Northern Gannet (Sula; and white feathers from an albino juvenile Great Frigatebird and an albino Eastern Bluebird (*Sialia sialis*) of unknown age. The white gannet feathers are similar in size to those of the frigatebirds and provide a control for lack of melanin in a typically white feather that is not albinistic. Such white feathers do not show the excessive damage seen in the albinistic feathers, but do show more damage than feathers that contain melanin. We use this continuum of feather damage to explore for associated structural changes in the feathers that could account for the damage. The structure of the rachis, barbs, and barbules as well as their overall orientation is studied in detail, using scanning electron microscopy.

Board 4

Brian Siller

Faculty Mentor: Brad Trees
Department of Physics

Project Title: Enhanced Macroscopic Quantum Tunneling of a Damped Metastable System Coupled to a Nanomechanical Resonator

The tunneling rate of a damped Josephson Junction coupled to a nanomechanical resonator was studied. It has been proposed that such systems could be used to represent quantum bits (qubits), which could one day form the building blocks of quantum computers. A low tunneling rate is crucial for proper operation of qubits, but the effect of the added resonator on the junction's tunneling rate has not been previously studied. To model this system, the junction was treated as a particle trapped in a potential well defined by a cubic function and the resonator was treated as a harmonic oscillator. Due to the small size and low temperature of the system, all calculations done required the use of quantum mechanical techniques. It was found that the junction and resonator adopt a common frequency of oscillation when the coupling between them is sufficiently strong and their natural frequencies are sufficiently similar. This frequency locking causes the energy level spacings of the two oscillators to match and allows for the exchange of quanta of energy, setting up a quantum mechanical resonance. Because this resonance is strongest when the two natural frequencies match, the tunneling rate enhancement was expected to be strongest under this same condition. However, the tunneling rate is enhanced by the greatest amount for large coupling strength and small resonator frequencies, independent of the junction's frequency.

Board 5

Cassie Henry

Faculty Mentor: David Markwardt
Department of Zoology

Project Title: Control of Gene Expression by the mRNA Surveillance Pathway

Eukaryotic cells have surveillance measures in place to protect against mRNA transcripts that code for potentially damaging proteins, such as mRNAs that contain nonsense (i.e. premature termination) codons. Nonsense Mediated mRNA Decay (NMD) is the process that eliminates these aberrant mRNAs. NMD targets mRNAs that have resulted from mistakes in transcription and mutated DNA. More recently *natural targets* of NMD have been identified. These are transcripts that are consistently degraded in *wild type* organisms. One way natural targets acquire nonsense codons is through alternative splicing. The coupling of NMD with alternative splicing presents a possible method for controlling gene expression, a process known as RUST (Regulated Unproductive Splicing and Translation). Our goal is to identify and characterize natural targets, especially those that arise due to alternative splicing, in the fission yeast *Schizosaccharomyces pombe*. Nearly half of all genes in *S. pombe* contain introns. Thus, *S. pombe* should prove to be a superior model organism for studying splicing events than the more widely used *Saccharomyces cerevisiae*, which contains very few genes with introns. We studied NMD in a wild type strain that possesses a normal NMD pathway and a mutant strain that lacks a working NMD pathway. We compared the steady-state levels of cellular mRNAs between the two strains using DNA microarrays. Microarray analysis is a process in by which labeled cDNA, created from extracted mRNA from our strains, is hybridized to a DNA chip containing the complete *S. pombe* genome. Microarray experiments have provided us with 127 *natural targets* whose levels of mRNA were greater in the mutant than the wild type strain. We will take a closer look at those transcripts using RT-PCR (Reverse Transcription Polymerase Chain Reaction) and northern blotting. We will pay special attention to the intron containing genes on our list in hope of finding evidence of alternative splicing.

Board 6

Christopher Earl

Faculty Mentor: Sean McCulloch
Department of Mathematics and Computer Science

Project Title: Shared Shortest Paths in Graphs

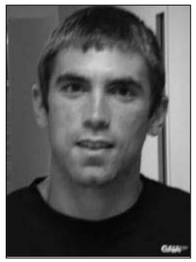
Shared shortest paths on mathematical graphs are paths that collaborate on edges that are shared in common to split the cost of traversing those edges. A *journey* is defined as a path that has a source and destination and whose cost depends upon collaborations with other journeys that share the cost of common edges. An optimal solution to this problem is a set of paths that connect each journey's endpoints where no journey has a lower cost shared path available. Algorithms and heuristics to find shared shortest paths were studied. Polynomial-time algorithms to solve this problem for a variable number of journeys are unlikely to be found. However, an efficient polynomial-time algorithm to solve the shared shortest path problem for two journeys was found and implemented. Also, an algorithm was found that runs in exponential time with respect to the number of vertices and the number of journeys in the graph. Since this algorithm executes too slowly for realistic graphs, we developed heuristics, which approximate optimal solutions. Our heuristics added journeys one at a time in an order determined by properties of the unused journeys. Some of the properties used were the current cost of the shared shortest path, and the current cost of the edges that are not currently being shared. Twenty-two such heuristics for a variable number of journeys based on these and other properties were implemented. Testing was done by comparing the average percentage of savings of each heuristic to the average percentage of savings of all the heuristics. Our test suite consisted of graphs that had varying numbers of vertices and various types of connectivity between vertices with weights chosen randomly from within fixed ranges.

Board 7

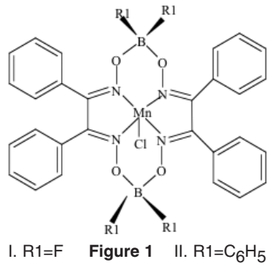
Daniel R. Albert

Faculty Mentor: Kim A. Lance
Department of Chemistry

Design and Synthesis of Stereospecific Catalysts for Drug Design



Oxidation catalysts that mimic the biological function of such enzymes as Cyctochrome P-450 are becoming ever important in drug synthesis. The goal of this research is to synthesize a novel oxidation catalyst by condensation of the monoximes. We can now report the attempted catalytic study of a manganese(III) α-dioxime complex, ligand system **I**(Figure 1) and the synthesis of a different manganese(III) α-dioxime complex, ligand system **II**(Figure 1). Ligand system **I**(Figure 1) showed little oxidation of the substrate, cyclohexene, because of what we believe to be a rigidly six-coordinate ligand system. This rigid structure exists because of an electron deficient central metal atom. Ligand system **II** (Figure 1) was created to introduce less electron withdrawing substituents on the periphery of the macrocycle by replacing BF_2 groups with $B(C_6H5)_2$ groups. Ligand system **II** (Figure 1) was synthesized by creating the copper(II) complex and removing copper as the sacrificial metal with potassium cyanide. The free-ligand was then reacted with manganese(III) acetylacetonate and lithium chloride in acetonitrile. This formed the new manganese(III) α-dioxime complex, ligand system **II**(Figure 1). The oxidation catalysis potential of this system was then studied, but the catalyst showed no epoxidation of the substrate. We believe this to be a steric problem caused by the large phenyl groups. To correct the sterics issue a new cyclops ligand system is being investigated, Bis(2,3-butanedione monoxime)ethylenediamine capped with diphenyl boron(Figure 2).



I. R1=F **Figure 1** II. R1=C_6H_5

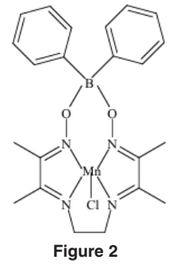


Figure 2

Board 8

Erin N. Hoagland

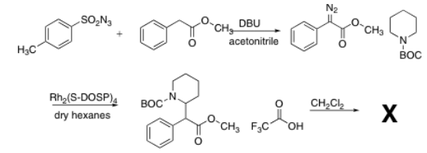
Faculty Mentor: Katherine L. Hervert
Department of Chemistry

Project Title: Examination of Ritalin Derivatives using Fluorescence to Examine Binding Ability

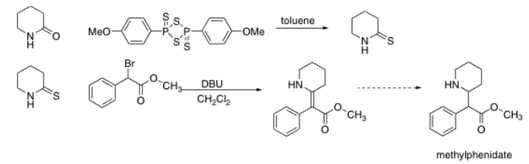
Due to the medical implications involved, the properties and binding ability of dopamine uptake inhibitors, such as methylphenidate (Ritalin), have become an increasingly important area of interest for scientific research. With more understanding of how these inhibitors bind, it would be possible to develop new drugs that would be able to treat numerous neurological disorders and possibly even cocaine addiction. Our goals, during this research, were to synthesize methylphenidate and some of its derivatives and then examine their binding abilities using fluorescence. We also wanted to compare the binding of some rigid systems in some of the derivatives versus the flexible system of methylphenidate.

We originally attempted to synthesize methylphenidate and methylnapthylacetate using a CH insertion. Unfortunately, this method proved to be unsatisfactory due to complications in the purification process. Our next attempt for the synthesis of methylphenidate was to incorporate the Eschenmoser sulfide contraction. This avenue remains promising in our research. Following each step in our synthesis, we analyzed the intermediates using NMR spectroscopy. We were also able to begin some preliminary work with the fluorescence. Future research will focus on using the Eschenmoser sulfide contraction reaction to complete the intended synthesis of methylphenidate and its derivatives as well as further investigation into the fluorescence of methylphenidate and its derivatives.

Scheme 1: Synthesis of methylphenidate using CH insertion



Scheme 2:



Board 9

Julie A. Peterson

Faculty Mentors: David M. Johnson and
Nancy A. Murray
Department of Botany and Microbiology

Project Title: Systematics & Biogeography of the genus *Xylopia* (Annonaceae) in New Caledonia

The Ethiopian pepper tree genus *Xylopia* (Annonaceae) has a pantropical distribution that extends to the remote island of New Caledonia in the western Pacific Ocean. Investigation of the systematics of species on this island will contribute to knowledge about the evolutionary history and worldwide distribution of *Xylopia*. A taxonomic review of the New Caledonian representatives of the genus is presented based on a museum study of 89 collections. Four previously described species, all endemics, are maintained; they are fully described and documented for the first time and a key to the species is presented. The most common species, *X. pancheri*, is limited in range to *maquis* environments with serpentine soils in the central and southern regions of the island, as well as on the Ile des Pins. A less common but more widespread species, *X. vieillardii*, is found in humid forest environments throughout New Caledonia. Two rare species, *X. pallescens* and *X. dibaccata*, are found in both *maquis* and humid forest environments in the central region of New Caledonia; these species are quite similar and should be compared further in the field. It is surprising that the generalist species are rare, while the species restricted to specific habitats are more common. Future investigation will focus upon whether the New Caledonian species have radiated *in situ* from a common ancestor or if each is more closely related to other species of neighboring areas such as Fiji. Morphological differences, including a variation in stigma morphology discovered using the scanning electron microscope, will next be investigated in determining these relationships. Several specimens that had been identified as *Xylopia* were found to be members of the Asian genus *Goniothalamus*, previously unknown from New Caledonia.

In addition, a field study of a local species of Annonaceae, *Asimina triloba* (pawpaw), was conducted in order to assess the significance of the initial carpel number of a flower on maturation and abortion of ripening Annonaceae fruits. The study of *Asimina* fruit production revealed a lower level of fruit abortion than reported in previous studies, and that, contrary to prediction, there was no relationship between the initial carpel and ovule number in the flower and the final number of fruits and seeds produced.

Board 10

Kristina Wiese

Faculty Mentor: Jerry Goldstein
Department of Botany and Microbiology

Project Title: Analysis of *Enterobacter cloacae* 16S rRNA and Plasmid Genes

The skeleton of an 11,750 year old mastodon discovered in Newark, Ohio in 1989 is the most complete and well preserved mastodon ever found. The skeleton was discovered in a peat bog that was cold (50^{O} Fahrenheit year round), anaerobic, acidic, and highly proteinaceous, conditions ideal for preservation. Along with the skeleton, material was found that proved to be the remains of the intestinal tract from which the bacterium *Enterobacter cloacae* was cultured. Because these bacteria don't grow at 50^{O} F, they were in a state of suspended animation for 11,750 years. Studying the genes of these bacteria and comparing them to a current strain of *E. cloacae* can give valuable information about the evolution of the bacteria. The 16S ribosomal RNA gene and genes from a plasmid present in the bacteria were compared. DNA was isolated from the mastodon strain of *E. cloacae* and a current culture of *E. cloacae*. The 16S rRNA genes were amplified by PCR and cloned into TOPO-TA vectors, transformed into competent *E. coli* and grown on selective medium. Recombinant TA vectors were then prepared for sequencing. Plasmids were purified from *E. cloace* and known gene fragments on the plasmid were used for extension PCR. The amplified DNA was cloned into TOPO-TA vectors, transformed into competent *E. coli* and grown on selective medium. Recombinant TA vectors were then prepared for sequencing. There is a 96% similarity between 874 nucleotides, out of 1,505 nucleotides of the complete 16S rRNA gene, of the two bacterial genes. The rest of the 16S ribosomal RNA gene is currently being cloned and sequenced. Of the 14,000 plasmid nucleotides, 4,733 have been cloned and sequenced this summer. DNA sequences on the E. cloacae plasmid similar to genes present on other bacterial plasmids have been identified including resolvase, RepA protein, and ArdK protein.

Board 11

Marie McNeely and Molly Everett

Faculty Mentor: Danielle Hamill
Department of Zoology

Project Title: Analysis of a Cell Division Mutant in Caenorhabditis elegans

McNeely

Everett

Cell division is a complex process that requires the coordination of many cellular components. Genetic mutations can affect the presence and function of these components, preventing successful cell division. The objective of this study was to better understand cell division in a model organism through examining the spindle defective (*spd*) mutation in *C. elegans*. This embryonic lethal, temperature sensitive mutation causes failure in early embryonic cell division, resulting in multi-nucleated, dead embryos. Phenotypic analysis of this mutation was performed using various forms of imaging. Through immunofluorescence microscopy of fixed specimens, various antibodies were used to tag proteins important for cell division, including tubulin and centrosomal proteins. Images obtained show that *spd* mutant embryos form monopolar spindles during cell-division, possibly due to the failure of centriole duplication. Another type of imaging used to monitor cell division was DIC microscopy, in which irregular spindle formation was observed in many live, mutant embryos during either the first or second round of cell division. Discovering which gene is responsible for the *spd* mutation is important for characterization of this mutant. Towards this goal, three-factor mapping was conducted, and our data suggests that this mutation is at about 1.7 map units on LGIII. This is slightly inconsistent with previous data, so more mapping needs to be done. DNA samples from cosmids covering the region around where *spd* maps were prepared for the future goals of mutant rescue. Also, more phenotypic visualization and analysis will be conducted on live *spd* mutant embryos using GFP-tagged gamma tubulin, a centrosome component in *C. elegans*. This research is important for understanding the intricacies of the cell division process and evaluating the genetic causes behind unsuccessful cell division in a model organism.

Board 12

Philip Rademeyer

Faculty Mentor: N. Kyle Smith
Department of Psychology

Project Title: Downstream Consequences of the Attention Bias

Research has shown that people pay more attention to negative information than positive information. A common method used to assess this attention bias is the emotional Stroop task, in which participants name the color in which a Research has shown that people pay more attention to negative information than positive information. A common method used to assess this attention bias is the emotional Stroop task, in which participants name the color in which a negative or positive trait adjective is written. Since negative words capture more attention, they interfere more with the color-naming than do positive words. This typically results in longer reaction times for negative than positive words. Recent research has shown that the attention bias can be attenuated if positive constructs are made more accessible in memory, for example by subliminal priming. The current study had two goals. First, we aimed to evaluate whether eliminating the attention bias can influence memory. Second, we wanted to evaluate whether the attention bias is more resistant to attenuation in anxious or depressed participants than in nonanxious, nondepressed controls. To test these questions, participants were subliminally primed with either positive or negative words. They then performed a modified emotional Stroop task containing positive, negative, depression- and elation-related words. Next, their memory for the Stroop words was assessed. Finally, each participant completed depression and anxiety inventories. The emotional-Stroop attention bias was replicated. That is, negative targets elicited longer reaction times than positive targets. However, the bias was equally large in both priming conditions, suggesting that positive priming did not modulate the size of the bias. Consistent with the lack of attenuation of the attention bias, there were also no significant recall differences. However, a significant three-way interaction was found between priming condition, word valence and anxiety. Low anxiety participants showed longer reaction times for negative than positive words in both priming conditions. High anxiety participants showed this trend only after positive priming. After negative priming, the typical bias was eliminated with negative words having similar reaction times than positive words.

Board 13

Rachael Roettenbacher

Faculty Mentor: Robert Harmon
Department of Physics and Astronomy

Project Title: Stellar Surface Imaging via Light Curve Inversion

Stars HD 171488 and HIP 106231 were observed with the intention of mapping their starspots. Starspots, similar to sunspots on the Sun, are dark areas on the surface of a star caused by intense magnetic fields. Aperture photometry was used to create light curves (i.e. plots of brightness vs. time) of these stars. The light curves were analyzed via Light Curve Inversion, which is a technique that produces an image of the starspots based on the variations in the star's brightness they produce as they rotate into and out of view of Earth. Using an 8-inch Meade Schmidt-Cassegrain Telescope in conjunction with a Santa Barbara Instruments Group ST-8E CCD Camera and CFW8 filter wheel, digital images were obtained of these stars. The light curve that was produced for HD 171488 did not allow a mapping of the surface because the star's light curve changed over the time observed, implying that the spots themselves had changed. The star has a rotational period of 1.3371 days and was observed for over a month, so it is not surprising that the spots changed over so many rotations. A map of the surface was created from data collected for HIP 106231, which has a rotational period of 10.17 hours and was observed for three consecutive nights. The light curve changed insignificantly over this shorter period of time so the surface could be mapped.

Board 14

Ryan Yoder

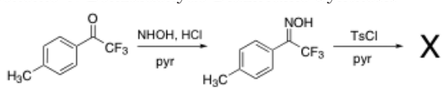
Faculty Mentor: Katherine L. Hervert
Department of Chemistry

Project Title: Functionalized Diaziridines as Potential Pharmaceutical Precursors

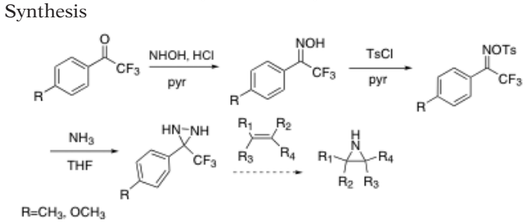
The ability for chemists to establish new methodologies is vital to the advancement of all fields of chemical research and development, especially in the pharmaceutical industry. Our efforts focused on creating an alternative pathway for NH aziridination, the nitrogen analog to the more common epoxidation reaction. As of yet, the formation of aziridines, a useful functional group, has been largely unresearched.

Initially, we investigated the formation ofng the diaziridine intermediate for to then use in the for aziridination reaction. We began with benzaldehyde, which brought little success in forming the required intermediate. Later, molecular modeling studies showed benzaldehyde to be too endothermic and unstable to use in the diaziridine synthesis. Yet, the trifluoromethyl-aryl derivatives of benzaldehyde yielded more favorable results by gently manipulating the altering the substrate's electronics. After each step in the synthesis, analysis analyses of the isolated intermediates were was performed using NMR and IR spectroscopy. In turn, we were able to reach the precipice of attempting to developing a successful aziridination method. Future work will focus on further exploring diaziridine intermediates in order to discover the an optimum NH aziridination pathway.

Scheme 1: Benzaldehyde Diaziridine Synthesis



Scheme 2: Triflouro-aryl Benzaldehyde Diaziridine Synthesis

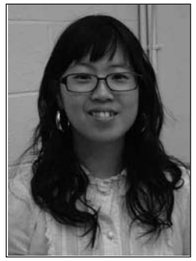


Board 15

Claire Ryu

Faculty Mentor: Bob Kaye
Department of Physics and Astronomy

Project Title: Lifetime Measurements and Deformation in ^{79}Sr



The proton-rich Sr isotopes have been known to have large deformations at low angular momentum (or spin) for some time, but the degree of deformation at high spin has not yet been determined for many of these nuclei. In this work, high-spin states in ^{79}Sr were produced following the ^{54}Fe (^{28}Si, 2pn) fusion-evaporation reaction using a beam energy of 90 MeV at the Florida State University (FSU) Tandem-Linac facility, and the resulting de-exciting g rays were detected with the FSU Ge array of 10 Compton-suppressed detectors. The ^{54}Fe target was thick enough so that all of the synthesized nuclei could stop completely in the target, resulting in Doppler-shifted g-ray line shapes that could be analyzed using the Doppler-shift attenuation method, where lifetimes of excited states are extracted by comparing the experimental line shapes with theoretical ones generated by a computer simulation code. In all, 23 lifetimes were measured in three separate band structures using this method, and then used to infer transition quadrupole moments (Q_t) and quadrupole deformations (b_2) using the rotational model. The results show good qualitative agreement with the predictions of both cranked Woods-Saxon (CWS) and projected shell model (PSM) calculations. The band based on a $d_{5/2}$ single-particle orbit, verified in this study through g-g coincidences, intensity measurements, and directional correlation of oriented nuclei (DCO) ratios, was found to have the largest average deformation ($b_{2,\,ave}$= 0.41) among the three bands, in agreement with the CWS and PSM predictions.

Board 16

Max R. Schroeder

Faculty Mentor: Dr. Edward H. Burtt, Jr.
Department of Zoology

Project Title: Examination of the Microbial Flora of Birds and the Effect of Uropygial Oil on the Microbes

We collected uropygial oil and microbial communities from birds caught at Cornell University, Ithaca, NY. We sampled American Robins, Black-capped Chickadees, House Finches, House Sparrows, and Tree Swallows only. We have identified 5 different species of bacteria and 11 different species of fungi based on visual and/or microscopic evaluation of colonies. The uropygial oil is produced by a bird's uropygial or preening gland, and the oils are used by birds during preening. The chemical structure of the oils vary based on the species of bird and we plan to study the effects of the uropygial oils on the microbes collected from the birds to determine if the oils have antimicrobial properties..

Board 17

Jacqui Barker, Stephanie Parnes, Elizabeth Polter

Faculty Mentor: Harry P. Bahrick, Lynda K. Hall, Melinda K. Baker
Department of Psychology

Project Title: A Comparison of the Tip-of-the-Tongue and Feeling of Knowing Phenomena

Failure to access information is a frustrating experience, particularly when we feel strongly that we have the information in memory. This ability to judge whether we know information well enough to remember is an example of metacognition. Metacognition is our awareness of our own cognitive systems, and knowledge of their workings (Ashcraft, 1998). Tip-of-the-Tongue (TOT) and Feeling of Knowing (FOK) are metacognitive judgments about ability to recall currently inaccessible information. TOT is the feeling of certainty that one knows some piece of information and that recall is imminent. FOK refers to a level of confidence that one knows a piece of information, and would be able to recognize the information. These two metacognitive judgments are currently studied as separate phenomena. The current study aims to determine to what extent these two judgments are truly independent assessments of the information we have about our memory versus separate names given to overlapping or identical information. Forty-six college students were given a two-session general knowledge test. In the first session, participants were given TOT evaluations for some of the questions they did not answer and FOK evaluations for others. In the second session, the same questions were presented in recall format. If participants did not provide the correct response, the question was repeated in recognition format. TOT and FOK predictions from the first session were compared to actual memory performance on the second session to determine overlap in metacognitive accuracy. Analyses revealed no significant difference in TOT (M=.12, SD=.12) and FOK (M=.12, SD=.14) recall scores (t=-.168, p>.05) or TOT (M=.76, SD=.20) and FOK (M=.75, SD=.18) recognition scores (t=.199, p>.05) when participants predicted they would remember the answer. This suggests an overlap in the functional outcomes of Tip-of-the-Tongue and Feeling of Knowing. Further analyses will investigate metacognitive accuracy when participants report that they will be unable to remember an answer.

Off-Campus Research Students

Board 18

Marie Rymut

Faculty Mentor: Mitchell Drumm, PhD and Becky Marsick, MS
Department of Pediatrics and Genetics, Case Western Reserve University

Project Title: Endothelin Receptor A Variants with Cystic Fibrosis Pulmonary Disease

Through the Gene Modifier Study (GMS) established by researchers at Case Western Reserve University and the University of North Carolina, clinical and blood sample data of over 1000 delta F508 homozygous cystic fibrosis (CF) patients was collected as an effort to identify potential genetic modifiers of CF pulmonary disease and survival. Single nucleotide polymorphisms (SNP) relating to regulation of airway reactivity of GMS patients with different severities of lung function were genotyped. A significant association was determined between pulmonary function and genotype within variants of the endothelin receptor A (EDNRA) gene. Analysis of the relationship between EDNRA markers indicated that the association was a likely result of a combination of polymorphisms rs5335 and rs1801708. To test this, phase of the two variants was determined. The location of the variants in the gene suggested regulation of mRNA as a mechanism to explain the association. Quantification of mRNA was performed using a single base extension protocol on human airway smooth muscle cells to compare EDNRA expression from the allele found more commonly in "severe" CF patients, and the allele found more commonly in "mild" CF patients. This preliminary comparison of EDNRA expression demonstrates that expression levels appear to be approximately 20% higher from alleles found more frequently in the "severe" CF population. This finding supports the hypothesis that increased levels of EDNRA are associated with worse pulmonary disease.

Board 19

Dana M. Reznik

Faculty Mentor: David C. Smith
Graduate School of Oceanography, University of Rhode Island, Narragansett, Rhode Island

Project Title: Hydrogenase Activity in *Psychromonas kaikoae*, a Piezophilic, Facultative Anaerobic, Marine Bacterium

It has been argued that deeply buried marine sediments can serve as an analog for modeling habitability on extra-terrestrial planets. Therefore, microorganisms inhabiting this subsurface anaerobic environment are of particular interest to microbiologists and astrobiologists. H_2 is an important intermediate in anaerobic metabolism and its utilization by microorganisms is mediated by the enzyme hydrogenase. Hydrogenase may be a proxy for microbial activity in subsurface habitats with very low metabolic rates. Currently, core samples from the subsurface environment are brought up to atmospheric pressure in order to examine hydrogenase activity. Pressure effects have not yet been taken into account in these assays, even though pressure is known to affect some aspects of cellular processing including enzyme activity. In order to study the differences of hydrogenase activity at high and low pressures, the piezophilic bacterium *Psychromonas kaikoae* will be grown anaerobically under pressure and tested for the presence of hydrogenase. If hydrogenase activity is present, this bacterium will be a useful model to thoroughly study the differences in enzyme activity caused by pressure changes. Determining the effects of pressure on this key enzymatic activity in the subsurface will allow this parameter to be considered in future experimental protocols and data interpretation.

Board 20

Katie Ayers

Faculty Mentor: Rachele Berria
Case Western Reserve University-MetroHealth Medical Center, Cleveland, Ohio

Project Title: Adiponutrin Gene and Protein Expression and its Link to Insulin Sensitivity in Adipose Tissue at Term Pregnancy

Adiponutrin (ADPN) is a recently cloned phospholipase, primarily expressed in adipose tissue (1), whose mRNA was found to correlate negatively with fasting plasma insulin concentration and positively with insulin sensitivity (2). However, in vitro studies conducted on isolated adipocytes found no difference in mRNA expression of ADPN with increasing concentrations of glucose (3). Preliminary studies from our lab demonstrated that ADPN mRNA is upregulated during early pregnancy, characterized by increased lipogenesis and insulin sensitivity (4), and downregulated during late gestation, characterized by increased lipolysis and insulin resistance, suggesting that ADPN may play a regulatory role in the modulation between insulin sensitivity and insulin resistance. In order to investigate the role of ADPN, and to determine whether changes in prevailing plasma glucose in vivo, as seen in Gestational Diabetes Mellitus (GDM) patients, could influence its expression, the white adipose tissue (WAT) of pregnant patients was examined for mRNA and protein content. Nine healthy nondiabetic lean, 8 healthy nondiabetic obese, and 8 gestational diabetic women (BMI 21.5±0.9 kg/m^2, 36.9±1.6 kg/m^2, 37.9±5.7 kg/m2, respectively) underwent abdominal fat biopsy during a scheduled cesarean section at term, when adiponutrin mRNA and protein expression in WAT were evaluated. Toward this purpose, reverse transcriptase Real time polymerase chain reaction (rt-RT-PCR), using b-actin as a standard, and Western blot analysis, using GAPDH as a standard, were performed. At term gestation, adiponutrin mRNA was downregulated in obese women vs. their lean counterpart (FC: 0.19±0.04, p=0.01), and further decreased in women with GDM (FC: 0.04±0.005, p<0.001 vs. lean and obese women). Adiponutrin protein abundance, normalized by GAPDH and expressed as a ratio, was 2.2±0.5 in the lean group and 1.4±0.2 in healthy obese patients, accounting for a 32% decrease. Gestational diabetic women had a protein ratio of 1.0±0.06, which represented a decrease in ADPN protein expression of 29% vs. the obese group, and a decrease of 52% vs. lean women. The down-regulation of ADPN mRNA and protein abundance in obese and gestational diabetic women further strengthens the belief that ADPN could be involved in the modulation of insulin sensitivity during gestation and supports the previously published data (2) in humans. Moreover, higher prevailing glucose concentrations, commonly seen in GDM patients, seem to be associated with a decrease in both ADPN mRNA and protein expression, in contrast with the in vitro data.

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Board 21

Kellie M. Jaremko

Faculty Mentor: Matthias Buck
Department of Physiology & Biophysics at Case Western Reserve School of Medicine

Project Title: Using Coiled-Coil Fusion Proteins to Explore the role of Oligomerization for Protein Function: The Rac1/Rnd1 Binding Domain of Plexin-B1

Plexin B1 is a receptor protein for semaphorins, which are implicated in repulsive axonal guidance, control of cell adhesion and migration in the collapse of neuronal growth cones. In order to accomplish this effect, plexin requires the binding of Rac1/Rnd1, members of the family of small Rho GTPases. The Rac1/Rnd1 binding domain of the receptor is naturally weakly dimerized and upon binding this oligomerization is disrupted and may structurally alter the entire receptor. Since function and regulation can depend upon a protein's oligomerization state, this relationship is a crucial part of understanding the physiology of plexin B1. To explore this further, tighter oligomers were designed via adding a GCN4 sequence with the hypothesis that these changes would prevent Rac1/Rnd1 binding and hinder overall receptor function. GCN4 is type of zipper motif that binds to DNA and subsequently folds the target protein into the desired oligiomerization state. Addition of the unmodified GCN4 results in tighter dimers and by mutating leucines to isoleucines, trimers and tetramers may be generated. These additions to the existing Rac1/Rnd1 binding domain at either the N-terminal or C-terminal end were done initially through subcloning the sequence out of a gift plasmid and finally through primer design and polymerase chain reactions. This was followed by ligation into an empty pET11a vector and transformation into *E. coli*. Once transformed, these constructs were sent for sequencing and grown to express the desired protein. Only the C-terminal dimer has been correctly sequenced and expressed thus far but other constructs with minor mutations are being corrected with site directed mutagenesis. Purification of the proteins is carried out by fast liquid chromatography followed by further analysis using gel filtration and nuclear magnetic resonance spectroscopy to compare these proteins with their wild type counterpart.

Board 22

Lauren Woods

Faculty Mentors: John W. Chapman[1] and Brett R. Dumbauld[2]
[1]Dept Fisheries & Wildlife, Oregon State University, Hatfield Marine Science Center
[2]USDA, Agricultural Research Service, Oregon State University, Hatfield Marine Science Center

Project Title: The Effects of a Blood-Sucking Parasite from Castration to Feminization

The mud shrimp *Upogebia pugettensis* is native to intertidal areas of Pacific estuaries, and is viewed as a pest by the shellfish industry because of its ability to disturb sediment and bury oysters. It is estimated that 50-90% of Eastern Pacific reproductive sized *Upogebia* are infested by the parasitic bopyrid isopod, *Orthione griffenis*. *Orthione* appears to castrate and prevent the reproduction of its host, and could potentially be used to biologically control *Upogebia* populations. Some parasitic castrators feminize the external sex characteristics of their male hosts resulting in a reduced size and feminine appearance. We looked for evidence of feminization by measuring carapace and chela lengths of infested and uninfested *Upogebia*. We found significant differences in chela sizes of *Upogebia* infested with isopods of varying brooding stages. Infested female *Upogebia* had larger chela than uninfested females of the same size. Conversely, infested male *Upogebia* had a reduced chela size compared to uninfested males of the same size. This result indicates that feminization does occur among infested male *Upogebia* in the form of a reduced, and more feminine, chela. Further studies are needed to understand the physiology of feminization and determine if it is due to hormonal disruption or simply nutrient loss.

Board 23

Michael Mucher

Faculty Mentor: Shawn Kaeppler
Graduate Mentor: Ian Prust
Department of Agronomy, University of Wisconsin-Madison

Project Title: Characterization Of Wilted and Brittle Mutants in *Zea mays L.*

Breeding for structural characteristics in maize (*Zea mays L.*) has played a pivotal role in increasing crop yields. Structural and mechanical properties of the stem offer an area for genetic improvements. Two mutants, wilted and brittle, were investigated in an attempt to characterize their affects on maize development. However, in depth study of the wilted mutants was impossible because of hybrid vigor blocking the wilting phenotype. A protocol was developed to infiltrate and embed maize tissue into paraffin for use in tissue sectioning.

A homolog of BRITTLE CULM1, was identified in maize. Mutations in BC1 in rice result in brittle stalks. A P39-dervived brittle stalk mutant in corn was examined for transposon activity in the BC1 homolog. Results show no evidence of transpositional activity; however sequencing could provide more information.

Board 24

Reeti Khare

Faculty Mentor: Mostafa Fatemi
Department of Biomedical Engineering, Mayo Clinic

Project Title: Computer analysis and fusion of x-ray and vibroacoustography images

Vibroacoustography is a new method for characterizing biological tissue. Ultrasound beams are focused onto either excised or in vivo tissue, causing it to vibrate and emit high frequency sound waves. These are detected by an external microphone and translated into a 3D image that has less speckling than traditional pulse-echo sonograms. The aim of this study was to determine whether these images could be aligned with more familiar x-ray images in Analyze 7.0. This would allow diagnosticians to more accurately understand how tissue lesions, cancers, calcifications etc. appear with vibroacoustography. Phantoms containing tissue or metallic inclusions were created to test for alignment; it was found that agar phantoms, as opposed to methylcellulose or gelatin phantoms, produced better x-ray contrast. However, this study found that the x-ray cone beam causes some distortion and magnification of the image. On the other hand, parallel ultrasound waves emitted by the vibroacoustography transducer do not. This produces an inherent difficulty in overlaying/comparing the two types of images. Further experimental modifications or computer algorithms need to be found to correct for the discrepancy.

Board 25

Shannon L. Fredebaugh

Faculty Mentors: Eduardo Fernandez and William Timberlake
Department of Psychology, Indiana University

Project Title: Possible Influences of Positive Scent Stimuli on the Behavior of Captive Polar Bears (*Ursus maritimus*)

Predatory animals in captivity often exhibit stereotypic behaviors, such as pacing, which are repetitive and seemingly pointless. Previous studies have shown that environmental enrichment in certain zoo animals may help to decrease these stereotypic behaviors. This study attempted to use environmental enrichment on two captive polar bears (*Ursus maritimus)* to encourage behavior more closely related to natural foraging. The hypothesis was that presenting the animals with a beef and fish scent stimulus on a fixed interval schedule would encourage the bears to search for food around their exhibit and decrease their stereotypic behaviors. The animals were not allowed to consume food during the observation time, so only the smell of food, and not actual food, would affect their stereotypic behaviors and recognizable focal foraging behaviors. Tundra, a 20 year old female, exhibited more food oriented behaviors such as sniffing and licking the air, which shows that the spray was effective in engaging focal search to some extent, but it may not have been strong enough to encourage more foraging activity. Triton, a 9 year old male, showed significant decreases in inactivity before and during the spray periods, so he was engaging in other activities including increases in stereotypies. This change in behavior showed that the pacing may be a type of foraging behavior for the bears. Triton's enclosure use and activity levels increased when he was alone on exhibit, which could be explained by the fact that polar bears in the wild are solitary animals. Overall, the spray had some effect on the bears' activities, but the stereotypies increased which was not a hypothesized effect. The spray concentration may not have been strong enough to encourage certain behaviors because of external stimuli present in the zoo that were beyond our control.

Board 26

Steve Yang

Facutly Mentor: J.A. Lawton
Department of Chemistry, Eastern University

Project Title: Cloning and Expression of HsvA, a Virulence-associated Protein from *Erwinia amylovora*, the Cause of Fire Blight Disease in Apple and Pear

Erwinia amylovora was the first bacterium identified as a plant pathogen. A Gram negative and rod-shaped bacterium, *E. amylovora* is the causative agent of what is popularly known as fire blight in the plants of the *Rosacaeae* family, which includes such familiar fruits as apples, peaches, pears and cherries. Believed to have originated in North America, *E. amylovora* has since spread globally and was first identified in Great Britain in 1954. The bacterium infects the blossoms, immature fruit, vegetative tissue, and rootstocks of host plants by the production of a variety of toxic proteins that weaken the plant defenses. The symptoms of infection include water soaking of the infected tissue followed by wilting and tissue necrosis that can affect an entire tree. This infection is further aggravated by the lack of current treatment methods. Aggressive pruning, copper sprays, antibiotics and biocontrol agents have proved to be only partially affective against *E. amylovora* at best; in fact, the over use of streptomycin has led to the development of resistant strains. This disease is especially virulent in areas of high temperature, rainfall, and humidity. For example, *E. amylovora* is the most significant threat facing the commercial production of peaches in California.

This study focuses on the characterization of one of the proteins (HsvA) of *E. amylovora* that may be crucial for its virulence. HsvA (hrp-associated systemic virulence) is located on the same operon as HsvB and HsvC. The mutation of any of these three genes causes the virulence of *E. amylovora* to become significantly reduced, especially in apples. This study aims to clone and express the protein of HsvA by using an *E. coli*-based heterologous expression vector. If the protein proves to be at least partially soluble and can be expressed at a reasonable level, it will then be purified using chromatographic techniques (perhaps using nickel tagged agarose). The final goal is to crystallize the HsvA protein and to study its structure using x-ray crystallography. We hope the completion of this study will provide a better understanding of the biochemical functions of HsvA in *E. amylovora* as well as a way of combating this debilitating pathogen that has caused millions of dollars in damage worldwide.

Board 27

George S. Hamaoui, Jr.

Faculty Mentors: Diana E. Northup[1], Robert L. Sinsabaugh[1], Michael N. Spilde[2], and Steven P. Kaestner[3]
[1]Department of Biology, University of New Mexico, [2]Institute of Meteoritics, University of New Mexico, and [3]Jefferson Middle School, Albuquerque, NM

Project Title: Project Title: Bacteriological, Microscopic, and Biochemical Analyses of Bacteria Inhabiting Cave Ferromanganese Deposits: A Preliminary Study

Cave ferromanganese deposits (FMD) are formed from dissolution of carbonate bedrock through abiotic and biotic processes. Studying these dissolution processes provides us not only with greater knowledge about the expansion of cave passages but also about the mechanisms used by organisms inhabiting these deposits to obtain energy and nutrients. The biotic aspect of this dissolution was analyzed in this study by investigating the microorganisms inhabiting the FMD. FMD samples were collected aseptically from Spider and Lechuguilla Caves, Carlsbad Cavern National Park, New Mexico. A three-pronged approach was used to study these FMD samples. First, new types of bacteriological media were inoculated with FMD samples, allowed to incubate in the cave for approximately one month, and viewed for growth and manganese (Mn) or iron (Fe) oxidation. Second, enrichment cultures that were inoculated with FMD and were incubated for approximately seven years at 15°C in darkness were viewed with scanning electron microscopy for bacterial growth characteristics. This was done in order to compare culture morphologies with morphologies seen from environmental FMD samples viewed with SEM. Third, exoenzyme assays were performed in order to determine what enzymes classes were being secreted by the microbes in the FMD. Growth was observed on all media types inoculated, but neither Mn nor Fe oxide formation was seen at time of viewing. Previous culturing studies have shown that Mn and Fe oxide precipitation is a very slow process in the cave environment. SEM images of the seven-year enrichment cultures showed a large number of coccoid cells present. Some cells were thickly coated with Mn and Fe oxides. Lastly, exoenzyme assays revealed that bacteria in the FMD were producing moderately high amounts of phosphatases, enzymes used in the degradation of phosphate molecules. With these preliminary results greater understanding of the growth and biochemical characteristics of microbial populations in the FMD has been obtained. Future research will include the continued monitoring of the new enrichment cultures for oxide production, SEM analysis of precipitated minerals, and further exoenzyme analyses.

Board 28

Annie Schneider

Mentor: David W. Mittlefehldt
NASA Johnson Space Center

Project Title: Compositional Models of Hematite-rich Spherules (Blueberries) at Meridiani Planum, Mars and Constraints on Their Formation

The Mars Exploration Rover Opportunity discovered hematite-rich spherules ("blueberries") believed to be diagenetic concretions formed in the bedrock in stagnant or slow-moving groundwater. These spherules likely precipitated from solution, but their origins are poorly understood. Three formation mechanisms are possible: inclusive, replacive and displacive. The first would result in a distinct spherule composition compared to the other two. We propose that chemical clues may help to constrain the nature of blueberry formation. We used Alpha Particle X-ray Spectrometer data for undisturbed soils that were blueberry-free and with visible blueberries at the surface in Microscopic Imager images. We made plots of the elements versus iron for the spherule-rich soils and compared them to a mixing line representative of a pure hematite end member spherule (called "the zero model"). This modeled the replacive formation mechanism, in which pure hematite would replace all of the original material. If the spherules grew inclusively, chemical data should reflect a compositional component of the rock grains included during formation. Four models were developed to test for possible compositions of a rock component. These models could not easily explain the APXS data and thus demonstrate that the most plausible rock compositions are not components of blueberries. The absence of disturbances in outcrop stratigraphy at spherule boundaries argues against a displacive mechanism, where preexisting grains would have been pushed aside as the spherules grew. These results seem to support the replacive formation mechanism, but this leaves unexplained discrepencies between the soil data and our zero model.

Board 29

Jessica Brenneman

Faculty Mentors: Chester Cooper[1], Thomas Kim[2], Gary R. Walker[1], and Julie Chandler[1]
[1]Department of Biological Sciences, [2]Department of Chemistry, Youngstown State University

Project Title: Identification of Proteins Responsible for the Dimorphism of *Penicillium marneffei*

Penicillium marneffei is a dimorphic fungus that grows as a mold at room temperature (25°C) and as a pathogenic yeast at human body temperature (37°C). When in the mold form, the *P. marneffei* cells are multinucleated but when in the yeast form, *P. marneffei* cells are mononucleated. Using 2D electrophoresis, the identity of several proteins that differ between the two forms were identified. *P. marneffei* produce conidia, or spores, which were collected from agar cultures and used to inoculate broth media. The broth cultures were grown at either 25°C or 37°C for twenty-four hours at which time the cells were collected via centrifugation. The cells were broken and treated to obtain a whole protein extract. Ionization pH gradient (IPG) strips were passively rehydrated, loaded with isolated protein from either the yeast or the mold form, and electrophoresed. The second dimension, SDS-PAGE, was run using 12% acrylamide gels. The gels were stained using Sypro, and imaging was done using PDQuest. The gel images of the mold samples and those of the yeast samples were compared and differing proteins were identified, selected, and sent to Ohio State University for sequencing. By determining which proteins are produced in one form of *P. marneffei* but not in the other, the mechanism by which the fungus becomes pathogenic in the human body may be elucidated.

Board 33

Nicholas Reif

Faculty Mentor: Barbara Frase, Bradley University
Rocky Mountain Biological Laboratory

Project Title: *Populus tremuloides*, Ungulate Herbivory and Regeneration in the Sagebrush Grasslands of Western Colorado

Several environmental factors function as biological regulators of aspen (*Populus tremuloides*) stand fitness. While these processes can both inhibit or promote stand regeneration within this species, many speculate that on local scales, aspen populations are in fact declining. The objective of this study was to investigate the effect of winter elk browse (*Cervus elaphus*) on the fitness and regeneration of aspen stands in lower elevations of Western Colorado. I hypothesized that: 1. Stands subjected to extensive elk browse would exhibit a greater percentage of stem mortality, lower stem densities, and smaller bole volumes when compared to non-browsed stands and 2. Bole volume will be correlated to age such that, smaller trees in browsed stands will be older than trees of the same size class in non-browsed stands. My results indicate that browsed stands have greater bole volumes, a greater percentage of stem mortality and lower mean densities than non-browsed stands ($P<0.001$). Tree ring analysis of smaller individuals within the sample indicates that age had no effect on the volumes of trees examined. Therefore, the two treatments were nearly identical ($P<0.96$). These results suggest that on some level, high-intensity elk browsing is negatively affecting the regeneration of aspen species in this region. Future studies examining this ecological relationship are necessary for successful elk management operations throughout the Colorado Rocky Mountains.

Dr. Lawrence E. Young Awards Projects

Board 30

Qingshan Yang

Mentor: Zhongcheng Li and Rangzhuang Cui
The Heart cerebrovascular diseases research laboratory in Tianjin Chest Hospital

Project Title: Laboratory experiment and clinical study of the function of sodium tanshinone IIA sulfonate (STS) on cardiac ischemisc reperfucion

The herb, Dan Shen (*Salvia miltiorrhiza*), has been known to Chinese physicians because of its effect on anti-blood clotting and prevention of myocardial blockage ever since ancient times. Modern studies show that this particular Chinese medicine has several important components, such as Tanshinone I, Tanshinone IIA, Tanshinone IIB and Vitamin E. Using the Langendorff Heart model, our experiment tested the modified Tanshinone IIA containing medicine, Sulfotanshinone Sodium, to learn how it works to protect against ischemia-reperfusion, the IR effect on cardinal cells. The experiment is not completely finished yet but we have done the mice dissections and observed the experimental process of cardiac activities. We also saved the fluid samples, extracted RNAs of the cardinal cells, and built a cDNA library. We still need to apply molecular biology techniques on our samples and to test several factors, such as the medicine's effect on calcium ion channels and the renin-angiotensin, the RAS system, for clinical usage. Our preliminary studies show that the proper amount of the Sulfotanshinone Soduim medicine does prevent unusual cardiac activities from appearing after artificial ligation.

Board 31

Amanda Mook

Faculty Mentor: Wilfrido Torres
Child Family Health International Program

Project Title: Amazon Community Medicine in Ecuador

Medical practices were observed in rural communities of the Amazon region of Ecuador. These rural communities included an indigenous group in the jungle and various rural hospitals and clinics.

The Shuar people are an indigenous group that live in several different areas of the Amazon Jungle. Separate communities are usually comprised of about 130 people or less. It is against their beliefs to go to hospitals; instead they use a wide variety of plants for medicinal treatment.

Medical practices in hospitals were observed in a rural town called Puyo and the surrounding areas. Gastritis is a very common problem in rural Ecuador. Malaria is not a common problem in this particular area of Ecuador because at that elevation a vector for malaria does not exist. The primary doctors in these rural areas are often more like "tertiary" doctors; for a medical problem, people first consult home remedies, then go to pharmacies, and visit the doctor only if these two methods do not result in a cure.

Board 32

Danny Peters

Faculty Mentor: Rosita Tamayo
Child Family Health International: Andean Health

Project Title: Public Health in Latin America: Quito, Ecuador

The study of Ecuadorian culture revealed poverty and a lack of medical aid in urban areas of Quito. Discovering this culture was a lot like learning how to swim. First, there was an initial fear or apprehension, but once that fear was overcome, experiencing a new Spanish-speaking community and way of living was life-changing as well as enjoyable.

Our group of about twenty undergrad and medical students hit the ground running the first week. We all had to absorb so much while taking 4-6 hours of Spanish classes a day and spending the rest of it volunteering. Over the last 150 years, Ecuador has seen over 40 different presidents and military leaders in command. This civil unrest and its influence were seen throughout the infrastructure of the country, especially within the hospitals and clinics. Malaria, tuberculosis, and several parasitic infections are present in every day life. The child mortality rate of children under five years of age is over fifty percent, and many of the facilities are inadequate and understaffed. But although these people live in a place of great instability, many in great despair, it was inspiring to see the doctors and nurses overcome these hurdles with determination and grace.

Over the course of my four-week stay in Ecuador I was familiarized with the average medical environment. I spent time in a family practice clinic, performing endoscopies and practicing my Spanish with the patients. Most were as glad to help me as I was to help them. I also spent some time in an emergency room where I witnessed many horrible things. But I did my best to help the doctors suture wounds and anesthetize people in pain. The most difficult part of these tasks was not performing the operations, but communicating in times of urgency. I finished my stay working with a naval hematologist in a government-owned hospital. This was by far the most satisfactory staff and facility that I saw. There I studied pathology and was able to diagnose patients with the help of several qualified physicians.

DEPARTMENTAL HONORS 2005-2006

Graduation with Departmental Honors requires an independent project, and oral exam on the project, and a comprehensive exam in a student's major department during his or her senior year. This program is open to students who have attained cumulative grade point averages of 3.5 in their majors after fall semester, 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 Academic Policy Committee at OWU.

STUDENT NAME	DEPART.	SUPERVISING PROFESSOR	TITLE
Asif Akhtar	INTL	Sean Kay	Dependency & Development in the International Political Economy
Mark Fujishige	Fine Arts	Phyllis Kloda	Suggestive Evolution: The Body in Clay
Marian Homan	PSYC	Richard Leavy	The Effects of a First Year Seminar on Student Success and Freshmen Retention at Ohio Wesleyan University
Jennifer Howard	PSYC	Kim Dolgin	Religious Development Across the Life Span
Sahar Khan	INTL	Sean Kay	Security Dilemmas Facing South Asia
Leanne Lamusga	ENV	John Krygier	Climate Change and Environmentalism: Reestablishing our Values
Leah Lavelle	PSYC	K. Smith	The Context Dependent Effects of *Androstadienone* on Mood
Mallory Martin	PSYC	Kim Dolgin	Children's Understanding of Sadness, Grief and Emotional Pain
Amanda Nanney	PE	Nancy Knop	Resource Development for Assessment, Programming, Methods and Prescription for Multi-Age Core Fitness Training
Stefan Natu	MATH	Jeff Nunemacher	Topics in Mathematical Analysis
Jonathan Noble	EMAN	John Boos	Local Economic Development Agenciess
Karan Odom	Zoology	Dennis Radabaugh	A Test for Differences Between Vocalizations of Wild-reared and Human-reared Birds of Prey: is Learning Involved in Call Development of Owls and Eagles?
Deanna Probst	EMAN	Robert Gitter	Demographic Analysis of Savings, Consumption, and Social Security Policy
Jamie Rea	PE	Nancy Knop	Developmentally Appropriate Training Program for Injury Prevention and Performance Enhancement for Division 3 Women's Basketball Players, Using Literature Review, Performance Evaluation, and Developmentally Appropriate Practices
Amanda Robinson	BOMI	Chris Wolverton	Overexpression of Potassium Transfporter Gene AKT1 in *Arabidopsis thaliana*
Margaret Roush	ENG	Marty Hipsky	Modernism and Cultural Materialism
Jacqueline Sitko	PE	Nancy Knop	Adherence to Nutritional Behavioral Changes
Emcet Tas	EMAN	Saif Rahman	Politics, Globalization, and the Economy: A Comparative Political Economy Analysis of Socioeconomic Progress
Anjana Titus	INTL	Sean Kay	The Case for a Palestinian State
Jessica Walz	ZOOL	Sarah Leupen / David Markwardt	The Effects of Ethanol on Activity/Circadian Rhythms in Golden Hamsters
Joshua Warner	HIST	Mike Flamm	Intellectuals and the Rise of the Cold War
Meghan Weaver	ZOOL	John Gatz	A Survey of the Amphibians at Kraus and Bohannan Nature Preserves
Melissa Yinger	ENG	Patricia DeMarco	Women in the Renaissance

KEY: PE - Physical Education, BOMI - botany-microbiology, INTL - international studies, EMAN - economics management, PSYC - psychology, ZOOL - zoology,HIST is history, ENV - environmental studies, ENG - English, MATH - mathematics.

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Ohio Wesleyan Researchers

Off Campus Researchers

Dr. Lawrence E. Young Award Projects

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