

**The Ohio Academy of Science**  
 120<sup>th</sup> Annual Meeting  
 Hosted by  
**Otterbein University**  
 Westerville, Ohio  
 April 15-16, 2011

**ABOUT THE ANNUAL MEETING**

The Ohio Academy of Science's Annual Meeting is for academic, governmental, and industry scientists and engineers, university and pre-college educators and teachers, and pre-college, undergraduate, and graduate students, and interested lay citizens in the Ohio region.

Welcome!

Otterbein University welcomes you to the 120<sup>th</sup> Annual Meeting of The Ohio Academy of Science. We invite you to explore our campus and to share in the excitement and opportunities provided in this program.

**REGISTRATION**

Registration is required for all meeting presenters and attendees. On-site registration will be available at a higher rate. The Ohio Academy of Science must receive forms by April 8, 2011. Please use Registration Form on the last page. Mail completed form and fee to:

OAS Annual Meeting Registration  
 The Ohio Academy of Science  
 PO Box 12519  
 Columbus OH 43212-0519  
 FAX 614.488.7629 (for Credit Card or PO only)

Registration by credit card or purchase order only will be accepted by FAX at 614/488-7629. Your registration materials, receipt, and name tag will be ready at the meeting registration desk upon your arrival. For further information, please call 614/488-2228.

An Adobe PDF form is available at:

<http://www.ohiosci.org/OtterbeinRegistrationForm.pdf>

Online payment option [http://ohiosci.org/index\\_store.html](http://ohiosci.org/index_store.html)

Friday, April 15: Registration will not be open on Friday.

Saturday, April 16: Registration in the atrium of Science Center from 7:30 AM-2:00 PM. On-site registration is possible by check, VISA, or MasterCard. Cash is discouraged.

**PARKING:** Watch for signs and see map in program. Please note that West Main Street is closed at the Alum Creek bridge west of the Science Center. The detour from Cleveland Avenue to W. Main Street is marked. Park in the lots northeast of the Science Center at the Campus center on 100 W. Home St., Westerville, OH 43081-1408. Disabled parking with wheelchair access is available on the west end of the Science Center on W Main Street.

**SMOKING POLICY:** Smoking is not permitted in any building.

**HOUSING:** Please contact hotels and motels directly. See list on page 3.

**MEALS:** Friday, April 15; none planned. Saturday, April 16: Special lunch of sandwich (vegetarian or non-vegetarian), fruit and drink in reusable "green" tote bag available in the Science Center for \$5. Pre-order with registration form by April 8th. A list of off-campus restaurants will be provided at the registration desk.

**GENERAL SCHEDULE**

**Friday, April 15, 2011**

3:00 PM-5:00 PM      The Ohio Academy of Science  
 Board of Trustees Meeting  
 Roush 331

**Saturday, April 16, 2011**

7:30 AM-2:00 PM      General Meeting Registration  
 Atrium of Science Center

9:00 AM-11:00 AM      Morning Podium and Poster  
 Sessions  
 Science Center

11:15 AM              All-Academy Lecture  
 Cowan Hall Auditorium

*The Galactic Center – Uncovering the Pulse of Our Galaxy*

ANDREA M. GHEZ, PhD  
 Professor of Physics & Astronomy  
 University of California Los Angeles  
 MacArthur Fellowship Award (2008)  
 Sackler Prize(2004)  
 Member, National Academy of  
 Sciences and American Academy  
 of Arts and Sciences (elected)

**D**R. ANDREA M. GHEZ IS A WORLD CLASS OBSERVATIONAL astronomer and professor of physics and astronomy at UCLA who studies star formation as well as evidence for the proposed super-massive black hole in the center of our galaxy. As a graduate student at the California Institute of Technology she discovered that new stars are most often part of a binary system; that is, in mutual orbit with a nearby companion star. This raises interesting questions about the role of companion stars for new star formation, and how our sun, which does not have a companion, was formed. Dr. Ghez has also reported increasingly conclusive evidence for the presence of a black hole at the center of the Milky Way Galaxy. Using the Keck II telescope on Mauna Kea with its Laser Guide Star adaptive optics system of correcting for atmospheric distortion, she has been able to produce images of unprecedented resolution of the center of the Milky Way Galaxy. From much repeated imaging she precisely records the movement of stars near the center of the galaxy, and has found that the stars near the center are orbiting a compact object which is almost four million times more massive than our sun, yet is emitting little if any light. The prevailing explanation is that this dark and mas-

sive object is a supermassive black hole. Dr. Ghez projects that these studies will enable her to make a unique test of the theory of General Relativity, and to investigate the mysterious nature of these supermassive black holes. Dr. Ghez's discoveries won her the MacArthur Fellowship Award (2008) and election to the National Academy of Sciences and American Academy of Arts and Sciences among many other awards and distinctions, but her love of teaching and combating "physics phobia" – particularly among women – has also earned her several UCLA Physics Department Outstanding Teaching Awards.

- 12:00 Noon                      Announcement of Ohio Patent Awardees and Academy Fellows  
Cowan Hall Auditorium
- 12:15 PM                        Official Notice of Annual Business Meeting for Academy Members Only.  
Cowan Hall Auditorium
- 12:30 PM                        Sack lunch in reusable grocery tote available in atrium of the Science Center. Please order the \$5 lunch by April 8. See registration form at end of program.
- 12:45 PM                        Panel Discussion during lunch on meeting's theme:

### *Science Literacy in the 21st Century*

Open to all meeting attendees.

**T**HE QUESTION OF WHAT KIND OF SCIENCE EDUCATION is needed as a preparation for everyday life as a twenty-first century citizen - "science literacy for all" - is an often overlooked but crucial topic for Ohio Academy of Science members. The panel discussion will be a prompted debate among Gregory J. Kelly, Ph.D., Associate Dean for Research, Outreach and Technology and Professor of Science Education, Pennsylvania State University and Editor of *Science Education* (Wiley); Marjorie M. (Kelly) Cowan, Professor of Microbiology, Miami University, Chair of the Undergraduate Education Committee of the American Society for Microbiology and former Dean of Miami University Middletown; and Bruce R. Patton, Ph.D., Professor of Physics, Director of the Interdisciplinary Middle Childhood Education Program in the College of Arts and Sciences at The Ohio State University and Ohio Board of Regents Math and Science Teaching Fellow.

- 2:00-4:00 PM                      Afternoon Poster Session  
Pre-college students  
Science Center

**ABOUT OUR HOST**      Otterbein University  
Prof. Mary Gahbauer  
Chairperson, Local Arrangements

**O**TTERBEIN UNIVERSITY IS A PRIVATE, CO-EDUCATIONAL, comprehensive liberal arts institution located in Westerville, a small town on the periphery of Columbus, Ohio. Otter-

bein's undergraduate programs encompass the College of Arts and Sciences and the School of Professional Studies, while Otterbein's Graduate School includes the disciplines of Nursing, Education, and Business Administration. Otterbein comprises a total enrollment of more than 3000 full- and part-time students and currently ranks 15th among 140 peers in the University-Master's Midwest category of U.S. News and World Report's "Guide to America's Best Colleges."

Otterbein offers several BA or BS degrees in the natural and physical sciences, with majors in Biology, Environmental Science, Chemistry, and Physics; minors are also available in these disciplines, and an additional minor is available in the field of Earth Science. Starting in fall 2011, two new majors will be offered: Biochemistry and Molecular Biology (BS), and Sustainability Studies (BA or BS). Otterbein students can also explore science in tandem with related fields, completing either a 4+1 program with a science and business degree, or a 3+2 program in physics and engineering.

**S**TUDENT EXPERIENCES AT OTTERBEIN IN ALL DISCIPLINES are shaped by the Five Cardinal Experiences: community engagement, undergraduate research, internships and related work experiences, citizenship and leadership, and international study and global engagement. Science faculty members are active in developing the established curriculum to emphasize these vehicles of learning.

Otterbein's Science Center is a newly-renovated and greatly-enlarged facility incorporating the previous Shear and McFadden Halls. The \$20 million project was designed with technologically advanced teaching laboratories for small classes, greatly increased research space for faculty and student projects, and a layout that facilitates interdisciplinary integration. The Departments of Biology and Earth Science, Chemistry, and Physics are all housed in the Science Center, in addition to Equine Science and the Department of Nursing. Other departments such as Mathematics and Computer Science and Health and Sport Sciences also derive strong support from the Science Center.

Student research is conducted with Otterbein faculty either on campus or in off-campus institutions of local and national renown. The results of student research have been presented at meetings of the Ohio Academy of Science, the American Chemical Society, the American Physical Society, the American Microbiological Society, the Central Ohio Undergraduate Research Symposium, and the Argonne Symposium for Undergraduate Research in Science and Mathematics. Equipment and programs are supported by grants awarded by such bodies as the National Science Foundation, the Merck Institute for Science Education, Research Corporation, the Ohio Supercomputer Center, and the Ohio Department of Natural Resources.

A liberal arts science degree is a foundation for a great variety of careers; Otterbein's students have been successful in many post-graduation paths. In addition to graduate school in science and engineering and professional school in several fields (including medicine and other health professions, and law), students have continued on to careers in high school education, science industries, and government agencies.

## Where to stay

<http://www.otterbein.edu/Admission/accommodations.asp>

The following overnight accommodations are near Otterbein. The approximate distance from the college is given in parentheses. Otterbein does not in any way endorse the following companies, products or services. This listing is provided as a resource only. There is no headquarters hotel or motel.

**Best Western Franklin Park Suites (3 miles)**  
2045 Polaris Parkway  
Columbus, OH 43240  
(614) 396-5100  
[www.bestwestern.com/franklinparksuites-polaris](http://www.bestwestern.com/franklinparksuites-polaris)

**Embassy Suites (2 miles)**  
2700 Corporate Exchange Dr.  
Columbus, OH 43231  
(614) 890-8600  
[www.embassysuites.com](http://www.embassysuites.com)

**Hilton - Columbus / Polaris (2 mi)**  
8700 Lyra Dr.  
Columbus, OH 43240  
(614) 885-1600  
[www.hiltonpolaris.com](http://www.hiltonpolaris.com)

**Ramada Columbus North (2 miles)**  
6767 Schrock Hill Court  
Columbus, OH 43229  
(614) 890-8111  
[www.ramada.com/hotel/17758](http://www.ramada.com/hotel/17758)

**Hampton Inn & Suites Columbus-Polaris (2 mi)**  
8411 Pulsar Place  
Columbus, OH 43240  
(614) 885-8400  
[www.hamptoninnpolaris.com](http://www.hamptoninnpolaris.com)

**The College Inn Bed and Breakfast** (adjacent to Campus)  
63 W. College Ave.  
Westerville, OH 43081  
(614) 794-3090  
[www.thecollegeinnonline.com](http://www.thecollegeinnonline.com)

**Extended Stay America (3 miles)**  
8555 Lyra Drive  
Columbus, OH 43240  
(614) 431-5522  
[www.extendedstayhotels.com](http://www.extendedstayhotels.com)

**Wingate Inn - Polaris (3 miles)**  
8505 Pulsar Place  
Columbus, Ohio 43240  
(614) 846-0125  
[www.wingateinns.com](http://www.wingateinns.com)

**Courtyard by Marriott - Columbus/Worthington (4 miles)**  
7411 Vantage Drive  
Columbus, Ohio 43235  
(614) 764-9393

**Residence Inn by Marriott - Columbus/Worthington (4 miles)**  
7300 Huntington Park Drive  
Columbus, Ohio 43235  
(614) 885-1557

**TownePlace Suites by Marriott - Columbus/Worthington (4 miles)**  
7272 Huntington Park Drive  
Columbus, Ohio 43235  
(614) 885-0799

## Brief Schedule of Abstracts

### Podium Sessions 9:00 AM

Aquatics & General Biology  
Science Center Room 237  
Dr. Douglas Kane – Session Chair  
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Education, Engineering & the Environment  
Science Center Room 238  
Dr. Danny Ingold – Session Chair  
Page 7

Geology  
Science Center Room 304  
Dr. Keith Milam – Session Chair  
Page 8

### Poster Sessions

Both in the Science Center.

Morning 9:00 AM—Page 9  
All fields of interest

Afternoon Poster Session—2:00 PM—Page 27  
All field of interest  
Pre-college students

## Notes

## Aquatics & General Biology Science Center Room 237 Dr. Douglas Kane – Session Chair

**09:00 COMPARING DISSOLVED OXYGEN DYNAMICS IN THE WESTERN BASIN, SANDUSKY SUBBASIN, AND CENTRAL BASIN OF LAKE ERIE.** Phoenix Golnick<sup>1,2,3</sup>, [pgolnick001@defiance.edu](mailto:pgolnick001@defiance.edu), Douglas D. Kane<sup>2,3</sup>, [dkane@defiance.edu](mailto:dkane@defiance.edu), <sup>1</sup>7401 W Wall St, Oak Harbor, OH 43449, <sup>2</sup>F.T. Stone Laboratory, Put-In-Bay OH 43456 and <sup>3</sup>Natural Science and Mathematics Division, Defiance College, Defiance OH 43512.

To determine whether Lake Erie oxygen dynamics were similar in three different regions of the lake, we measured water-column oxygen conditions at two sites located in each of the western basin, Sandusky subbasin, and the central basin. We sampled these sites once a week for four weeks during the summer of 2010 using a multiparameter sonde (Model 6600, YSI, Inc. Yellow Springs, Ohio) to measure temperature, dissolved oxygen, and chlorophyll *a* every half meter until the bottom was reached. Most sites were already stratified by 6-24-2010 and the first indication of hypoxia occurred on 7-7-2010 in the Sandusky subbasin (1.92 mg/L dissolved oxygen) followed by severe hypoxia at two sites in the western basin on 7-15-2010 (0.71 and 0.80 mg/L dissolved oxygen). Using linear regressions we determined relationships between hypolimnion thickness and both hypolimnetic oxygen content and chlorophyll *a* abundance. Hypolimnion thickness did not correlate with hypolimnetic oxygen content ( $r^2 = 0.051$ ;  $P = 0.50$ ) nor chlorophyll *a* abundance ( $r^2 = 0.048$ ;  $P = 0.49$ ). Further, oxygen depletion rates did not vary across the three basins (Kruskal-Wallis test,  $P = 0.165$ ). Although we found no statistically significant relationships, we observed severe hypoxia in the western basin and similar depletion rates in all three basins. Metalimnetic oxygen maxima (MOM) in both the Sandusky subbasin and central basin were also present. MOM were likely due to pockets of photosynthetically active algae in the metalimnion, as concomitant increases in chlorophyll *a* near MOM was documented. Overall, our results suggest that dissolved oxygen dynamics are similar in the deeper areas of the western basin, Sandusky subbasin, and central basin, at least during the time period of our study.

**09:15 DECLINING MAUMEE RIVER WATER QUALITY: EVIDENCE FROM LONGTERM BIOMONITORING OF BENTHIC MACROINVERTEBRATES.** Douglas D. Kane<sup>1</sup>, [dkane@defiance.edu](mailto:dkane@defiance.edu), Dalton Gordon<sup>1</sup>, [dgordon001@defiance.edu](mailto:dgordon001@defiance.edu), Andrew Kohls<sup>1</sup>, [akohls001@defiance.edu](mailto:akohls001@defiance.edu), Robert Lakes<sup>1</sup>, [rlakes001@defiance.edu](mailto:rlakes001@defiance.edu), Ann Coburn-Griffis<sup>2</sup>, [acoburngriffis@limanews.com](mailto:acoburngriffis@limanews.com), Robert Vargo<sup>2</sup>, [Bob.Vargo@dnr.state.oh.us](mailto:Bob.Vargo@dnr.state.oh.us), <sup>1</sup>Natural Science and Mathematics Division, Defiance College, Defiance OH 43512 and <sup>2</sup>Scenic Rivers Program, Division of Watercraft, Ohio Division of Natural Resources, 3140 S SR 100 Suite D, Tiffin OH 44883.

Recent lines of evidence suggest that water quality of the Maumee River is declining. These include: increases in Soluble Reactive Phosphorus and possibly increases in cyanobacteria loaded from the river into Western Lake Erie. In addition, data from twenty-five years (1983-2008) of Stream Quality Monitoring of benthic macroinvertebrate communities also indicate that water quality in the Maumee River is declining. Biomonitoring of macroinvertebrates of known pollution tolerances at a set of sites in the river across seasons (April-November) was conducted by citizen groups. Based on these observations, we found a significant, negative linear relationship ( $r^2=0.30$ ,  $p=0.001$ ) between Community Index Value (CIV) and year. We conducted additional biomonitoring at sites in the Maumee River ( $n=3$ ) and in the Tiffin River ( $n=1$ ) and Auglaize River ( $n=1$ ) during 2008-2010 to extend the spatial component of our study. The CIV at these five sites were marginally significantly different ( $p=0.065$ ) with the Tiffin River having the highest average CIV (18.7), the

Auglaize River having the lowest average CIV (10.7), and the three sites in the Maumee River having very similar average CIVs (15.7-17.3) across the three years of study. Finally, there was a negative, significant relationship between log Total Suspended Solids (as measured by a Sediment Stick) and CIV ( $r^2=0.28$ ,  $p=0.042$ ) for 2008-2010. This relationship suggests that turbidity is one possible stressor that negatively affects benthic macroinvertebrates in the Maumee River and its tributaries.

**09:30 DOES BREEDING BIRD DENSITY DRIVE VOCAL INDIVIDUALITY? Douglas R. McClain<sup>1</sup>, [dmcclain@muskingum.edu](mailto:dmcclain@muskingum.edu), Daniel T. Blumstein<sup>2</sup>, [marmots@ucla.edu](mailto:marmots@ucla.edu), <sup>1</sup>Muskingum University, Dept. of Biology, 199 Stormont Street, New Concord OH 43762 and <sup>2</sup>Department of Ecology and Evolutionary Biology, University of California, Los Angeles CA.**

Many species produce individually specific vocalizations and sociality is a hypothesized driver of individuality. Previous studies of social variation focused on species that were colonial nesters or not, and social group size in sciurid rodents. If sociality is an important driver of individuality, it is expected that species that defend nesting territories in higher density neighborhoods should have more individually-distinctive calls than those that defend nesting territories in lower-density neighborhoods. Beecher's information statistic was used to quantify vocal individuality in Lincoln's sparrows, *Melospiza lincolni*, and mountain white-crowned sparrows, *Zonotrichia leucophrys oriantha*, at the Rocky Mountain Biological Laboratory in Gothic, Colorado, from June through August 2010. These data were used to examine the relationship between nesting density and vocal individuality. The relative density of each species was determined by point counts. Mountain white-crowned sparrows exhibited a significantly greater degree of individuality within their songs than did Lincoln's sparrows. While there was no difference in density of the two sparrow species at this study's site, the literature review suggested that the relative density of white-crowned sparrows is typically greater than Lincoln's sparrows. From this it is possible to conclude that white-crowned sparrows are generally more social than Lincoln's sparrows, and that, as predicted, they have a greater degree of individuality in their vocalizations. Thus, the results suggest that bird species nesting in denser aggregation exhibited a greater degree of vocal individuality. With further work, it may be possible to use Beecher's information statistic as a potential predictor of breeding bird densities.

**09:45 ANTIFUNGAL PROPERTIES OF CUTANEOUS BACTERIA AND ANTIMICROBIAL PEPTIDES COLLECTED FROM AXOLOTLS (*Ambystoma mexicanum*).** Madeline Sofia<sup>1</sup>, [sofiama@mountunion.edu](mailto:sofiama@mountunion.edu), Andrew Loudon<sup>2</sup>, [loudonah@mountunion.edu](mailto:loudonah@mountunion.edu), (Dr. Brandon Sheafor, [bsheafor@carroll.edu](mailto:bsheafor@carroll.edu)) Dr. Leonard Epp<sup>2</sup>, [epplg@mountunion.edu](mailto:epplg@mountunion.edu), <sup>1</sup>1025 Royal Drive, Amherst OH 44001 and <sup>2</sup>Department of Biology, University of Mount Union, 1972 Clark Avenue, Alliance OH 44601.

*Batrachochytrium dendrobatidis* is a pathogenic fungus that causes Chytridiomycosis, a fungal disease which has contributed to worldwide amphibian decline. In Mexico, *B. dendrobatidis* has been linked to the decline of several species'. *Ambystoma mexicanum*, one species endemic to Mexico, has suffered widespread and catastrophic declines in the wild. Identification of *B. dendrobatidis*-positive axolotls, and understanding the susceptibility factors of the animal are essential to prevent the spread of *B. dendrobatidis* by the trade of the animal, and also in efforts to help protect the species. In amphibians, two highly studied areas of the immune response are the antimicrobial peptides produced by the glandular cells in the epithelium, and the metabolites produced by cutaneous bacteria. In this study, captive axolotls are tested for *B. dendrobatidis* presence, and antimicrobial peptides and cutaneous bacteria are collected. Challenge assays are used to measure the minimum concentration of



antimicrobial peptides and bacterial metabolites to inhibit *B dendrobatidis* growth. Concentrations are measure by spectrophotometry. By gauging the antifungal ability of both the antimicrobial peptides and metabolites produced by the cutaneous bacteria, it will be possible to attain a deeper understanding of why the axolotls are suffering such devastating decline.

**10:00 HEAT SHOCK GENE EXPRESSION IN DIFFERENT STRAINS OF THE AMPHIBIAN FUNGUS (*Batrachochytrium dendrobatidis*).** Andrew H. Loudon, loudonah@mountunion.edu, 250 West Pidgeon Road, Salem OH 44460; Madeline Sofia, sofiam@mountunion.edu, Brandon Sheafor, bsheafor@carroll.edu, (Leonard G. Epp, epplg@moutunion.edu), Department of Biology, University of Mount Union, 1972 Clark Avenue, Alliance OH 44601.

This study aims to determine how colonization of new climates affects adaptations in heat shock genes of *Batrachochytrium dendrobatidis*. This research will increase the understanding of *B. dendrobatidis*'s ability for adaptations, and increase our knowledge on how it has evolved to thrive in new climates. *B. dendrobatidis*, the causal agent of chytridiomycosis, is a fungal pathogen lethal to many amphibians globally. The pathogen is hypothesized to be endemic to Africa and had been introduced across the world via anthropogenic means starting in the mid 1930s. In the past 85 years the pathogen has spread across new climates, ranging with varying temperate periods. It has been shown that 30°C could be lethal to *B. dendrobatidis*. However due to ranging climates, selection for temperature elasticity could occur. Heat Shock genes produce proteins that cope with stress induced denaturation of other proteins, therefore may play a vital role when the pathogen colonize new climates. Strains of *B. dendrobatidis* from ranging degrees of tropical and temperate climates are grown at 29°C. The expression of heat shock genes 101, 90 and 70 are measured via reverse transcriptase quantitative polymerase chain reaction (rt-qPCR) and analyzed by Two-way ANOVAs. In addition growth assays are performed on all strains at 29°C.

**10:15 EFFECT OF CHITIN SUPPLEMENTATION ON THE ANTIFUNGAL ACTIVITY OF EXTRACTS OF THYME (*THYMUS VULGARIS*) AND OREGANO (*ORIGANUM VULGARE*).** Catherine LE Young, c-young.1@onu.edu, Vicki A Motz, v-motz@onu.edu, Linda M Young, l-young@onu.edu, Department of Biological and Allied Health Sciences, Ohio Northern University, Ada OH 45810.

Thyme (*Thymus vulgaris*) and oregano (*Origanum vulgare*) are used to treat fungal infections. The active antifungal compound(s) may be produced by the plants as a defense against fungal diseases or predation by insects, and production may be upregulated in response to a threat from these sources. We simulated such a threat by mixing 500 g powdered chitin (present in both the exoskeleton of insects and the fungal cell wall) per m<sup>3</sup> into the planting soil. Results were compared to three other treatment groups: an untreated control, a group exposed to a naturally occurring fungus (*Cyathus* spp), and a group planted with marigolds to repel insects. Herbs were dried and extracted in ethanol to a concentration of 1g dried herb/mL. Antifungal activity against the common pathogens *Candida albicans* and *Candida tropicalis* was assessed in triplicate by the Kirby Bauer method using 6mm dots of Whatman 3 filter paper impregnated with 50 µL of extract. Results were analyzed with the Student's t-test. In all cases, thyme extracts showed a larger zone of inhibition (ZI) than oregano extracts. Fungal-exposed thyme showed the largest ZI compared to the control (p<0.0001 vs. both pathogens, N=3); the efficacy of chitin-exposed thyme was not significantly different from that of fungal-exposed thyme (p=0.1 vs. *C. albicans*, p=0.057 vs. *C. tropicalis*, N=3) and significantly larger than the control (p=0.001 vs. *C. albicans*, p=0.039 vs. *C. tropicalis*, N=3). Marigold treatment showed no effect. Chitin supplementation

may be a viable method for increasing production of compounds of medicinal interest in herbs.

**10:30 EFFECT OF HEART RATE ON VISUAL REACTION TIME AMONG COLLEGE FEMALES AT OHIO NORHTERN UNIVERSITY, ADA OH.** Rebekah C. Lavin r-lavin@onu.edu, Ashton Dennen, Cara Schroeder, 402 W. College Ave unit 2286, Ada OH 45810.

A person's reaction time is affected in a stressful, heart rate elevating environment; such as performance/response in athletics or emergency situations. Understanding this relationship could explain and improve human reaction rates. Upon approval from the Institutional Review Board at Ohio Northern University, each female participant underwent three treatments. First, each participant's resting heart rate (RHR) was measured with a Cardiosport© 5631 heart rate monitor and completed a computer-assisted assessment of visual reaction time from humanbenchmark.com. In the second treatment, the participant increased her heart rate to 70% of her maximum heart rate (MHR) on an Octane Pro 3700© elliptical or a Matrix Ultimate Deck© treadmill. The participant ceased exercising and repeated the reaction test. In the third treatment the participant rested until her heart rate fell to 50% of her MHR and repeated the reaction test. Data was analyzed using the Pearson coefficient correlation test and a positive correlation between increased mean heart rate and increased mean visual reaction time was shown for college females (r= .97, n=30, α=0.05, p = 0.00017). By using the two sample t- test, a statistically significant different reaction time rate was demonstrated between the control RHR group and the 70% of MHR, (t=2.538, df= 58, N=30, α=0.05, p= .014). While the 50%MHR did increase the visual reaction time rate, it wasn't a statistically significant difference. These initial data show that 70% MHR can increase visual reaction time rate.

**10:45 EFFECT OF TEXT-MESSAGING DISTRACTIONS ON REACTION TIME.** Keira A. Corbett, k-corbett@onu.edu, Andrew J. Park, a-park@onu.edu, Joshua J. Salisbury, j-salisbury@onu.edu, Jennifer G. Aiello, j-aiello.1@onu.edu, 402 West College Ave. Unit 1585, Ada OH 45810.

Reaction time is a critical aspect of human physiology, particularly for the action of neural signaling involved in voluntary movement. Motor vehicle operation is fully dependent on the reaction of the individual behind the wheel, with braking and steering being two vital functions. This experiment aimed to demonstrate that text messaging can cause a significant increase in reaction time, which can translate to deadly results behind the wheel of a car. A combination of forty male and female college students was recruited to participate in a two-point study: a visual reaction time test both with and without a text messaging distraction. The reaction time test involved an online program in which subjects were prompted five times to react to a stoplight icon changing from red to green. For the first test, without distraction, the average reaction rate was .508±.021seconds. In the second test, texting a text message while taking the reaction time test, overall averages were calculated to be 1.216±.056 seconds. The results showed that sending a text message causes, on average a .70 second increase in reaction time, hence slowing one's reaction time by .70 seconds. Based on a two tailed t-test, mean reaction times between the two conditions were significantly different at α=.05 level. The approximate .70 second difference of the averages from the two tests demonstrates the increase in time it would take to react to visual input and output sensations in order to take appropriate actions while driving.

**Education, Engineering & the Environment  
Science Center Room 238  
Dr. Danny Ingold – Session Chair**

**09:00 SCIENCE INFORMATION LITERACY: REVIEW AND REACTIONS.** Chris J. Miko, cmiko@bgsu.edu, Jerome Library, Bowling Green State University, Bowling Green OH 43403.

During this past decade, the Science and Technology Section (STS) of the Association of College and Research Libraries (ACRL) Division of the American Libraries Association was charged with developing standards, performance indicators and outcomes for library instruction in science and technology based on the ACRL Information Literacy Competency (ILC) Standards for Higher Education. The STS identified five standards. The standards include 1) identifying the need for information, 2) procuring the information, 3) evaluating the information, revising the search strategy, and obtaining more information, 4) using the information, and 5) lifelong learning. The fifth standard entirely new and different from the ACRL ICL Standards for Higher Education, states that the information-literate student recognizes the need to keep current regarding new developments in his or her field and understands that information literacy is an ongoing process and an important component of lifelong learning. Following the publication of the standards, a survey of faculty at seven primarily undergraduate universities was conducted to determine how important they believed it was to have a particular information literacy skill related to the outcomes of the five standards. A four-point scale of "not important," "somewhat important," "important," and "very important" was used. The highest ranked overall outcome was that students demonstrate an understanding of what constitutes plagiarism and does not represent work attributable to others as his/her own. The lowest ranked overall outcome was that students participate in electronic discussions following accepted practices. The mean ranged from 3.9545 to 2.3443. Also, most faculty expected students to display the outcomes in their first year at the university or in high school.

**09:15 EFFECTS OF CHANGING EXTERNAL RESISTANCE IN MICROBIAL FUEL CELLS.** Ann D. Christy<sup>1</sup>, christy.14@osu.edu, Hamid Rismani-Yazdi<sup>2</sup>, hamid.rismani@gmail.com, <sup>1</sup>The Ohio State University, Dept of Food, Agricultural, and Biological Engineering, Columbus OH 43210 and <sup>2</sup>Massachusetts Institute of Technology, Dept of Chemical Engineering.

Microbial fuel cells (MFCs) are bio-electrochemical devices which convert chemical energy directly into electricity. When using cellulose substrate, the process links cellulose hydrolysis to fermentative acidogenesis to anaerobic respiration using the electrode as the electron acceptor. External resistance between anode and cathode electrodes of an MFC affects the flow of electrons produced. The objective was to test how changing resistance affects bacterial diversity and production of current, power, and metabolic intermediates. Duplicate MFCs were operated under four different resistances: 20, 249, 480, and 1000 ohms. The eight MFCs were inoculated with a consortium of dairy rumen microorganisms and provided with cellulose substrate. After ten weeks, based on DGGE analysis of 16SrRNA genes, clear differences were observed between bacterial populations for the four resistances. Maximum current (0.43 mA) and power density (66 mW m<sup>-2</sup>) were produced by the 20-ohm MFCs. Conversely, minimum current (0.26 mA) was produced by the 1000-ohm MFCs. Those MFCs with 249, 480, and 1000-ohm external resistances produced 57.5, 27, and 47 mW m<sup>-2</sup> respectively. The 1000-ohm MFCs produced 75% more short chain fatty acids than the 20-ohm MFCs (7760 mg/L versus 4423 mg/L). The data show that higher circuit loads produced less electricity (as measured by current and power density), significantly different microbial populations (as indicated by Jaccard's coefficient comparing DGGE banding patterns), and increased buildup of intermediate fatty acid metabolites. By manipulating the external resistance of the application, different microbes might be selected, thus controlling the balance between fermentative acidogenesis and anaerobic respiration, and ultimately optimizing MFC performance.

**09:30 METAL CONCENTRATIONS IN SEDIMENT AND WATER IN THE SANDUSKY BAY, OHIO.** Lauren R Trombley<sup>1</sup>, ltrombl@bgsu.edu, John R Farver<sup>1</sup>, jfarver@bgsu.edu, Jeffrey G Miner<sup>2</sup>, jminer@bgsu.edu, <sup>1</sup>Dept of Geology, and <sup>2</sup>Dept of Biological Sciences, BGSU, 1082 Fairview Ave Apt R1, Bowling Green OH 43402.

The Sandusky Bay is a major spawning and nursery area for several important sport and commercial fish. A sediment survey conducted by the Ohio EPA in 2001 indicated several metals were present in concentrations that exceeded the Probable Effect Level (PEL). The presence of these metals poses the possibility of up trophic-level transfer to fish and ultimately to humans. In addition, the Ballville dam, located upstream of the Sandusky Bay, is scheduled for removal in 2012 releasing 0.35 million cubic meters of impounded sediment. The objective of this study was to determine the current levels of metals in sediments and water in the Sandusky Bay, prior to dam removal. Sediment grab samples were collected at 33 sites in the bay using a Petite Ponar and 39 surface water samples were collected in acid-washed bottles. The samples were processed using standard USEPA methods (3051A, 3005) and analyzed using an ICP-OES. The concentrations (mg/kg dry wt.) of Cd, Cr, Cu, Ni, Pb, and Zn in the sediments are 0.02-4.53, 21.92-84.98, 19.70-631.9, 22.05-76.97, 11.87-261.41, and 80.72-468.91, respectively. The Threshold Effect Level (TEL) was exceeded for Cd, Cr, Cu, Ni, Pb, and Zn at 22, 20, 22, 33, 4, and 19 sites, respectively, and the Ni concentration was above PEL at 21 sites. The sediment metal concentrations measured are greater than previously reported values. The elevated (above PEL and TEL) and increasing levels of these heavy metals in the sediments presents the possibility of negative impacts on aquatic organisms in the bay, including fish.

**09:45 MEASUREMENT VARIABILITY IN STR-DNA GENOTYPING IN FORENSIC ANALYSIS.** Uohna J. Foster, foster.84@wright.edu, 6567 Thistle Grove, Morrow OH 45152.

Short tandem repeat (STR) DNA testing has become the most powerful form of human identification in forensics. A complete match across a standard set of 13 polymorphic STR loci can be a most compelling piece of evidence. In spite of the many methodological improvements, significant challenges remain. DNA profiling is firmly grounded in metrology, and measurement variability is part of every aspect, from detection, to data interpretation, to uncertainties associated with statistical weighing of a final DNA profiling result. Reliably distinguishing between signal and noise is of particular difficulty as the minimum peak height thresholds used generally fail to consider variability in the sensitivity of instruments, reagents, or analyst's skill level. This study sought to quantify the variation in peak height (measurements) generated when performing DNA genotyping via capillary electrophoresis detection of fluorescent PCR products. The DNA samples (from 42 individuals) were amplified in two separate aliquots and each subjected to two injection; giving a total of four analyses per individual. The level of variability from one injection to the next ( $r^2 = 0.94$ ) was far smaller than from one amplification to the next ( $r^2 = 0.67$ ). On average, the peaks from the first injection were higher than the second injection. These results indicate that re-injecting a sample lowers the peak heights while re-amplification typically produces higher peak heights. This level of variability suggests that a static RFU (relative fluorescent units) threshold is unreliable for identifying background noise and is insufficient to capture discrepancies in DNA profiling.

**10:00 ABUNDANCE AND HABITAT USE OF WINTER RAPTORS ON A RECLAIMED SURFACE MINE IN SOUTHEASTERN OHIO.** Danny J. Ingold, ingold@muskingum.edu, Biology Dept, Muskingum University, New Concord OH 43762.

Numerous studies have documented the benefits of reclaimed surface mines to breeding grassland birds, but



relatively few studies have focused on the use of such grasslands by winter raptors. Birds of prey were surveyed along a driving transect on a reclaimed surface mine (the Wilds) in east-central Ohio from early January through mid-April 2009. A total of 382 birds were sighted: red-tailed (*Buteo jamaicensis*) and rough-legged hawks (*B. lagopus*) were the most abundant (178 and 115 individuals respectively) followed by American kestrels (*Falco sparverius*, 43 individuals) and northern harriers (*Circus cyaneus*, 26 individuals). Numbers of rough-legged hawks, the only purely migratory species in this region, declined from January through April, while numbers of red-tailed hawks and harriers increased. Rough-legged hawks, kestrels and harriers were all found in open grasslands at a rate greater than expected to occur by chance alone ( $P < 0.01$  in all cases) while red-tailed hawks were found disproportionately more often along forest edges ( $P < 0.01$ ). The majority of rough-legged hawks and harriers were observed soaring rather than perched, while approximately equal numbers of red-tailed hawks were observed soaring or perched in large trees. Most kestrels were observed on utility wires or in small trees. These observations, that the majority of rough-legged hawks, kestrels and harriers observed in this study were seen in open grasslands (71%, 81% and 89% respectively), support previous findings that reclaimed surface mines provide important winter habitat for both resident and migratory birds of prey.

**10:15 DIGESTIVE PHYSIOLOGY OF THE YELLOW BELLIED SLIDER TURTLE, *TRACHEMYS SCRIPTA*, ON A FRUIT DIET.** Jamie E. Clapper, [Jamie.clapper@otterbein.edu](mailto:Jamie.clapper@otterbein.edu), (Dr. Sarah S Bouchard, [sbouchard@otterbein.edu](mailto:sbouchard@otterbein.edu)), 1 S. Grove Street, Otterbein University, SMC 12302, Westerville OH 43081.

The Yellow-Bellied Slider Turtle, *Trachemys scripta*, is an opportunistic omnivore, with a strong tendency toward herbivory. As adults, they typically consume plants such as duckweeds, *Lemna sp.*, waterweeds, *Elodea sp.*, and water lilies, *Nymphaea odorata*. However, they are known to consume large quantities of fruit in the tropics. Little is known about their ability to digest and subsist on such a fruit diet. The goal of this experiment was to determine the extent to which the turtle can digest and assimilate nutrients and energy from fruit. A five week feeding trial was conducted in which seven turtles were fed plums, *Prunus*, *ad libitum*. Intake, digestibility and nutrient and energy gains were determined. Intake was determined by providing a known quantity of fruit in the morning and measuring the quantity remaining five hours later. Turtles were fitted with fecal collection devices to collect and quantify total fecal production. Apparent digestibility was calculated by comparing the total nutrients consumed with the amount remaining in feces. All turtles consumed the fruit diet and were able to maintain a constant body mass. The fruit was highly digestible, with dry and organic matter digestibilities over 95%. Additionally, turtles fed selectively on different fruit parts to minimize fiber intake. Understanding the digestive processing of a diet provides insight into the value of the diet and into factors influencing diet selection by that species.

**10:30 AUTHENTIC RESEARCH EXPERIENCE AS A MEANS TO INCREASE SCIENCE LITERACY IN SCIENCE MAJORS AND HIGH SCHOOL TEACHERS.** Gwynne S. Rife, [rife@findlay.edu](mailto:rife@findlay.edu), The University of Findlay, 1000 N Main Street, Findlay OH 45840.

The problems inherent in giving students authentic scientific research experience are common to all science educators. Time frames are short, monies for doing research are limited, and the time needed to supervise students on an individual basis is substantial. In the end, the data collected is seldom of a quality a researcher is comfortable enough with to use for publication. However, the benefits of even the simplest authentic research experience are especially important in increasing student scientific literacy. Experiences with the scientific research cycle supports this by: 1) providing experiences that foster an understanding of the economical and physical

requirements for high quality data collection in the sciences that aids in skills involved in critical analysis of literature, 2) insuring that students have the introductory tools to use scientific literature to investigate scientific phenomenon, and 3) offering a critical experience that follows the scientific method from design, to execution, to communication in written form. Experiences offered through an undergraduate research course as well as a graduate professional development course for teachers suggests that authentic scientific research experience has increased the scientific literacy in these students. Surveys distributed over the last five years in these courses indicate that students have increased ability to address questions about scientific literature after experiencing authentic scientific research ( $N = 178$ ). On a sixteen item survey focused on questions relating to scientific literacy, responses to questions increased from 23% on the pre-test to 83% on the post test. Answers of "I don't know" on the survey dropped from 63% to only 3%.

## Geology Science Center Room 304 Dr. Keith Milam – Session Chair

**09:00 THE SERPENT MOUND IMPACT CRATER IN SOUTHERN OHIO: LARGER THAN PREVIOUSLY PROPOSED.** K. A. Milam, [milamk@ohio.edu](mailto:milamk@ohio.edu), Ohio University, Department of Geological Sciences, 316 Clippinger Laboratories, Athens OH 45701.

Previous geologic mapping of the Serpent Mound impact crater in southern Ohio identified only 2 of the major geologic landforms of complex craters: a central peak and surrounding circular graben. Evidence for a crater rim has not been detected in this heavily-eroded crater. Known morphometric relationships using estimated central peak diameters (2.6 – 5.0 km) predict that the size of the Serpent Mound impact crater is much larger than previously predicted, ranging from 10 – 25 km in diameter. Examination of a digital elevation model reveals no indication of a crater rim in the western part of the study area, but in the east the Allegheny Escarpment is unusually circular. Hills extending from the escarpment southeast of the crater form a roughly circular arc 10 – 14 km from the center and conform to the crater shape as previously mapped, which is consistent with crater morphometric predictions. Well logs and mapping at surface exposures were used to contour the unconformable contact between Middle Silurian carbonates and Upper Devonian shales. Contour maps of the contact reveal attitude deviations from regional dip ( $<0.1^\circ$  E) in the vicinity of the Serpent Mound impact crater, indicating downward displacement of the contact during the impact event. The lateral extent of this deformation is limited to a generally circular area approximately 14 km in diameter. All of these observations suggest that the Serpent Mound impact crater is  $<14$  km in diameter, up to 2x larger than previous estimates.

**09:15 NUTRIENT SPIRALING IN CAVE STREAMS.** Chad M. Rigsby, [s11.crigsby@wittenberg.edu](mailto:s11.crigsby@wittenberg.edu), Kristen M. Shearer, [s12.kshearer@wittenberg.edu](mailto:s12.kshearer@wittenberg.edu), (Dr. Horton H. Hobbs III, [hhobbs@wittenberg.edu](mailto:hobbs@wittenberg.edu)), Department of Biology, Wittenberg University, Springfield, OH 45501.

The cave stream environment is very different from that of a surface stream, often being carbon-limited, without primary production, and with low nutrient demand. Therefore, the spiraling length of a nutrient particle is thought to be greater in caves, with smaller mass transfer coefficients and areal uptake rates. Methodology has always been an issue for scientists studying nutrient spiraling, however enormous strides have been made within the last several years. Current methods allow for the estimation of ambient uptake metrics, half-saturation constants, and uptake metric curves based on nutrient concentrations. Using a slug addition method, we are

studying nutrient spiraling in a contiguous surface and cave stream system within Cascade Cave in Carter County, Kentucky. Preliminary results from experimentation in Cascade Cave suggest that, as expected, nutrients have greater uptake lengths based on the fact that there are no primary producers in caves as well as evidence from previous research; however, preliminary experiments also produced inconclusive mass transfer coefficients and areal uptakes. This methodology is currently being expanded to more caves in Carter County and Ohio. The newly developed Tracer Additions for Spiraling Curve Characterization method will be used to quantify all the above mentioned spiraling metrics as well as physical and biological retention in these cave stream systems and some surface streams for comparison. This methodology allows us to compare nutrient spiraling dynamics in these two very different kinds of stream ecosystems.

**09:30 EVALUATION OF A FRACTURE PREDICTION MODEL USING LABORATORY EXPERIMENTS & FIELD SOIL TEXTURE DATA.** Eun Kyoung Kim, kim.916@osu.edu, Young Woon Kang, kang.111@osu.edu, Ann D. Christy, christy.14@osu.edu, and Julie Weatherington-Rice, weatherington-ri.1@osu.edu. The Ohio State University, Dept. of Food, Agricultural, and Biological Engineering, Columbus OH 43210.

Fractures in soils can cause environmental problems; currently no model exists for predicting fracturing. The objective of this study was to develop, test, and validate such a model. Based on analysis of 143 naturally-occurring fractured Ohio field samples and 30 additional samples prepared by experimental lab tests, a model was developed. X-ray diffraction showed that these samples contained Ohio's common clay minerals: illite, kaolinite, chlorite, and some vermiculite. Clay mineralogy is independent of clay size. Sand-silt-clay ratios were determined for all 173 samples; the original 143 were tested by sieve and hydrometer, and the additional 30 were determined by mathematical calculation and weight ratios. Calculated and weighed quantities of silica sand and water were added to the five representative soil samples, left to dry, and visually evaluated for fracture presence or absence. All 173 data points were plotted on a USDA soil texture ternary diagram. The plotted points documented that fracturing could occur with as much as 78.5% sand as long as 6.5% clay was present. This boundary established the model limits, and the model was validated against soil data tests from two additional fractured locations in Ohio, plus sites in eastern Iowa, southwest Michigan, Wisconsin, and Montana. All of the new data points fell within the expected range known to produce fractures, thereby confirming the accuracy of the model. This model can be a useful tool for predicting fracturing based on soil texture, and should be reliable as long as expected typical Ohio clay mineralogies do not appreciably change.

**09:45 USE OF INDUSTRIAL BYPRODUCTS AND MINERALS TO FILTER PHOSPHATE AND PESTICIDES IN PUTTING GREEN DRAINAGE WATER.** Sheela G. Agrawal<sup>1</sup>, sheela.agrawal@ars.usda.gov, Kevin W. King<sup>1</sup>, kevin.king@ars.usda.gov, James F. Moore<sup>2</sup>, jmoore@usga.org, Phil Levison<sup>1</sup>, phil.levison@ars.usda.gov, Jon McDonald<sup>3</sup>, jmcDonald@kristar.com, <sup>1</sup>USDA Agricultural Research Service, Columbus OH 43210, <sup>2</sup>US Golf Association, McGregor TX 76657 and <sup>3</sup>Kristar Enterprises Inc, Santa Rosa CA 95407.

Putting greens are vulnerable to phosphate ( $\text{PO}_4^{3-}$ ) and pesticide loss by infiltration through the sandy grass-rooting media used into subsurface tile drainage. The objective of this study was to remove  $\text{PO}_4^{3-}$ , chlorothalonil, mefenoxam, and propiconazole in putting green drainage water using a blend of industrial byproducts and minerals, including granulated blast furnace slag (GBFS), cement kiln dust (CKD), silica sand, coconut shell activated carbon (CS AC), and zeolite. Two, six hour storm events were simulated on separate days by repeat irrigation of a putting green immediately following  $\text{PO}_4^{3-}$  and pesticide application. A control experiment, in which no filter

media blend was used, was run on the first day, while the experimental run, which included the filter blend, was conducted on the second day. A significant decrease in the post-filter chlorothalonil load for the experimental run was observed compared to the control ( $N = 6$ ,  $p < 0.05$ ). In contrast, the filter media blend was not effective in removing  $\text{PO}_4^{3-}$ , mefenoxam, nor propiconazole ( $N = 6$ ,  $p > 0.05$ ). Instead, the filter media actually added  $\text{PO}_4^{3-}$  to the effluent above flow rates of 0.037 L s<sup>-1</sup>, which suggests the need for a different filter design to slow high incoming flows and increase contaminant contact time with the filter media. Contaminant physical and chemical properties may have also influenced the filter media's ability to remove contaminants. More research is needed to determine the optimal blend and configuration for the filter media to remove significant amounts of all contaminants investigated.

**10:00 EFFECTS OF TADPOLE DENSITY ON GUT LENGTH IN RED-EYED TREE FROG AGALYCHNIS CALLIDRYAS.** Chelsea R. Jenney, chelsea.jenney@otterbein.edu, Sarah S. Bouchard, sbouchard@otterbein.edu, Karen Warkentin, kwarken@bu.edu, Otterbein University, SMC 14525, Westerville OH 43081.

Red-eyed treefrogs display size-dependent post-metamorphic growth. Small froglets emerging from high density tadpole environments initially gain mass, whereas large ones from low density environments lose mass. Effects of larval density on digestive processing were assessed before and after metamorphosis as a potential mechanism underlying this pattern. At high densities tadpoles may have longer guts, resulting in increased digestive efficiency, and increased gut length may carry over post metamorphosis. This hypothesis was tested by raising tadpoles at densities of 5, 25, and 50 tadpoles per 400 L mesocosms. Tail and head-body length were measured because these traits correlate with gut length in other species. Gut transit time of a charcoal marker was also measured in size matched tadpoles from each treatment. Finally, diet transit times of froglets emerging from each density were measured. High density tadpoles had head-body lengths that comprised 35% of their total length, whereas the head-body lengths of low density tadpoles comprised 33%. Tadpoles raised in the high-density treatment had significantly longer transit times than low-density treatment (8 vs. 16 h, ANOVA,  $p < 0.001$ ). Low density froglets were five times heavier than high density froglets, but neither intake nor transit time varied with tadpole density. These results are consistent with density dependent changes in gut length that carryover post metamorphosis.

## Poster Session 1 Science Center 9:00 a.m. – 11:00 a.m.

**Poster Board No. 001 HONEY BEE (APIS MELLIFERA) FUNGAL ASSOCIATES EXHIBIT VARIED RESPONSES TO FUNGICIDE PRISTINE®** Brian Z. Hedges, Derrick J. Heydinger, (Jay A. Yoder), Department of Biology, Wittenberg University, Springfield OH 45501.

Bee bread, which is found in bee colonies and serves as the primary nutritional source for developing bee larvae, is converted from stored pollen by symbiotic fungal associates of honey bees. Fungicides are commonly applied to crops to control fungal pathogens and have been found in samples of bee bread taken from colonies. This study explores the effects of Pristine® (BASF), a broad-spectrum fungicide frequently applied to various commercial crops, on bee bread fungi *in vitro* by radial growth rate determination of 12 treated bee bread fungal isolates. Field conditions of bee hives were simulated by conducting the experiment on bee-bread supplemented non-nutritive agar at 30°C in darkness, and 5% atmospheric  $\text{CO}_2$ . Radial growth rates for each fungus were generally reduced 12% - 80% by



fungicide, depending on fungal species and concentration of applied fungicide, which included levels found in the field and ranged from 0.1 to 100 mg/ml (serially diluted) with a DI water control. Effectiveness of Pristine® was found to be species-specific and to not be a function of increased exposure times for slow growers or decreased exposure times for fast growers. Fungi found to be most tolerant to Pristine® were *Rhizopus* sp., *Mucor* sp., and *Absidia* sp.; and *Penicillium* sp. and *Aspergillus niger* were the most sensitive. Further, Pristine® exhibited a controlling effect on bee fungal pathogens, *Ascospaera apis* (chalkbrood) and *Aspergillus flavus* (stonebrood). Thus, bee bread fungi respond to this fungicide differently, and this could have a negative effect on colony health by altering the composition of mycoflora that bees use to process and store their food.

**Poster Board No. 002 COMMON APIS MELLIFERA DISEASES STONEBROOD AND CHALKBROOD UNAFFECTED BY TREATMENT WITH COMMERCIAL ANTIBIOTICS.** Derrick J. Heydinger, s12.dheydinger@wittenberg.edu, Brian Z. Hedges, s12.bhedges@wittenberg.edu, Stephen A. Zumnick, s14.szumnick@wittenberg.edu, Jay A. Yoder, jyoder@wittenberg.edu, Wittenberg University, Department of Biology, Springfield OH 45501.

Frequently used antibiotics Fumagillin (Fumagilin-B®, Medivet), tylosin (Tylan®, Eli Lilly) and oxytetracycline (Terramycin®, Pfizer) were applied to control nosemosis (*Nosema apis*) and foulbrood (*Paenibacillus larvae*) in honey bee colonies. The purpose of this study was to determine the effect of these antibiotics on the growth of bee breed fungi, which provides digestive enzymes in adult bees, and produces nutrients for developing bee larvae from stored pollen. The trisecting line method was implemented to determine radial growth rates ( $K_r$  is mean  $\pm$  SE of 45 measurements (replicates of 15 measurements/plate;  $N = 3$ ) of the 13 most frequently recovered bee fungal isolates, including *Ascospaera apis* (agent of chalkbrood disease) and *Aspergillus flavus* (agent of stonebrood disease), on media treated with antibiotics in concentrations of 1%, 0.1% and 0.01% both alone and in combination with each other. To imitate essential conditions for making bee bread in a capped wax cell, agar supplemented only with bee bread nutrients at 30°C, in darkness, and transferred from 5% CO<sub>2</sub> to aerobic conditions, was used to support fungal growth. Under such conditions, contact with the antibiotic solutions produced no physical changes in fungal characteristics such as obverse/reverse pigmentation, colony, conidia, philiade characteristics, and also failed to initiate production of teleomorphs in any of the 13 fungi. Determined by lack of dose-response, no fungi displayed antibiotic sensitivity, mortality, antibiotic synergistic effects, or difference from control growth rates. These results suggest that shifts in composition of the bee colony mycoflora are unlikely to occur by use of these antibiotics. Further, beekeepers should understand that use of antibiotics is not a viable treatment for the diseases stonebrood and chalkbrood.

**Poster Board No. 003 INFECTIOUS DISEASE PREVENTION AT ORGANIC DAIRIES THROUGH ANIMAL BEDDING.** Rachel Hennings, henningsr@findlay.edu, Charles Starkey, Carolyn Weiss, Matt Hoostal, The University of Findlay, 1000 North Main St, Findlay OH 45840.

As organic dairy farms are prohibited from the use of antibiotics, assuring the prevention of infectious diseases is critical to maintain herd health and, thusly, optimize the profitability of organic milk. The objective of this study was to examine the inhibitory effects of red cedar bedding on the growth of various laboratory pathogens, as well as pathogens isolated from bedding and pasture soil at an organic dairy in Hancock County. Bacterial growth curves were performed at increasing concentrations of red cedar bedding or iodine, as well as with unamended controls. Initial growth curve experiments demonstrated a greater efficacy of red cedar bedding at inhibiting the growth of various laboratory pathogen cultures than alpine pine

bedding ( $P > 0.05$ ), as well as a nearly fourfold increase in the concentration of polyphenols within red cedar bedding. Among laboratory strains of bacteria, both Gram-negative and Gram-positive strains were significantly inhibited by the 2.0 g red cedar treatment ( $P < 0.05$ ), while only Gram-positive strains were inhibited by the 1.0 g of red cedar at  $\alpha = 0.05$ . However, neither Gram-positive nor Gram-negative isolates from the animal bedding were inhibited by animal bedding ( $P > 0.05$ ). Bacteria isolated from animal bedding were 50% less inhibited by iodine disinfectant than corresponding laboratory species. Consequently, bacteria isolated from animal bedding may be adapted to tolerate inhibitory effects of red cedar bedding and iodine, diminishing the role of animal bedding in infectious disease prevention and management.

**Poster Board No. 004 INFECTIOUS DISEASE PREVENTION AT ORGANIC DAIRY FARMS THROUGH DISINFECTANT USE.** Jennifer Robson, robsonj@findlay.edu, Audra Ligas, Tara Beitzel, Scot Sliwinski, Christopher Pollock, Colin Logan, Matt Hoostal, University of Findlay, Findlay OH 45840.

As organic dairy farms are prohibited from the use of antibiotics, assuring the prevention of infectious diseases is critical to maintain herd health and, thusly, optimize the profitability of organic milk. The objective of this study was to assess the inhibitory effects of iodine disinfectant on the growth of various laboratory pathogens, as well as *Staphylococcus aureus*, *Escherichia coli*, and *Enterococcus aerogenes* isolated from bedding and pasture soil at an organic dairy farm. Growth curves were performed with each bacteria strain at 0.1%, 0.2%, and 0.3% iodine added to complex media, as well as with unamended controls. Among laboratory strains of bacteria, both Gram-negative, as well as Gram-positive strains, were significantly inhibited by the 0.3% iodine ( $P < 0.05$ ), while only Gram-positive strains were inhibited by the 0.2% iodine at  $\alpha = 0.05$ . However, both Gram-positive and Gram-negative isolates from the animal bedding were uninhibited by each treatment ( $P > 0.05$ ). Laboratory strains of the fungi *Candida albicans* and *Aspergillus niger*, as well as *C. albicans* and *A. niger* isolated from dairy pasture soils and animal bedding were uninhibited by 0.3% iodine ( $P > 0.05$ ). However, no microorganisms tested were able to grow at iodine concentrations typically employed at the organic dairy (5-10%). Consequently, while both the type of microorganism and potential adaptation to disinfectants may modulate levels needed for microbial inhibition, the employment of standard levels of iodine may effectively prevent infectious disease at organic dairy farms.

**Poster Board No. 005 DIFFERENCES IN ANTERIOR CRUCIATE LIGAMENT TEAR LENGTH IN MALES AND FEMALES AGES 13-30.** Lisa Adams, s11.ladams@wittenberg.edu, Cathy L. Pederson, cpederson@wittenberg.edu, Richard Phillips, rphillips@wittenberg.edu, Department of Biology, Wittenberg University, Springfield OH 45501.

Young adults are more likely to experience an anterior cruciate ligament tear than males in the same age range. Magnetic Resonance Images (MRIs) were obtained from nine male participants and five female participants, between the ages of 13 and 30, who were diagnosed with a complete or incomplete anterior cruciate ligament (ACL) tear. The MRIs were examined to measure three parameters: the location of the tear from the inferior attachment point, the diameter of the torn ligament, and the distance between the femur and tibia. It was hypothesized that gender would have an impact on the position of the tear. The results were analyzed using a univariate analysis of variance. There was no significant difference in age between the genders, nor was there a significant difference for the position of the tear or diameter of the ACL. However, there was a significant difference in the distance between the femur and tibia from the tear ( $F(1,13) = 7.90, p = .02$ ), with males having a greater distance than females. When the length of the inferior portion of the ACL was taken as a percentage of distance between

the femur and tibia, no significant differences were found between groups ( $p > .05$ ). The length between the tibia and femur may demonstrate a reason why females have a greater risk of ACL tears than males, because there is not much room for the ACL to stretch and react to trauma. From the results, it could be concluded females have a shorter distance between the femur and tibia than males.

**Poster Board No. 006 EFFECTS OF STORM EVENTS ON WATER QUALITY FOR ALUM CREEK NEAR WESTERVILLE OHIO.** Lauren R Kopas<sup>1</sup>, Lauren.kopas@otterbein.edu, Mary H Evert<sup>2</sup>, Mary.evert@otterbein.edu, Joan E Esson<sup>2</sup>, jesson@otterbein.edu, Kevin D Svitana<sup>1</sup>, ksvitana@otterbein.edu, <sup>1</sup>Department of Earth Sciences, <sup>2</sup>Department of Chemistry, Otterbein University, Westerville OH 43081.

Alum Creek is the main source of drinking water for the city of Westerville, Ohio. In the last decade extensive real estate development has occurred in the watershed. Since no documented historic water quality information exists, this study determines the effects of storm events on water quality from along the Alum Creek reservoir south to Schrock Road. The goal is to establish baseline concentrations for select parameters along this reach of the creek. From June through August 2010 sampling and analyses of water from six locations along Alum Creek were completed to assess the impact a storm event has on water quality. A total of three sample periods were recorded prior to and immediately following rainfall events in order to assess the effect of runoff on water quality. Water samples were analyzed for conductivity, salinity, pH, and dissolved oxygen using field meters. Nitrates, phosphates, and turbidity were analyzed in the laboratory using HACH kits, while metal cation concentrations were assessed using Flame Atomic Absorption Spectrometry. Dissolved oxygen and turbidity were found to increase following rainfall by 26.8% and 70%, respectively. However, conductivity and pH decreased by 16% and 8%, respectively. Nitrates and phosphates were found to be highest at two locations that are down gradient from major storm water outlets, suggesting input of nutrients at the outlets. All other parameters displayed no consistent change after rainfall events.

**Poster Board No. 007 INVESTIGATING THE FLUIDITY OF MODEL MEMBRANE SYSTEM UTILIZING FLUORESCENCE POLARIZATION.** Stewart C. Gruey, StewartGruey@walsh.edu, (Nisreen A. Nusair, nnusair@walsh.edu), P.O. Box 410, Walsh University, 2020 E. Maple St, N. Canton OH 44720.

The cell membrane is selectively permeable and controls the movement of substances in and out of cells. It consists of phospholipid bilayer. One remarkable feature of all biological membranes is their fluidity. This fluidity of the phospholipid membrane allows certain molecules such as O<sub>2</sub>, water and other necessary molecules to enter the cell without the use of transport proteins. This study is focused on examining the fluidity of model membrane system utilizing Fluorescence Polarization (FP) Spectroscopy. The model membrane system consists of 1-palmitoyl-2-oleoyl-sn-glycero-3-phosphocholine (POPC) phospholipid bilayers. An increase in the membrane fluidity is depicted as a decrease in FP. The data suggests that unsaturated phospholipids have higher degree of fluidity than saturated phospholipids. Cholesterol, as an integral part of cell membranes, is unique in its ability to cause a wide variety of effects on the physical properties of membrane. The results reveal that cholesterol increases the degree of ordering (decreases the fluidity) of phospholipids in cell membrane. When a cell membrane comes in contact with certain molecules, the fluidity can be affected. These molecules are usually hydrophobic, and are capable of disrupting the fluidity by interacting with the hydrocarbon chains of the phospholipid bilayer. Bupivacaine is a hydrophobic long acting local anesthetic. Fructose is a hydrophilic compound used in the diet for patients with mild and well-balanced diabetes. By understanding the

tendencies of the molecules in water, it can be predicted that the anesthetic will disrupt the membrane more easily than Fructose. Fructose didn't penetrate through the phospholipid bilayers and interacted with the polar head groups on the surface of the phospholipid bilayers. It is observed that the potency of Bupivacaine is higher than that of fructose. The results obtained in this study reveals that the model membrane system can be employed to study the effects of lipid peroxidation on the dynamic properties of cell membrane.

**Poster Board No. 008 EFFECT OF GLUCOSAMINE AND CHONDROITIN SULFATE ON MATRIX METALLOPROTEINS.** Darlene K. Woolf, darlenewoolf@walsh.edu, (Michael J. Dunphy, mdunphy@walsh.edu), Walsh University, 2020 E. Maple St., N. Canton OH 44720.

In this study, the potential inhibitory effects of Glucosamine (GlcN) and/or chondroitin sulfate (CS) on Matrix Metalloproteins 2 and 3 (MMP-2 and MMP-3, respectively) are investigated. MMP-2 and MMP-3 are known to be involved in the degradation of articular cartilage, and when over-expressed, may contribute to osteoarthritis in joints. Recently, Glucosamine (GlcN) and Chondroitin Sulfate (CS) have been sold worldwide as dietary supplements for the treatment of joint pain. The hypothesis of this study is that GlcN and/or CS may function as non-competitive inhibitors of MMP-2 and/or MMP-3. Commercially available MMP-3 and MMP-2 were activated just prior to use by chymotrypsin cleavage and treatment with p-aminomercuric acetate, respectively. The substrate for the enzyme is gelatin that has been treated with succinic anhydride to block primary amines. The succinylated gelatin is purified by dialysis and assayed for total protein with the Bicinchoninic acid assay. MMP digestion of succinylated gelatin produces N-terminal fragments which are then reacted with picrylsulfonic acid to generate a chromophore absorbing at 450 nm. The initial velocity of the enzyme reactions was determined from the slope of the absorbance versus time plots. Potential inhibitory effects of GlcN and CS on MMP-2 and MMP-3 are being assessed using Lineweaver-Burke plots of enzyme initial velocity versus substrate concentration at various concentrations of GlcN and CS.

**Poster Board No. 009 CHARACTERIZING THE PHENOTYPE OF 9.17 HETEROZYGOUS, TRIO HOMOZYGOUS MUTANTS IN THE DROSOPHILA CNS.** April R. Fields, fields\_a@denison.edu, (Eric Liebl, liebl@denison.edu), Denison University, 9104 Slayter Union, Granville, OH 43023.

Directional actin polymerization of axons within the growth cone filopodia, is believed to be a primary event in targeted growth cone outgrowth, and inhibiting tyrosine kinases disrupts axon guidance in specific ways. Liebl et al. has identified a dosage-sensitive genetic interaction between *Abl* (a tyrosine kinase) and a neuronally expressed, Rac/Rho guanine nucleotide exchange factor (GEF), *trio*. Dosage-sensitive genetics suggest *trio*'s protein may interact biochemically with gene mutation *M9.17*'s protein. When the flies are +/+; *trio*<sup>M89/trio</sup><sup>P0368/10</sup>, there is 80% viability which is the *trio* mutant phenotype. This phenotype is dominantly worsened with the *9.17* gene mutation, *M9.17*+; *trio*<sup>M89/trio</sup><sup>P0368/10</sup> where there is only 5% viability. As the *trio* transcript is strongly expressed in the developing nervous system and *trio* mutations show effects on axon path-finding, it is likely that *Drosophila Trio* acts to influence the actin cytoskeleton in the growth cone of CNS axons. To characterize the dosage-sensitive mutation phenotype, embryos were fixed in formaldehyde, stained with monoclonal antibody BP102 that reveals central nervous system structure, cleared, and examined under a microscope. The number of disruptions in commissures within segments in the nerve chord were counted and compared to wild type numbers. A chi square test was done to compare the frequency of normal vs. disrupted segments with a significant difference between the frequency of normal and disrupted segments between

the *M9.17* heterozygous, *trio* heterozygous control embryos and the experimental embryos, *M9.17* heterozygous, *trio* homozygous (179.2,  $p < .05$ ). However, of the 182 segments of the experimental embryos, 12.6% were disrupted and came from only two embryos. Future directions will be to stain the mutant embryos with monoclonal antibody 1D4 to visualize multiple dendritic (MD) neurons, long fascicles, and axon extension in the peripheral nervous system (PNS) rather than focus on the nerve cord of the CNS for characterizing the mutant because *sequoia*, the gene recently discovered to have the gene mutation *M9.17*, may dominantly effect the *trio* mutation in different locations of the nervous system.

**Poster Board No. 010 VARIABILITY IN LEAF LITTER N CONCENTRATION OF ACER RUBRUM GROWING IN DIFFERENT ENVIRONMENTS.** Natasha M. Collins, collinnm@mountunion.edu, (C. McClaugherty mcclauca@mountunion.edu), University of Mount Union, 1972 Clark Ave, Mailbox #472, Alliance OH 44601.

Leaf litter has a major role in the flow of nutrients from plants to soil. In most terrestrial ecosystems nitrogen is limiting. The retranslocation of N occurs prior to abscission in most deciduous trees. *Acer rubrum* is interesting because it has a wide environmental tolerance and is able to grow in sites with variable fertility. This study examines the [N] in *A. rubrum* litter across different environmental conditions on soils of the glaciated Allegheny plateau in northeastern Ohio. This study will examine whether *A. rubrum* withdraws N from senescing foliage to a common, species-specific base level, or if the level is influenced by the environment. It is hypothesized that *A. rubrum* trees will shed litters that differ in [N] among sites in different environmental conditions. It can be anticipated that the N content of soil could in turn correlate with the [N] of abscised litter. Freshly fallen *A. rubrum* leaf litter was collected from beneath two trees at each of six sites (two samples per site) then dried and ground separately. [N] will be measured as Total Kjeldahl N (TKN). Soil samples (three per site) were collected and combined within sites for TKN and organic matter analysis. The [N] in both leaves and soil will be analyzed using ANOVA with site as the independent variable. Correlation coefficients will be determined for [N] in soils and litter.

**Poster Board No. 011 COMPARISON OF POLLEN  $\delta^{13}C$  VALUES FROM A SUBTROPICAL FIELD STUDY AND LABORATORY GROWTH CHAMBER EXPERIMENTS AND THEIR POTENTIAL USE AS PALEOTEMPERATURE PROXIES.** Daniel King<sup>1</sup>, kingdp@mountunion.edu, Katrina Foelber<sup>2</sup>, Brian Schubert<sup>2</sup>, bschube@hawaii.edu, A. Hope Jahren<sup>2</sup>, jahren@hawaii.edu, <sup>1</sup>University of Mount Union, Student in Biology, Alliance OH 44601 and <sup>2</sup>University of Hawaii, Dept of Geology and Geophysics, Honolulu HI 96822.

The morphology and quantity of pollen assemblages in temperate terrestrial and marine sediment cores often provides descriptive and qualitative paleotemperature data. However, quantitative paleotemperature data are necessary in order to more accurately reconstruct paleoclimate change models. In this experiment, field collections and growth chamber experiments were conducted in order to determine if temperature was directly correlated with the  $\delta^{13}C$  value of pollen assemblages. Field pollen was collected from five species of *Hibiscus* at eleven locations across Oahu and Kauai, Hawaii, with a maximum of three species gathered at any one site. A positive correlation ( $r^2 > 0.6$ ,  $n > 100$ ) between the mean July 2008 and 2010 temperatures and the  $\delta^{13}C$  value of *Hibiscus* pollen was discovered. In contrast, growth chamber studies with *Brassica rapa* indicated a weaker correlation ( $r^2 < 0.1$ ,  $n > 60$ ) between the average growth temperature and the  $\delta^{13}C$  value of *B. rapa* pollen. Therefore, the growth chamber studies suggest that the  $\delta^{13}C$  values in field studies are influenced by other variables such as irradiance, precipitation, or wind speed.

**Poster Board No. 012 TISSUE MOVEMENTS DURING GROWTH IN HYDRA: MOVEMENTS AT THE HEAD END.** B. Cody Adkinson, adkinsbc@mountunion.edu, (Leonard G. Epp, epplg@mountunion.edu), University of Mount Union, 1972 Clark Ave., Alliance OH 44601.

Growth in hydra involves continuous cell proliferation balanced by bud formation and by loss of cells from the base and tentacle tips of the animal. Transgenic animals incorporating Green Fluorescent Protein in the endoderm (gastrodermis) and Red Fluorescent Protein in the ectoderm (epidermis) were used to investigate the migration of cells and tissues at the head end of hydra during steady-state growth. It was hypothesized that migration and replacement of tissues would be continuous and of equal rate in the two layers. However, observations after grafting proximal and distal animal halves between transgenic and normal steady-state animals ( $n=11$ ) reveal that ectoderm migrates and turns over much faster than endoderm. For example replacement of ectoderm along the length of the tentacles takes about 7 days post grafting while replacement of tentacular endoderm takes approximately 10 days. In addition, both tissue layers appear to be replaced extremely slowly at the very tips of the tentacles as compared to the tentacles proper with ectoderm not demonstrating fluorescence at the tentacle tips until 9 days post grafting and endoderm still non-fluorescent at the very tips after 23 days. Investigations involving tissue movements during conditions such as starvation and regeneration are also underway.

**Poster Board No. 013 TISSUE MOVEMENTS DURING GROWTH IN HYDRA: MOVEMENTS AT THE FOOT END.** Anh H. Vu, vuah@mountunion.edu, (Leonard G. Epp, epplg@mountunion.edu), Mount Union College, 1972 Clark Ave., Alliance OH 44601.

Growth in hydra involves continuous cell proliferation balanced by bud production and by loss of cells from the base and tentacle tips of the animal. Transgenic animals incorporating Green Fluorescent Protein in the endoderm (gastrodermis) and Red Fluorescent Protein in the ectoderm (epidermis) were used to investigate the migration of cells and tissues at the foot end of hydra during steady-state growth. It was hypothesized that migration of tissues would be continuous and of equal rate in the two layers. Observations after grafting proximal and distal halves of marked and unmarked steady-state animals ( $n=10$ ) revealed that as tissues proliferate ectoderm migrates much faster than does endoderm. Nearly all peduncle ectoderm is replaced in as little as a single day after grafting, while the corresponding endodermal tissue takes as long as 5 days. Tissues actually forming the basal disk at the very bottom of the peduncle remain non-fluorescent for up to 9 days, much longer than would be predicted from turnover of the peduncle tissue just above it. The presence of a developing bud near the graft site decreases the ability of tissues to migrate into the peduncle. As expected, sloughing of ectodermal tissue occurs at the basal end of the animal. However, loss of endodermal cells appears to be by sloughing into the gastrovascular cavity followed by loss through the mouth. Investigations involving tissue movements during starvation, regeneration and budding are also underway.

**Poster Board No. 014 THE EFFECTS OF VITAMIN B12 ON FROZEN-THAWED BOAR SEMEN.** Alysha M. Hyde, hydea@findlay.edu, Lauren Elsea, elseal@findlay.edu, (Brian D. Whitaker, whitaker@findlay.edu), College of Sciences, The University of Findlay, 1000 North Main Street, Findlay OH 45840.

Oxidative stress on sperm is believed to be a contributing factor to the relatively low success rate of *in vitro* fertilization (IVF) in pigs. Vitamin B12 is important for cellular replication and the synthesis of RNA and DNA however its interaction with frozen-thawed boar semen has not been evaluated although it has been used as a treatment for male infertility in humans. This study



was conducted to evaluate the effects of adding different concentrations of vitamin b12 supplemented to the incubation medium of frozen-thawed boar semen stored in liquid nitrogen. Concentrations of vitamin b12 (0, 0.5, 1.0, 2.0  $\mu\text{M}$ ) were warmed to 39 °C and evaluated for their effects on the total percent of spermatozoa demonstrating forward progressive motility and viability after 1 h post-thawing. At 1 hour after thawing there was no significant difference in forward progressive motility between the control and the 2  $\mu\text{M}$  or the 0.5  $\mu\text{M}$  and the 1  $\mu\text{M}$  B12 supplemented groups. Forward progressive motility of the 0.5  $\mu\text{M}$  and 1  $\mu\text{M}$  groups were significantly higher ( $P < 0.05$ ) than the control and 2  $\mu\text{M}$  Vitamin B12 supplemented groups. At 1 hour after thawing there was no significant difference in the viability between the control, 1 and 2  $\mu\text{M}$  group. Viability of the 0.5  $\mu\text{M}$  group was significantly higher ( $P < 0.05$ ) than the control and the other supplemented groups. Fertilization success was evaluated 12 h after oocyte fertilization and embryo development was analyzed at 48 h and 144 h post-fertilization. Data will be analyzed by ANOVA.

**Poster Board No. 015 THE EFFECT OF DIETARY SELENIUM SUPPLEMENTS ON SPERM DNA FRAGMENTATION, FERTILIZATION, AND EMBRYONIC DEVELOPMENT IN BOARS.** Audra Ligas<sup>1</sup>, ligasa@findlay.edu, Ashley Okon<sup>1</sup>, okona@findlay.edu, Lauren Elsea<sup>1</sup>, elseal@findlay.edu, Mark Estienne<sup>2</sup>, mestienn@vt.edu, (Brian D. Whitaker<sup>1</sup>, whitaker@findlay.edu), <sup>1</sup>College of Sciences, The University of Findlay, 1000 North Main Street, Findlay OH 45840 and <sup>2</sup>Virginia Tech.

This study compares the spermatozoan DNA fragmentation, fertilization, and embryonic development after thawing semen from boars fed diets supplemented with organic or inorganic sources of selenium. The freezing and thawing of boar semen causes physical and chemical stress on spermatozoa which decreases *in vitro* fertilization success rates of oocytes. At weaning, crossbred boars were assigned to one of three dietary treatments: I. basal diets with no supplemental selenium (control), II. basal diets supplemented with 0.3 ppm organic selenium (Sel-Plex) and, III. basal diets supplemented with 0.3 ppm sodium selenite ( $n = 6$  boars/treatment). At sexual maturity semen was collected, processed, and extended using a yolk-based media and frozen in 5.0 mL straws in a Cryo-Med chamber to control the freezing rate. A semen straw from each boar was thawed and incubated for 1 h at 39°C and 5%  $\text{CO}_2$ . Spermatozoa will be evaluated for DNA fragmentation using single cell gel electrophoresis or Comet assay and silver staining. Oocytes will be fixed and stained 48 hours after IVF with 1% orcein to permit visualization of nuclear material, appearance of polyspermic penetration and male pronuclear formation using a phase-contrast microscope at 400x. Embryos will be evaluated for cleavage and blastocyst formation under a stereomicroscope at 48 and 144 hours after IVF. Data will be analyzed by ANOVA.

**Poster Board No. 016 REEFS IN HIGH WAVE ENERGY AREAS HAVE GREATER CORAL COVERAGE THAN REEFS IN LOW WAVE ENERGY AREAS ON SAN SALVADOR, THE BAHAMAS.** William G. McKelvey, s10.wmckelvey@wittenberg.edu, Lewis W. Hebert, s12.lhebert@wittenberg.edu, Dr. James M. Welch, jwelch@wittenberg.edu, Dr. Kathleen A. Reinsel, kreinsel@wittenberg.edu, Dr. Richard S. Phillips, rphillips@wittenberg.edu) Department of Biology, Wittenberg University, PO Box 720, Springfield OH 45501.

Coral are sessile colonies of polyps that obtain most of their energy and nutrients from endosymbiotic microalgae called zooxanthellae. Corals compete for space on reefs with macroalgae, which can overgrow coral or shade it. Over the past several decades, many coral reefs have shifted from a coral-dominated state to an algal-dominated state. What controls this phase shift, however, is unknown. It was hypothesized that reefs in high wave energy areas would have greater coral coverage than reefs in low wave energy areas. Two reefs on San Salvador, The Bahamas were studied: Sand Dollar Reef and Monument

Reef, a high wave energy site and a low wave energy site, respectively. The wave energy of each site was confirmed by examining average sediment grain size at each site; 0.5 mm at Sand Dollar Reef and 0.125 mm at Monument Reef. Coral and algae cover on each reef was determined using a 1m<sup>2</sup> quadrat that was evenly divided into 16 equal square sectors. The dominant organism (coral or algae) in each sector was determined by visual inspection and values for each quadrat were converted to percent cover. Sand Dollar Reef exhibited 27% coral cover while Monument Reef showed 14% coral cover. These data support the hypothesis that there is an increase in coral cover in higher wave energy environments. The higher wave energy environment may produce an increase in coral cover by preventing sediment from covering the coral, or by making it more difficult for macroalgae to settle on the reef.

**Poster Board No. 017 BURROW FIDELITY OF BLACK LAND CRABS, *GECARCINUS RURICOLA*, IN SAN SALVADOR, THE BAHAMAS.** Benjamin A. Rausch, s13.brausch@wittenberg.edu, Sarah E. Reilly, s13.sreilly@wittenberg.edu, Tasha J. Boerst, s13.tboerst@wittenberg.edu, James M. Welch, jwelch@wittenberg.edu, Kathleen A. Reinsel, kreinsel@wittenberg.edu, Richard R. Phillips, rphillips@wittenberg.edu, Wittenberg University, P.O. Box 6100 Box 1714, Springfield, OH 45501.

*Gecarcinus ruricola*, black land crabs, use their rocky burrows near the shoreline to prevent desiccation and provide shelter from predators. Given the importance of burrows to crabs, we hypothesized *G. ruricola* would exhibit burrow fidelity. The study was conducted along rock walls lining the roads of the Gerace Research Centre in San Salvador, Bahamas. Crabs ( $n=30$ ) were captured by pouring water into their burrows, marked with individual marks and returned to the same burrow from which they were captured. Crabs were allowed 24 h to disperse back into the population. The burrows of the original crabs were checked 4 additional times over one week for the presence of a crab, unmarked or marked. Examination of burrows revealed that 1 crab had died, reducing our sample size to 29. Of the marked crabs, only 2 (6.9 %) were ever recaptured, but they were in their original burrows, exhibiting burrow fidelity. At some point during the burrow examinations 9 (7.5%) of the burrows were occupied by an unmarked crab. It was observed that 93.1% *G. ruricola* did not exhibit apparent burrow fidelity. The crabs that did exhibit burrow fidelity may have been either geographically trapped or experienced an excess of human traffic, which may have forced them to stay in their original burrow. Perhaps, *G. ruricola* did not exhibit burrow fidelity because it takes less energy to use the closest available burrow rather than always returning to their initial burrow after foraging.

**Poster Board No. 018 ACTIVE AND ABANDONED SITES OF *CASTOR CANADENSIS* ON THE RECLAIMED STRIP MINE SITE IN OHIO KNOWN AS THE WILDS.** Kyle R. Axe kaxe@muskingum.edu, (James L. Dooley Jr. jdooley@muskingum.edu) Muskingum University 163 Stormont St, New Concord Ohio 43762.

The American Beaver, *Castor canadensis*, is well documented for its behavior and ability to alter habitats both physically and chemically. Beavers create lodges and dams, and as a consequence often create habitat that is actually important for other animals and plants. The study area is a densely wooded reclaimed strip mine area north of State Route 146 which encompasses 600.27 square meters. The variables include: is the site active or abandoned, distance to nearest pond, distance to nearest beaver impoundment, relative water size, and latitude and longitude coordinates to create a GIS map of beaver locations as well as analyze spatial relationships. Beaver on this reclaimed strip-mine site exhibit high population abundance owing to the fact that the beaver have been without hunting pressures for over twenty years. I studied beaver activity at 14 active sites and 5 inactive sites. The

most common water type at the wilds was ponds. The average distance of active sites to nearest dam was 182 meters, and the average distance to the nearest abandoned site was 118 meters. The average distance to nearest water for active sites was 127 meters, and for the abandoned sites the average distance was 123.5 meters. The nearest road for active sites was 402.1 meters, and the average distances for abandoned sites were 627 meters. Little research has been conducted on reclaimed strip mine sites in regards to activity and abundance of *Castor canadensis*; therefore conducting work at the Wilds in Southeast Ohio provides an important opportunity for research.

**Poster Board No. 019 INTEGRATING MULTI-SCALE ENVIRONMENTAL DATA TO DETERMINE FACTORS AFFECTING THE DISTRIBUTION OF THREE SYMPATRIC PLETHODONTID SALAMANDER SPECIES** Chelsea L. Fahy, fahyc@findlay.edu<sup>1</sup>, Eden Dulka, dulkae@findlay.edu<sup>1</sup>, Jessica A. Wooten Ph.D., wooten@findlay.edu<sup>1</sup>, William Sutton Ph.D., billsutton.wv@gmail.com<sup>2</sup>, Thomas K. Pauley Ph.D., pauley@marshall.edu<sup>3</sup>, <sup>1</sup>The University of Findlay, Department of Natural Sciences, 1000 N. Main Street, Findlay OH 45840, <sup>2</sup>Alabama A&M, Department of Forestry, Normal AL & <sup>3</sup>Marshall University, Department of Biological Sciences, Huntington WV.

We used ecological niche models (ENM), maximum entropy algorithms, and climate and vegetation variables to investigate biogeographical patterns of three sympatric plethodontid salamanders. At the local scale, we used 30-years of field-collected data and an information-theoretic approach to evaluate multiple habitat models that best identified microhabitat features that may limit the distribution of these species. At the landscape scale, we used presence-only data combined with 19 climate and four vegetation variables to predict suitable habitat using ecological niche modeling. The ENM overpredicted the known geographic range for each species. For *Plethodon nettingi*, the ENM was restricted to some of the highest peaks in the Appalachian Mountains, whereas the predicted ranges for *Plethodon cinereus* and *Desmognathus ochrophaeus* were distributed throughout eastern North America. At the local scale, all three species were best predicted by two bivariate models including, aspect and elevation and presence of historical fire and emergent rocks; however, the relationships and model parameters were different for each of the species. Our analyses suggest that abiotic factors do not limit the distribution of these species, and other factors, such as geographic or biotic, actually limiting. At the local scale, our analyses suggested that the distribution of *P. nettingi* is due to landscape disturbance (e.g., clearcut harvesting and widespread wildfires) and the resulting competitive interactions among these ecologically similar species. Although *D. ochrophaeus* and *P. cinereus* were undoubtedly affected by these disturbances, they appear to tolerate broad microclimate and microhabitat characteristics and therefore have a less restricted distribution than *P. nettingi*.

**Poster Board No. 020 STRONG HABITAT SEGREGATION IN SYMPATRY: THE SURPRISING LACK OF AGGRESSION IN TWO SPECIES OF DUSKY SALAMANDERS (GENUS DESMOGNATHUS) FROM THE SOUTHERN APPALACHIAN MOUNTAINS.** Kelsey Stoll<sup>1</sup>, stollk@findlay.edu, Carlos D. Camp, Ph.D. 2, ccamp@piedmont.edu, Jessica A. Wooten<sup>1</sup>, wooten@findlay.edu, <sup>1</sup>The University of Findlay Department of Natural Sciences, 1000 N Main St Findlay OH 45840 and <sup>2</sup>Piedmont College Department of Biology, 165 Central Ave, Demorest GA 30535.

Other than the fact that the Black-bellied Salamander, *Desmognathus quadramaculatus* and the Dwarf Black-bellied Salamander, *Desmognathus folkertsi* are mostly sympatric, little is known about the ecological relationship between these two species. The aim of the study was to test whether salamanders actively avoid the presence of another salamander, whether a conspecific or heterospecific. We collected 30 allopatric *D. folkertsi*, 30 allopatric *D. quadramaculatus*, and 30 of each species from the same sympatric site. Each test consisted of placing two

salamanders or a salamander and a control into a neutral chamber. We measured the time for a salamander to escape the chamber through exists provided on the opposite sites. Each salamander was used in three trials. We then independently tested differences among treatments in time to escape using a Kaplan-Meier survival analysis, a non-parametric test that uses  $\chi^2$  to test for differences in cumulative survival functions among groups. There was a significant difference in escape time for allopatric *D. folkertsi* ( $\chi^2 = 10.512$ ,  $p = 0.0052$ ). There also was a significant difference in escape time for allopatric *D. quadramaculatus* ( $\chi^2 = 18.483$ ,  $p < 0.0001$ ). In both cases, the test salamander escaped the chamber housing another salamander, regardless of species, faster than one housing the control. Neither the absence of aggression nor the abundance of resources satisfactorily explains the strong habitat segregation exhibited by the two species in sympatry. Whatever the cause(s) of segregation, *D. folkertsi* has a clear advantage over *D. quadramaculatus* in small streams, while the reverse is true in large streams.

**Poster Board No. 021 PHYLOGENETIC ANALYSIS SUPPORTS MORPHOLOGICAL ISOMETRY IN AN ADAPTIVE RADIATION OF SALAMANDERS (PLETHODONTIDAE: DESMOGNATHUS).** Charles W. Starkey<sup>1</sup>, starkeyc@findlay.edu, Jessica A. Wooten Ph.D. <sup>1</sup>, wooten@findlay.edu, Justin C. Bagley Ph.D. Candidate<sup>2</sup>, justin.bagley@byu.edu, <sup>1</sup>The University of Findlay, Department of Natural Sciences, 1000 N Main St, Findlay OH 45840 and <sup>2</sup>Evolutionary Ecology Laboratories, 410 WIDB (Widsoe), Department of Biology, Brigham Young University, Provo UT 84602-5535.

In nature, allometric scaling relationships are rarely isometric (slope,  $b = 1$ ) due to structural and functional constraints. However, traditional regression models suggest adult *Desmognathus* salamander morphology exhibits isometric growth. Unfortunately, such tests may have been invalid since they did not control for phylogenetic relatedness. We evaluated morphometric isometry among mature *Desmognathus* using a candidate model analysis considering nine trait evolution models based on phylogenetic generalized least squares (GLS) regression. Nonphylogenetic models often (78.6%) fit the data equally or better than phylogenetic models, despite evidence for phylogenetic signal. Overall (85.7%), best-fit and multimodel inferences supported isometry (hypermorphosis), corroborating previous findings. This suggests selection has been on size and its ecological correlates during *Desmognathus* evolution. These findings support the hypothesis that phylogenetic nonindependence may be a less severe problem for evolutionary allometry of morphometric data, and they predict phylogeny should generally be unimportant for understanding allometry of morphologically conservative adaptive radiations.

**Poster Board No. 022 THE PRESENCE OF METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS (MRSA) IN LOCAL DAIRY CALVES WATER SUPPLIES.** Nicole R. Dively, divelyn@findlay.edu, Michael E. Pesato, pesatom@findlay.edu, Jennifer L. Smith, smithj2@findlay.edu, Amy C. Lack, lacka@findlay.edu, (Bethany Henderson-Dean, Advisor) University of Findlay, #320 1000 North Main Street, Findlay OH 45840.

Since the advent of antibiotics, scientists have determined that increased use of antibiotics correlates to an increased frequency of antibiotic resistance. Thusly, antibiotic resistance is a continual and growing problem worldwide in both human and animal medicine. One such example of antibiotic overuse is the increased prevalence of methicillin-resistant *Staphylococcus aureus*, MRSA, as a humanosis and more recently as a zoonosis. MRSA transmission has been well documented in multiple animal species around the world with most studies focusing on equine and swine populations. This research focuses on the presence of MRSA in calves' and their water supplies from two Hancock area dairy farms. The hypothesis of this study is that MRSA will be isolated from calves' and their water supplies and that MRSA isolates will be ca-MRSA strains. Twenty



water samples were taken at random from calves' buckets. The water samples were then concentrated and plated on a selective agar. Water samples were also analyzed for ammonia levels, nitrate levels, pH, dissolved oxygen levels, and water temperature to determine if certain water conditions enhanced the prevalence of MRSA. MRSA isolates were isolated from 75% of the samples. ANOVA analysis will be performed to determine if water conditions affected MRSA prevalence. Additionally, PCR screening will be completed to spa-type MRSA isolates to determine if they are ca-MRSA or ha-MRSA strains.

**Poster Board No. 023 MACROINVERTEBRATES OF TREE HOLE WATERS ON THE KENT STATE UNIVERSITY STARK CAMPUS (STARK COUNTY, OH).** Kristen L. Kolar, [kkolar@kent.edu](mailto:kkolar@kent.edu), (Robert Hamilton IV, [rhamilt6@kent.edu](mailto:rhamilt6@kent.edu)), Kent State University at Stark, 6000 Frank Ave NW, North Canton OH 44720.

The purpose of this project is to determine the prevalence of tree holes and examine the composition and seasonality of the invertebrate community within. The goals of this study are to measure the water volume, pH, temperature, and dissolved oxygen content within each tree hole to determine how these characteristics may influence invertebrate community structure and persistence. It is hypothesized that analyzing these physical and chemical characteristics will increase knowledge about the structure and dynamics of tree hole invertebrate communities. Sampling is ongoing, beginning during September of 2010 and continuing until December of 2011, and conducted on the 81-hectare Stark Campus in three habitats of differing tree densities – the center of a forest remnant, the edges of the forest remnant, and the center of the campus, between buildings. The analysis began by taking weekly samples starting in September and will resume with the end of freezing weather conditions (likely in March). Collected invertebrates are preserved in 70% ethanol. The invertebrates and abiotic tree hole characteristics will be summarized and compared using descriptive statistics and analyses of variance (ANOVAs). Correlation analyses will be used to determine relationships, if they exist, between the measured tree hole characteristics and the invertebrate community structure and persistence. Graphs will then be designed to illustrate the dynamics of tree hole communities and the physical and chemical properties that may impact these communities.

**Poster Board No. 024 INVESTIGATIONS INTO ECOLOGICAL SPECIATION IN AGKISTRODON.** Mary Talbott, [talbottm@findlay.edu](mailto:talbottm@findlay.edu), William Sutton Ph.D., [billsutton.wv@gmail.com](mailto:billsutton.wv@gmail.com), Jessica A. Wooten Ph.D., [wooten@findlay.edu](mailto:wooten@findlay.edu), <sup>1</sup>The University of Findlay, Department of Natural Sciences, 1000 N. Main Street, Findlay OH 45840 & <sup>2</sup>Alabama A&M, Department of Forestry, Normal AL.

*Agkistrodon*, a group of pitviper snakes, contains three polytypic and widely distributed species, including the cantils, copperheads, and cottonmouths. Cottonmouths and copperheads range throughout much of the eastern and central United States and inhabit a wide range of habitats, whereas cantils are endemic to Central America. Currently, there are five known subspecies of copperheads and three nominal subspecies of cottonmouth pitvipers. Some researchers have suggested that there are species-level genetic differences, which suggests that there may be undiscovered and possibly cryptic biodiversity within *Agkistrodon*. Using published phylogenies and ecological niche modeling, we tested for ecological differences among subspecies. Ecological niche models use presence-only data to estimate the geographic locations in which an organism should occur based on climate (i.e., temperature and precipitation) and vegetation. If the ecological niche model predicts outside of the known range, then we expect that other limiting factors (e.g., competition, predation) influence the distribution of these subspecies. Preliminary results from the ecological niche models and analyses indicated that abiotic requirements of temperature and vegetation limit the geographic distribution of the

*Agkistrodon* subspecies. In the future, DIVA-GIS and ArcGIS will be used to extract unique climate (e.g., temperature and precipitation) and vegetation data (e.g., levels of greenness and percent tree canopy cover) to statistically test for fundamental niche differences among the aforementioned subspecies. Finally, we are particularly interested in testing for niche conservatism at the subspecies and species levels using jackknife and independent samples t-test. These results will provide insights into the levels of ecological species that may exist in this closely related group of vipers.

**Poster Board No. 025 INVESTIGATIONS INTO HYBRIDIZATION BETWEEN PLETHODON CHATTAHOOCHEE AND PLETHODON SHERMANI: EVIDENCE OF ANCIENT HYBRIDIZATION IN GEORGIA.** Nathan M. Richey<sup>1</sup>, [richeyn@findlay.edu](mailto:richeyn@findlay.edu), Jessica A. Wooten Ph.D.<sup>1</sup>, [wooten@findlay.edu](mailto:wooten@findlay.edu), Carlos Camp Ph.D.<sup>2</sup>, [ccamp@piedmont.edu](mailto:ccamp@piedmont.edu), <sup>1</sup>The University of Findlay, Department of Natural Sciences, 1000 N. Main Street, Findlay OH 45840 & <sup>2</sup>Piedmont College, Department of Biology, 165 Central Ave, Demorest GA 30535.

This study investigated the levels of: 1) biodiversity among populations of *P. chatahoochee*, and 2) ancient hybridization and the influence of *P. shermani* genes in high-elevation populations of *P. chatahoochee* in Georgia. Hybridization among *Plethodon shermani*, the Red-legged Salamander, and salamander species from within the *Plethodon glutinosus* complex, the Slimy Salamanders, has been documented. However, in Georgia, *P. shermani* populations have been extirpated, yet evidence of hybridization with *Plethodon chatahoochee*, Chatahoochee Slimy Salamander, is readily observed by the presence of red spots on the forelimbs in some high elevation populations. Because previous research has shown that allozymes underestimate the levels of biodiversity and it is known that there are high levels of biodiversity in mountainous regions, our study was two-fold. Sequences totaling 2800 nucleotides for the RAG1 nuclear gene, and two mitochondrial gene portions (ND2 and cytb) were analyzed using maximum likelihood and Bayesian analyses to create a phylogenetic hypothesis to investigate the levels of gene diversity and ancient hybridization in *P. chatahoochee* and *P. shermani* in 74 populations in Georgia. There was evidence of *P. shermani* influence as far south as Dick's Creek Gap (elevation ~ 760 m) and on Kelly Knob (elevation > 1066 m) and Brasstown Bald (elevation > 1372 m) in Georgia. Results suggest that there is at least one unique evolutionary lineage that is both genetically and morphologically distinct from the other *P. chatahoochee* populations. A species description is forthcoming.

**Poster Board No. 026 QUANTITATIVE ANALYSIS OF HAPTIC PERFORMANCE USING HUMAN MACHINE INTERACTION AND MULTI-TASK PERFORMANCE MODEL.** Melissa A. Jones, [jones.497@wright.edu](mailto:jones.497@wright.edu), (Dr. Chandler A. Phillips, [chandler.phillips@wright.edu](mailto:chandler.phillips@wright.edu)), Wright State University, 2706 Gardenia Avenue, Beavercreek OH 45431.

Previous haptic research characterized a human-machine-interaction model for a human operator performing five simultaneous tasks using a common joystick and MATB programming. To further develop this research, the tasks: lights, dials, tracking, frequencies and channels, were performed using a force feedback haptic stick. The human-machine-interaction model was redesigned to reflect a randomized study to test operator performance on tasks using both haptic feedback and no haptic feedback. Subjects performed in two 20-minute trials during one of which the feedback was activated and in the other, the feedback was inactivated. Three levels of total machine-initiated baud rate (BIN) were generated and three human operator baud rates (BO) were recorded during testing. The total baud ratio ( $B$ ) is defined as the ratio of BO to BIN. The research refined the previously developed human-machine-interaction model and studied operational interaction with the addition of haptic feedback. As the



input baud rate increased, the output baud rate decreased, resulting in a lower performance score. The addition of haptic feedback improves performance in tracking but minimally affects the other tasks. Additionally, results indicate an improvement in the overall effectiveness of human performance in multiple task information processing using force feedback.

**Poster Board No. 027 ASSESSING THE QUALITY OF HONEYSUCKLE LEAVES AS A SOURCE OF ORGANIC MATTER IN STREAMS.** Kristen M. Shearer, s12.kshearer@wittenberg.edu, Chad M. Rigsby, s11.crigsby@wittenberg.edu, (Horton H. Hobbs III, hhobbs@wittenberg.edu), Department of Biology, Wittenberg University, Springfield OH 45501.

*Lonicera maackii* (Amur honeysuckle, Caprifoliaceae) is an invasive North American shrub, and its takeover of much of the riparian zones results in a large organic material input from this species to streams. However, this species has deleterious effects on other plant species as well as herbivores by way of phytotoxic compounds stored in its tissues in the terrestrial environment. The quality of *L. maackii* as an organic carbon source in stream systems was accessed by several means. The decomposition rate and macroinvertebrate colonization of *L. maackii* leaves were determined by placing leafpacks along a 50m reach of the Little Miami River, Clark County, OH, and collecting four replicate samples weekly over 90 days. The fraction of biodegradable organic carbon supplied by the leached leaf material can be determined using fluorescence spectroscopy, incubating a leachate/microbe slurry for 30 days and subtracting the final low molecular-weight fraction from the initial fraction. Microbial stress as a result of exposure to *L. maackii* is measured using similar incubation experiments and calculating a metabolic quotient for each treatment, found by dividing the respiratory carbon production rate by bacterial biomass. This rate is calculated by converting the dissolved oxygen lost in each incubation into units of carbon and then dividing by the incubation time. Bacterial biomass is estimated by staining ATP with a fluorescing stain and measuring fluorescing intensities with a spectrometer. Data from additional experiments allows for an assessment of the quality of organic matter that *L. maackii* can provide to stream ecosystems.

**Poster Board No. 028 TOXICITY OF LEAF EXTRACTS OF ACER SPP. ON EQUINE ERYTHROCYTES.** Stacey A. Schall, stacey\_schall@yahoo.com, Jeffrey S. Lehman, jlehman@otterbein.edu, 1 South Grove St., Department of Biology and Earth Science, Otterbein University, Westerville OH 43081.

Ingestion of wilted *Acer rubrum* (red maple) leaves by equids can result in red maple toxicosis due to erythrocyte hemolysis and methemoglobin production. The objective was to evaluate the toxicity of extracts of dried leaves of *A. rubrum* and related species *A. platanoides*, *A. nigrum*, *A. saccharinum*, *A. saccharum*, and *A. negundo* on equine erythrocytes. Dried leaves (1g) were ground in dH<sub>2</sub>O (10ml) and filtered (45µm). Volumes of extracts (0, 25, 75, 100, and 200µl) were added to 1.0ml of washed and buffered equine erythrocytes and incubated at 37C for 2 hours. Individual samples (25µl) were added to NaCl solutions (1ml) ranging from 0.0 to 0.9% and centrifuged (2,800×g; 15 min). Absorbencies of supernatants were recorded at 560, 576, and 630 nm to determine percentage hemolysis (%H) and percent methemoglobin (%M). %H was plotted against %NaCl to calculate area under hemolytic curve (AUHC). Linear regression and ANOVA were used to evaluate differences between individual *A. rubrum* trees and between species. Experiments consisted of 3 replications and were repeated twice. Increased amounts of extract resulted in increased %H and %M and were defined by linear equations AUHC=0.115×(µl extract)+16.243 ( $P=0.001$ ,  $R^2=0.90$ ) and %M=0.2254×(µl extract)+9.0979 ( $P=0.001$ ,  $R^2=0.91$ ). AUHC and %M were highly correlated ( $R=0.99$ ). There was no significant variation between individual *A. rubrum* trees for AUHC. %M for individual trees differed significantly for treatments 50 and 75µl, but not for 0 and 25µl. For

treatments 25, 50, and 75µl, there was significant variation between species for AUHC. AUHC of *A. platanoides* and *A. nigrum* for treatments 25, 50, and 75µl were not statistically different than the control (no extract added). *A. saccharinum*, *A. saccharum*, and *A. negundo* caused the greatest hemolysis of the species tested. *A. rubrum* extracts are toxic to equine erythrocytes and follow a linear increase with concentration. Individual *A. rubrum* trees did not vary greatly for toxicity; however, there was significant variation in toxicity between *Acer* species.

**Poster Board No. 029 RATES OF EVOLUTION IN CHLOROPHYLLOUS AND ACHLOROPHYLLOUS ORCHIDS.** Cameron M. Conard<sup>1</sup>, cameron.conard@otterbein.edu, Erik P. Rothacker<sup>1,2</sup>, erothacker@otterbein.edu, Jeffrey S. Lehman<sup>1</sup>, jlehman@otterbein.edu, <sup>1</sup>1 South Grove St., Department of Biology and Earth Science, Otterbein University, Westerville OH 43081 & <sup>2</sup>1735 Neil Avenue, Center for Life Science Education, Ohio State University, Columbus OH 43210.

Chloroplast loci are used routinely to determine the phylogenetic relationships of plants. Many loci found here are critical in photosynthesis and are evolutionarily conserved; mutations in the chloroplast genome can result in the inability to photosynthesize. In instances of plants becoming parasitic and losing chlorophyll, the functional constraints on the chloroplast genome are relaxed. The Epidendroideae (Orchidaceae) is the largest subfamily containing 80% of orchid diversity. The 6 tribes of the basal Epidendroidieae have taxa that are chlorophyllous or achlorophyllous. Traditionally, species of *Gastrodia* have been categorized primarily based on the characteristic that they lack chlorophyll and all have morphology indicative of that, which in orchids has been shown to be the result of convergence. Using genetic markers it is possible to obtain a physical genetic map of the *Gastrodia* chloroplast genome and DNA sequences for phylogenetic and evolutionary studies. The objective of this research is to determine rates of chloroplast evolution in achlorophyllous *Gastrodia* spp. and whether achlorophyllous species show greater variability than chlorophyllous orchids. Total DNA from 10 species from different genera representing four tribes of the basal Epidendroideae was amplified with primers designed for the Large Inverted Repeat and sequenced. Sequence contigs were assembled with Sequencher 3.1.1 and aligned using Clustal X. Phylogenetic analysis was performed in PAUP. Analysis indicates that achlorophyllous orchids do possess these loci and exhibit size variation when compared to green relatives.

**Poster Board No. 030 CATALYTIC, ASYMMETRIC, INTERMOLECULAR IMINO-ENE CHEMISTRY.** Tiffany A. Stine, Tiffany.Stine@otterbein.edu, (Gregory Hanson, GHanson@Otterbein.edu), 87 S. Cleveland Ave, Westerville OH 43081.

The goal of this project is to probe the scope and limitations of a novel catalytic, asymmetric intermolecular imino-ene reaction. Studies have been performed by other laboratories regarding catalytic, asymmetric, intermolecular oxo-ene reactions, but there have been very few studies regarding a catalytic, imino-ene reaction. The hypothesis of this project is that simple aldimines will react with 2-(Trimethylsilyloxy)-propene in the presence of a well-known chiral Cr catalyst to produce [beta]-amino trimethylsilyl enol ether products. The aldimines are prepared from simple aldehydes (e.g. acetaldehyde and benzaldehyde) and simple amines (e.g. methyl, ethyl, and propyl amine) and the chiral catalyst has been used by other laboratories in successful catalytic, asymmetric, oxo-ene reactions. The products of these reactions can be further reacted to produce [beta]-amino ketones or [beta]-amino acids, structures that are found in many compounds with biological activity. These reactions involve a wide variety of advanced synthetic techniques including air and moisture sensitive techniques and chromatographic purification. Products from these studies have been analyzed and characterized by multiple techniques, such as thin layer chromatography (TLC), gas chromatography/mass spectrometry (GC/MS), and

nuclear magnetic resonance spectrometry (NMR). Once simple structural analysis has been performed, analyses of enantioselectivity using chiral GC, chiral high performance liquid chromatography (HPLC), and polarimetry will occur next. Results thus far are mixed: it appears that [beta]-amino ketones are generated from these conditions, however the mechanism involved (imino-ene vs. Mukaiyama-Mannich) is still unclear and under investigation and more data is needed to assess the hypothesis.

**Poster Board No. 031 SYNTHESIS OF PELLETIERINE BY A CATALYTIC, ASYMMETRIC IMINO-ENE REACTION.** Lindsay L. Main, [lindsay.main@otterbein.edu](mailto:lindsay.main@otterbein.edu), (Gregory H. Hanson [ghanson@otterbein.edu](mailto:ghanson@otterbein.edu)), 321 S. State Street, Westerville OH 43081.

This project aims to develop a novel, catalytic, asymmetric imino-ene reaction, utilizing a chromium-based catalyst endowed with a chiral amino-indanol backbone. This imino-ene reaction will be examined through the synthesis of the natural product pelletierine. Pelletierine is to be produced from 2-(Trimethylsilyloxy)-propene and the cyclic imine derived from a hydroxide-mediated elimination reaction of *N*-chloropiperidine. The synthetic pelletierine will be compared to natural pelletierine via several characterization methods, including thin layer chromatography, gas chromatography/mass spectrometry (GC/MS), and nuclear magnetic resonance spectrometry. Beyond these methods, the synthesized pelletierine is to be further analyzed via chiral GC, chiral high performance liquid chromatography, and polarimetry to determine enantiomeric purity and the degree of asymmetric induction delivered by the chiral catalyst. Thus far, the piperidine-imine has been synthesized and subjected to the asymmetric imino-ene conditions, and characterization studies of the products from this reaction are currently underway. If successful, this methodology can be further expanded to assist in the asymmetric synthesis of other amine containing organic compounds.

**Poster Board No. 032 GC-MS ANALYSIS OF THYME AND OREGANO EXTRACTS GROWN UNDER VARYING CONDITIONS AND HARVESTED AT DIFFERENT TIMES DURING THEIR SEASON CYCLE.** Holly A. Taylor, [h-taylor.1@onu.edu](mailto:h-taylor.1@onu.edu), (Christopher P. Bowers, [c-bowers@onu.edu](mailto:c-bowers@onu.edu)), Vicki A. Motz, [v-motz@onu.edu](mailto:v-motz@onu.edu), Jeanette Loyer, [j-loyer.1@onu.edu](mailto:j-loyer.1@onu.edu), Phillip Taylor, [p-taylor.2@onu.edu](mailto:p-taylor.2@onu.edu), Brittney Simmons, [b-simmons@onu.edu](mailto:b-simmons@onu.edu), Linda M. Young, [l-young@onu.edu](mailto:l-young@onu.edu), David H. Kinder, [d-kinder@onu.edu](mailto:d-kinder@onu.edu), Ohio Northern University, 402 W College Ave Unit 3201, Ada OH 45810.

Thymol, carvacrol, and p-cymene, present in differing concentrations in thyme (*Thymus vulgaris*) and oregano (*Oreganum vulgare*), are known to have antimicrobial and antifungal activity. Growing conditions, particularly water availability, and harvest times have been linked to differences in the concentrations of these phenolic compounds in plants grown here in Ohio and worldwide. The goal of this study is to analyze the thymol and carvacrol concentrations in thyme and oregano plants located in three different counties of Ohio (Allen, Hardin, and Union) and analyze the data to ascertain locational and seasonal differences in thymol and carvacrol content. It is hypothesized that there will be low phenolic content in the spring, rising in the summer and falling in autumn, with plants grown in low water conditions having greater phenolic content than those watered daily. Plants were grown in Lima, Ada, and Marysville, Ohio in full sun with natural rainfall and in full sun with daily watering equivalent to 1.27cm of rainfall. Plants were harvested both in early and late season, dried, and extracted with ethanol. Analysis of the extracts includes active component quantitation and component characterization for the major components (p-cymene, thymol, and carvacrol) using GC-MS and HPLC. Other components of the extracts will be identified from their mass spectra. One-way ANOVA will be run to determine significant differences in concentrations within Ohio followed by post-hoc comparisons by Student's *t*-tests. Comparison to international data will be made within the constraints of differing protocols.

**Poster Board No. 033 THALLIUM POISONING AND APOPTOSIS.** Caitlin E. Shears, [caitlinshears@walsh.edu](mailto:caitlinshears@walsh.edu), Joseph A. Lupica, [jlupica@walsh.edu](mailto:jlupica@walsh.edu), (Amy J. Heston, [aheston@walsh.edu](mailto:aheston@walsh.edu)), Walsh University, 2020 East Maple Street, North Canton OH 44720.

Thallium, a heavy metal, is known for its toxicity, but the mechanism is not well understood. Because Tl<sup>+</sup> and K<sup>+</sup> have similar ionic radii, Tl<sup>+</sup> easily enters the cell through the Na<sup>+</sup>/K<sup>+</sup> pump. Once inside, Tl<sup>+</sup> binds to riboflavin, the essential backbone of coenzymes FAD and FMN. Complexation with riboflavin could potentially interfere with oxidative phosphorylation and disruption of the mitochondrial membrane potential. This could lead to mitochondrial membrane break down and release of Cytochrome C. The release of Cytochrome C will result in the activation of the intrinsic apoptotic pathway and cellular death. This type of toxicity has been demonstrated using cyanide in primary cortical cells. In addition, thallium has been shown to induce apoptosis in Jurkat cells by activation of the intrinsic pathway and Caspase 9. Caspase 9 is an initiator caspase synthesized as 47 kDa proenzyme then proteolytically cleaved into a 37 kDa active form upon onset of apoptosis and, therefore, is considered the "point of no return" for cellular apoptosis. Thallium may differentially affect hair cells in this way, based on individuals suffering from thallium poisoning exhibit extreme hair loss. HeLa cells and hair cells were treated with 1-3 μM aqueous TlNO<sub>3</sub> and the activation of the intrinsic pathway of apoptosis was monitored utilizing western blot analysis using a human specific antibody that recognizes the 37 kDa active form of Caspase 9. Sulforhodamine B Colometric 1 Growth Assay monitored overall cell death. Results indicate cell death is dependent upon higher concentrations of thallium.

**Poster Board No. 034 HOMOLGY MODELING AND ANALYSIS OF CYTOCHROME P450 SNPS.** Patrick Kane, [patrickkane@walsh.edu](mailto:patrickkane@walsh.edu), (Peter J. Tandler, [ptandler@walsh.edu](mailto:ptandler@walsh.edu)), Walsh University, 2020 East Maple Street, North Canton OH 44720.

Cytochrome P450 is the family of heme-containing oxidoreductase enzymes that catalyze the detoxification of numerous substrates within living organisms. Two members of the Cytochrome P450 family that are highly variable among individuals are CYP2C19 and CYP2A6. CYP2C19 catalyzes the biotransformation of many clinical drugs such as proton pump inhibitors and antidepressants, while CYP2A6 is mainly involved in the breakdown of nicotine. Single-nucleotide polymorphisms (SNPs) in the CYP2C19 and the CYP2A6 families are presumed to be responsible for changes in drug metabolism between individuals. Many polymorphisms lead to splice mutations which do not allow a protein to be synthesized. However, some polymorphisms, such as CYP2C19\*5 (433 arginine-tryptophan) and CYP2A6\*18 (392 tyrosine-phenylalanine, lead to missense mutations which change a particular amino acid in the protein. The focus of this study was to use *in silico* methods to investigate the effects of the polymorphisms that lead to missense mutations of CYP2C19 and CYP2A6. Variants CYP2C19\*5 and CYP2A6\*18 were studied by creating homology models to CYP2C9 and CYP2A6 respectively. These homology models were then used to examine the docking of known substrates. Among these substrates were (S)-Mephenytoin and Clopidogrel, which are both sensitive to the CYP2C19\*5 mutation. For CYP2A6\*18, the clearance of Coumarin is decreased, while the Nicotine clearance was not affected by the mutation. The docking of (S)-Mephenytoin and Clopidogrel into the active site showed little difference in their binding energy suggesting that the missense mutation alters either access to the active site or deactivation of the heme group.

**Poster Board No. 035 THERMAL DISSIPATION OF COATED GOLD NANOPARTICLES.** Laura Meiler, [laurameiler@walsh.edu](mailto:laurameiler@walsh.edu), Tyler Pizzute, [tylerpizzute@walsh.edu](mailto:tylerpizzute@walsh.edu), (Peter J. Tandler, [ptandler@walsh.edu](mailto:ptandler@walsh.edu)), Walsh University, 2020 East Maple Street, North Canton OH 44720.



Gold nanoparticles have increasingly promising benefits within the medical field due to their thermal dissipative properties which can be used to destroy malignant cancer cells. To aid gold nanoparticles reach their anatomical destination in clinical applications, gold particles are often encapsulate with thiols. In this experiment, three different thiol compounds are bound to gold particles for measuring the effect coatings have on the particles' ability to dissipate energy thermally. Initial studies indicate that moderately high concentrations of aqueous colloidal gold are extremely efficient at converting light energy to thermal energy. However, these studies are limited in scope because the gold nanoparticles were not functionalized and the experiments were conducted in a simple matrix. It is hypothesized that although chemisorption of thiols shifts the absorption spectra of nanoparticles, there will only be minor effects on the efficiency of light-to-heat conversion. Gold nanoparticle synthesis was carried out using a modified Brust-Schiffrin procedure. The synthesis was performed at room temperature, as gold chloride was mixed with tetraoctylammonium bromide and then the ligand was added, followed by the addition of a reducing agent,  $\text{NaBH}_4$ . Successful synthesis of nanoparticles was monitored with a UV-Vis spectrometer. The results from UV-VIS spectra reveal peak shifts from each of these compounds when compared to the gold nanoparticles void of any bound ligand coating. After the particles have been synthesized and coated, a Class B laser will be used to heat the particles and determine the thermal dissipative properties of the nanoparticles near their absorption maximum.

**Poster Board No. 036 THE EFFECT OF WHITENING TEETH.** Gretta Seif, grettaseif@walsh.edu, Monika Duda, monikaduda@walsh.edu, (Peter J. Tandler ptandler@walsh.edu), Walsh University 2020 East Maple Street, North Canton OH 44720.

Enamel is almost entirely composed of a mineral called hydroxyapatite,  $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ . In your mouth, hydroxyapatite is constantly breaking down into ions (demineralization) and reforming itself (mineralization). The oxidative properties of hydrogen peroxide enable it to penetrate and whiten enamel and dentin. The mechanism by which whitening occurs is not fully understood, but there is evidence that it increases demineralization. An *in vitro* system was developed using hydroxyapatite soaked in artificial saliva and treated with hydrogen peroxide. After treatment, the hydroxyapatite is then centrifuged, repeatedly washed in distilled water, and then allowed to sit in pH 6 saliva for one week. The washes and pH 6 saliva were analyzed for their calcium content by using a spectrophotometric assay. A similar procedure was followed for teeth, except that a suspended tooth was dipped into each solution. In a preliminary study, a tooth treated for two minutes with a 15% hydrogen peroxide solution lost a greater amount of calcium after seven days than the control. In this study, the importance of the washing step will be investigated to determine whether the greater loss of calcium after seven days was due to insufficient washing after the whitening treatment. In this study, the number of washes (1-3) will be varied for a variety of washing solutions (distilled water, 0.01 M NaF solution and 0.01 M  $\text{NaHCO}_3$  solution).

**Poster Board No. 037 HPLC ANALYSIS OF NITROSYLCOBALAMIN.** Kristie N. Griffith<sup>1</sup>, kristiegriffith@walsh.edu, Joseph A. Bauer<sup>2</sup>, jbauer@uakron.edu, (Michael J. Dunphy, mdunphy@walsh.edu), <sup>1</sup>PO Box 399, Walsh University, 2020 E. Maple St, N Canton OH 44720, and <sup>2</sup>Bauer Research Foundation.

Cobalamins are biologically active molecules with hydroxo-, methyl-, adenosyl- and cyanocobalamins being well known examples. Recently, nitrosylcobalamin (NOCBL) has been implicated as a scavenger of nitric oxide *in vivo* and as a potential anti-tumor agent. NOCBL is synthesized by a ligand exchange reaction between hydroxocobalamin

and nitric oxide gas in dichloromethane. Consequently, the need exists for a quantitative NOCBL procedure to monitor synthesis kinetics and to analyze biological samples. We have developed a quantitative HPLC procedure for NOCBL analysis. The method is done using a modified C-18 column and gradient elution at 35°C with a phosphate buffer/methanol mobile phase. NOCBL elutes within 8 minutes and is completely separated from other common cobalamins. In biological fluids, NOCBL can be detected at ng/mL quantities with small sample sizes and a 15 $\mu\text{L}$  injection volume. Current work is focused on determining linear range, extraction recovery (both liquid-liquid and solid-phase), within and between day variation, and NOCBL detection limit in appropriate samples.

**Poster Board No. 038 THIN-LAYER CHROMATOGRAPHY OF MEDICATIONS: A "GREEN" UNDERGRADUATE LAB PROCEDURE.** Joey E. Romar, joeyromar@walsh.edu, (Michael J. Dunphy, mdunphy@walsh.edu) Walsh University, 2020 E. Maple St., N. Canton OH 44720.

Thin-Layer Chromatography (TLC) is a simple and versatile method used to separate and identify the components of a mixture. TLC is an ideal tool to introduce high school and college students to principles of chromatography and effects of inter-molecular forces in separation chemistry. TLC has been used for decades in drug screening, quality control spot-checking, organic synthesis, product verifications, and many other applications. The goal of this project was to develop an inexpensive, versatile and "greener" TLC lab experience suitable for first year college chemistry lab. The hypothesis was that substitution of greener solvents and visualization chemicals would accomplish the stated goals and not significantly diminish the quality of results obtained from a similar commercial system. The procedure can be applied to a variety of pharmaceuticals and can be done in a typical lab period. Analyses were done using commercial silica gel TLC plates (250  $\mu\text{m}$  coating, cut to 8 x 3 cm), spotting capillaries, a hair dryer, long wave UV lamp and readily available chemicals/standards and lab equipment. Results to date indicate that pure methanol can be substituted for complex organic solvent mixtures with clean separation of standards. Ammonium molybdate, a "greener" transition metal salt, was substituted for ammonium meta-vanadate with acceptable color production. Cost was decreased by 15% and at least 10 different pharmaceuticals could be characterized.

**Poster Board No. 039 TRADE-OFFS OF HATCHING EARLY: VULNERABILITY AND PERIOD OF EXPOSURE TO PREDATORS.** Meredith S. Palmer, mspalmer@owu.edu, Beatriz Willink, Universidad de Costa Rica, Karen M. Warkentin, Boston University, Ohio Wesleyan University, Dept. of Zoology, Delaware OH 43015.

Arboreal red-eyed treefrog (*Agalychnis callidryas*) embryos can hatch prematurely in response to egg predators. Induced early hatchlings face aquatic predators when less developed and for longer than do later hatchlings; both factors may alter survival through the high-risk early larval period. Prior work focused on developmental effects of induced hatching. In 24 hour trials, less developed hatchlings were more vulnerable to three aquatic predators (shrimp, fish, water bugs) but had similar or better survival than full-term hatchlings with libellulid and aeshnid dragonfly nymph predators. However, it is unknown how developmental effects and duration of exposure to predators combine to create the net effect of early hatching. Here we measured costs of early hatching over a 72 hour period, from first hatching competence past peak spontaneous hatching. Embryos hatched at age 4 (N = 400/experiment) or 6 (N = 400/experiment) days were exposed to water bugs, aeshnids, or libellulids. Early-hatched tadpoles suffered higher mortality than late hatchlings with all three predators (P < 0.0001, P = 0.008, P = 0.01). The longer exposure of early hatchlings to aquatic predators reversed their initial phenotypic advantage with aeshnids and revealed a cost of early hatching with libellulids where none was apparent



from phenotypes alone. In other experiments, early-hatched tadpoles reared without predators grew more quickly than those reared with predator cues, which grew more quickly than age-matched embryos, revealing phenotypic effects of both predator cues and the egg vs. aquatic environment. Nonetheless, any potential benefits of predator-induced phenotypes on tadpole survival were insufficient to compensate for the increased duration of predator exposure that is a consequence of hatching early.

**Poster Board No. 040 CAVE ADAPTATION INVOLVES A SWITCH FROM AVOIDING DEHYDRATION TO PREVENTING OVERHYDRATION IN THE CAVE CRICKET.** Michael J. LaCagnin, Brian Z. Hedges, Derrick J. Heydinger, Sarah E. Stueber, Jay A. Yoder and Horton H. Hobbs III, Department of Biology, Wittenberg University, Springfield OH 45501.

A species replacement series of cave crickets succeeds down the Cumberland Plateau, USA, and includes *Hadenocetus cumberlandicus* (Kentucky), *H. opilionoides* (Tennessee), and *H. jonesi* (Alabama). The purpose of this study is to determine whether differences among cave crickets, such as distribution and troglomorphic characteristics, are related to differences in water balance characteristics. In order to study this, water balance characteristics were determined gravimetrically at different relative humidities in dim red light at 13° C to mimic cave conditions. Water mass and proportion of water mass to dry mass were found to be different among the species (*H. jonesi* > *H. opilionoides* > *H. cumberlandicus*,  $P < 0.05$ ). Further, *H. jonesi* lost water approximately 2x faster than *H. cumberlandicus* and about 1.2x faster than *H. opilionoides* ( $P < 0.05$ ). These results indicate differences in water balance maintenance strategies between the three cricket species. With regards to dehydration prevention, *H. opilionoides* and *H. jonesi* require more moisture than *H. cumberlandicus* to compensate for higher water loss rates, partially explaining their reliance on caves as habitats. With regards to overhydration prevention, *H. jonesi* and *H. opilionoides* rely on high net transpiration rates to eliminate excess body water. Lower body water content and reduced cuticular permeability indicate that *H. cumberlandicus* solves overhydration by suppressing the amount of water that enters the body. We conclude that increasing water loss rates to prevent overhydration is a troglomorphic adaptation that permits increases in periods of cave residence and reasonably explains the distribution of the studied cave cricket species.

**Poster Board No. 041 THE RELATIONSHIP BETWEEN TEASEL (DISPACUS SP.) AND MAMMAL DISTRIBUTION AT THOREAU WILDLIFE SANCTUARY, DEFIANCE COUNTY, OH.** Ambrose Krouse, petrank87@yahoo.com, (Spiro Mavroidis, smavroidis@defiance.edu), Science and Math Division, Defiance College, 701 North Clinton St, Defiance OH 43512.

With increased globalization of trade, the movement of non-native invasive species (e.g., algae, herbs, trees, birds etc.) is becoming more common. Often invasive species disrupt local ecosystems to the detriment of native flora and fauna while others go undetected with little noticeable impact. Teasel (*Dipsacus sp.*) is an invasive plant species that is becoming a problem in the United States. In abandoned agricultural fields, teasel plants often crowd and out-compete native plant species and may alter the distribution of local fauna. The main objective of the study was to examine how teasel may impact the diversity and distribution of mammals. We compared mammal survey results from three different habitat sites: predominately teasel, tall grass prairie, and mixed young savanna. The study was conducted at Thoreau Wildlife Sanctuary (Defiance, OH), a 250 acre preserve. Small mammals were trapped using Sherman live-traps set 5 meters apart on a 6 x 5 grid within each of the three study sites. Larger mammals were photographed using infrared game cameras set along hiking trails near the trapping sites. Results from this study will increase our understanding of how teasel may impact the ecosystems where it has become invasive.

**PosterBoardNo.042SPECIESRICHNESSANDDIVERSIFICATION IN EQUATORIAL WESTERN AMAZONIA.** Brittany N. Davidson, bdavidso@capital.edu, Ian W. Cheesman, ian.w.cheesman@uwsp.edu, Daniel P. McCarthy, dmccat2@capital.edu, Alicia N. Tysl, atysl@capital.edu, Matthew D. Uy, muy@capital.edu, Eric D. Heuer, eheuer@capital.edu, Tiffany A. Beatty, tbeatty@capital.edu, (Kerry L. Cheesman, Alan C. Stam), Biological and Environmental Sciences, Department, Capital University, 1 College and Main, Columbus OH 43209.

The Amazonia rain forest contains a high species diversity of insects, many of which are still unknown and uncatalogued. A census of insect species in various part of the the rainforest adds knowledge about the forest and its health that can be used by researchers in a variety of disciplines, such as tropical ecology, zoology and environmental studies. In May 2010, a five-day field study was performed at Tiputini Biodiversity Station (owned by the Universidad de San Francisco de Quito) along the Tiputini River in equatorial western Amazonia in the province of Orellana, Ecuador. The purpose of the study was primarily to determine species diversity but also to examine food bait preference of ground feeding arthropods. Along a trail within the terra firma forest, insects were captured in pit-fall traps that contained four different food baits. Twenty cups were placed roughly at equal distance apart in groups of four, each containing one of four baits: chicken, beef, mandarin orange, or passion fruit. Insects were collected from traps twice a day and taken to the lab where they were identified to the genus level. Within a genus, insects were separated into morpho-species subdivisions. Beetles represented the greatest species richness, while ants were presents in the greatest numbers overall. Bait preference varied among species. Analysis of the data with respect to significant differences in species/bait interactions is ongoing.

**Poster Board No. 043 IMPACTS OF EMERALD ASH BORER ON FOREST VEGETATION STRUCTURE AND DIVERSITY IN HANCOCK COUNTY, OHIO.** Lauren N. Emsweller, emswellerl@findlay.edu, (Benjamin J. Dolan, dolan@findlay.edu), Department of Natural Science, The University of Findlay, 1000 N Main St, Findlay OH 45840.

Emerald Ash Borer (*Agrilus planipennis*) is an Asian beetle that was first discovered in North America in 2002, in Detroit, Michigan. Emerald Ash Borer (EAB) was most likely transported in ash (*Fraxinus*) wood that is used for stabilizing cargo in ships and for crating heavy consumer products. The beetle has been spreading slowly throughout North America since its introduction, and the ash population has been declining in response to EAB's presence. Adult beetles lay their eggs on the bark, and when larvae hatch, they burrow into the bark and feed on the phloem. They exit the tree as adults, leaving distinctive "d"-shaped holes. The larvae leave behind serpentine feeding grooves under the bark, which impede the transport of nutrients and water throughout the tree, leading to mortality. The succession of species that will occur after the disappearance of the ash population due to EAB infestation is unknown. It is hypothesized that vegetation diversity will increase, sugar maple (*Acer saccharum*) will become dominant, and invasive plant species abundance will increase as a result of gaps created by ash tree mortality within two University of Findlay properties in Hancock County, Ohio. Our statistical procedure follows a modified Before-After-Control-Impact design, with control plots randomly distributed in five forest sites (n=23), and impact plots centered on haphazardly selected ash individuals (n=14) in Hancock County, Ohio. Multivariate vegetation data will be analyzed using ordination and cluster analysis, and species diversity will be compared between strata using ANOVA methods. Future composition will be predicted with community succession models.

**Poster Board No. 044 ECOLOGICAL DIVERGENCE AMONG SLIMY SALAMANDERS, PLETHODON GLUTINOSUS SPECIES COMPLEX.** Alexandra M. Reist, reista@findlay.edu, Jessica A. Wooten PhD, wooten@findlay.edu, The University of Findlay, Dept of Natural Sciences, 1000 N Main St, Findlay OH 45840.

*Plethodon glutinosus* species complex is a group of closely related slimy salamanders that exhibit high levels of genetic diversity and extreme morphological conservatism. Currently, there are 16 nominal Slimy Salamander species in eastern and central North America, but the actual levels of biodiversity are unknown. The aim of this project was to investigate the ecological distinctness and divergence in the *P. glutinosus* species complex using unique climate data and maximum entropy ecological niche modeling. Ecological niche modeling (ENM) makes predictions about the occurrence of suitable habitats using presence-only data generated from natural history museums and novel statistical methods can be used to test for niche conservatism or divergence among closely related species. For our research, we used 12 of the 16 nominal *P. glutinosus* species complex to investigate factors that limit the distribution. We predicted that if climate and vegetation factors were limiting, then the ecological niche models would not predict outside of the known ranges. However, if the niche models did overpredict, then other factors, such as competition and predation influence the distributions. For most species, the ecological niche model overpredicted, implying that abiotic factors are not limiting. This means that other factors including limited dispersal ability, competition, and / or predation may be influencing the geographic distribution of these species. Furthermore, we found that for most of the species, precipitation is the most important abiotic factor driving the distribution. This finding is supported by the fact that these lungless salamander species are restricted to moist habitats for survival.

**Poster Board No. 045 POPULATIONS OF COLORADO POTATO BEETLE, LEPTINOTARSA DECEMLINEATA (SAY) ON POTATOES AND EGGPLANTS GROWN IN COVERED VS. UNCOVERED SOIL.** Mark E. Headings, headings.1@osu.edu, The Ohio State University, Agricultural Technical Institute, 1328 Dover Rd, Wooster OH 44691.

Potatoes, eggplants, tomatoes, and peppers are important human foods. The objectives of this investigation were to: (1) discover which insect pests feed on these four crops near Wooster, Ohio, including their relative abundance on each, and (2) compare insect pest populations on plantings in covered vs. uncovered soil. Sets of four plants of the above four crops were randomly planted within each of 10 rows. These rows were each 15.24 m in length. The soil in five rows was covered with black weed control fabric (91.44 cm wide) and the other five rows were left uncovered. Insect counts were taken twice (in August and September) on all plants. Two primary insect pests on potatoes and eggplants were Colorado potato beetles, *Leptinotarsa decemlineata*, (Say) and flea beetles, *Epitrix* sp. Total numbers of adult and larval Colorado potato beetles (Cpb) on these plants in covered soil were 29 and 7 respectively and were much lower than in uncovered soil (342 and 151 respectively). Flea beetle numbers on eggplants were high in both covered (273) and uncovered (305) plots with substantially fewer (74 and 10 respectively) in potato plots. No Cpb were found on tomato and pepper plants. Likewise, no flea beetles were found on pepper plants; however, 25 flea beetles were found on tomato plants in covered plots and 12 in uncovered plots. The reason for reduced Cpb numbers on potato plants in covered soil is inconclusive; however, one possibility is that fabric covers on soil may mechanically interfere with adult emergence from soil as well as with larvae seeking pupation in soil. Such covers may have implications for Cpb control.

**Poster Board No. 046 ANALYSES OF CRUDE PROTEIN AND MINERAL COMPOSITION OF THE ADULT HONEY BEE, APIS MELLIFERA L.** Mark E. Headings, headings.1@osu.edu, Shah

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Benefits of the honey bee *Apis mellifera* L. include plant pollination, honey and beeswax production, bee venom therapy and more. An ultimate contribution is that the bee's body is consumed by some animals (and even people) as a source of food. Animal predators of honey bees include bears, skunks, raccoons, opossums, frogs, toads, a variety of birds (such as blue jays,) hornets, yellow jackets, dragonflies and ants. The objective of this investigation was to determine the nutritional value of the body of the adult honey bee, including levels of crude protein and minerals present. Approximately 350 adult honey bees were prepared by first drying them in a vacuum oven at 60-65°C for 15 h and then grinding them through a one mm screen. Nitrogen content was measured by using a Nitrogen Analyzer and ash content was determined by subjecting samples to a muffle furnace at 600°C for four h. Minerals were determined by first wet-ashing ground samples using perchloric acid and then subsequent analysis with an ICP unit (Lyman ES 200). Analyses show that the adult honey bee body consists of 97.49% dry matter (DM). It is comprised of 52.00% crude protein (CP) and 4.50% ash (on a 100% DM basis.) In comparison, CP values for 15 other insect species present in the bee's body include 0.968% K; 0.769% P; 0.383% S; 0.142% Ca; 0.109% Mg; and .051% Na. Micro-mineral values are: 230.8 ug/g Fe; 104.3 ug/g Mn; and 96.9 ug/g Zn. Literature pertaining to the digestibility of insect proteins indicate that some protein may be bound up in chitin in the body wall and consequently is not all available for digestion in mammals.

**Poster Board No. 047 MANGROVE DEFORESTATION AND ISLAND DEVELOPMENT ALONG THE CENTRAL BELIZE COAST.** Alicia A. Campbell, alicia.parlette@otterbein.edu, (Halard Lescinsky, hlescinsky@otterbein.edu), Otterbein University, 8227 Gradington Drive, Westerville OH 43081.

Belize, home to the second longest coral reef in the world, supports a booming tourism industry. It is also experiencing increasing rates of island development that threaten the health of the coral reef ecosystem. Although the Belize government has set up marine protected areas and reserves, and its reefs were added to the United Nations Educational, Scientific, and Cultural Organization World Heritage List in 1996, the development of the cays has continued at a visually alarming, yet undetermined rate. The purpose of this study is to quantify this rate of development. Aerial photos were taken annually between 2003 and 2010 (courtesy of Ilka Feller, Smithsonian Institution) and field work was undertaken to investigate rates and patterns of cay development in the central Belize Pelican Cays. Five variables were measured: mangrove deforestation, island erosion, lagoon dredging, island filling, and land use. Mangrove cutting events and the subsequent island erosion will be measured by comparing island area changes over the number of years documented. While some islands will lose area due to erosion, others may become larger through lagoon dredging and island filling. Dredging of nearby sea bottoms results in the loss of coral reef habitat in the area. The dredged sediment is then deposited onto the deforested island to build up sandy beaches for development. A final investigation will be into the types of developments that are built.

**Poster Board No. 048 DEVELOPMENT OF A CANINE LYMPHOCYTE MODEL TO EVALUATE ENVIRONMENTAL EXPOSURE.** Jordan Yesesky, yeseskyj@findlay.edu, Carolyn Steele, steelec@findlay.edu, Sara Steward, stewards@findlay.edu, Jeremy Mascaró, mascaroj@findlay.edu, Michael Edelbrock PhD, The University of Findlay, Mail Stop 1051, 1000 North Main St, Findlay OH 45840.

This study looks at the utility of dogs to reflect human environmental exposure by developing a model to measure



genotoxic stress. Not only do dogs share the human environment, but they also respond to toxicity much like humans. Evidence suggests that cadmium may act as a co-carcinogen in combination with oxidative stress. A cytokinesis block assay was performed on circulating lymphocytes collected from dog blood samples. Circulating lymphocytes were stimulated to divide using phytohaemagglutinin (PHA). Cadmium (0.5 to 5.0  $\mu$ M) and menadione (10 to 25  $\mu$ M) were added to simulate the effects of environmental exposure. The lymphocytes are blocked from cytokinesis by addition of cytochalasin-B, allowing for binucleation to occur. Lymphocytes are isolated, fixed and stained on a microscope slide. Control slides (no cadmium or menadione) were prepared for each cohort. The presence of micronuclei, nuclear budding and bridging on binucleated cells are scored as biomarkers for genotoxic stress. Differences in the frequencies of chromosome aberrations between control and treated cells indicate that genotoxic stress has occurred due to the exposure. This would suggest that dogs may be able to be used to indicate adverse environmental exposure.

**Poster Board No. 049 ESTIMATING THE NUMBER OF WHITE-TAILED DEER (*ODOCOILEUS VIRGINIANUS*) AMONG THE VARIOUS HABITATS AT THE WILDS MUSKINGUM, COUNTY OHIO.** James Siford, [jsiford@muskingum.edu](mailto:jsiford@muskingum.edu), (James L. Dooley [jdooley@muskingum.edu](mailto:jdooley@muskingum.edu)), Dan Beetem [dbeetem@thewilds.org](mailto:dbeetem@thewilds.org), Conservation Science Program, Muskingum University, 163 Stormont St, New Concord OH 43762

There are a large number of deer within the various habitats of the Wilds; a 10,000 acre conservation park located on a reclaimed surface mine in Southeastern Ohio. Deer have been shown to alter habitat composition and structure. In addition, deer can serve as carriers for diseases that can impact species under captive management. Effective deer management requires relatively precise estimates of population size. We used drive counts and Program Distance to estimate deer population size over four transects. The work was conducted between September and November 2010. Data analysis will be conducted in January 2011. These data will be compared with results from work conducted in previous years in order to develop estimates of population trends. Based on multi-year findings, the Wilds will then be able to develop a detailed plan for management.

**Poster Board No. 050 EMBRYO CULTURE OF FRESHWATER MUSSELS IN ARTIFICIAL NUTRIENT MEDIA CONTAINING DIFFERENT CONCENTRATIONS OF FISH SERUM TO ACHIEVE TRANSFORMATION OF GLOCHIDIA TO JUVENILE MUSSELS.** Alissa G. Anderson, [alissaa@muskingum.edu](mailto:alissaa@muskingum.edu), (James L. Dooley Jr. [jdooley@muskingum.edu](mailto:jdooley@muskingum.edu)), Muskingum University, 163 Stormont St, New Concord OH 43762.

Freshwater mussels play important roles in the health and maintenance of the freshwater systems they inhabit through nutrient cycling, decomposition, and maintaining water clarity. North American freshwater bivalve population numbers are in decline, and globally, freshwater bivalves are threatened. Environmental stresses are suggested to contribute to this decline, and as a result the reproductive success of freshwater bivalves has decreased. The project was conducted to see if successful transformation of freshwater mussels parasitic larva, called glochidia, can be accomplished using artificial nutrient media containing largemouth bass fish serum in order to avoid the high environmental stresses found in the wild. Fish serum is used to act as a source of protein, and mimics the use of live hosts. Media was tested at varying concentrations of fish serum to determine at which concentration transformation was the most successful. Ten to thirty glochidia were cultured in media containing 5%, 15%, 30%, or 45% fish serum. Eight trials were conducted for media at each concentration. Overall, glochidia were more successful in media containing 30% and 45% fish serum, compared to media containing 5% and 15% fish serum. Due to contamination glochidia were unable to achieve full transformation at all concentrations of media tested.

**Poster Board No. 051 OCCURRENCE OF GENETIC MODIFICATION IN WHOLE KERNEL CORN.** Megan Thiery, [mthiery@capital.edu](mailto:mthiery@capital.edu), 1335 SR 274, Rushsylvania OH 43347. Michael Lanning & Kerry Cheesman, Capital University, Columbus OH.

The genetic modification of food crops for use in the commercial market remains a debatable topic. Advocates argue that being able to genetically modify food produces a higher yield and better nutrition, while opponents claim the development of new allergies and detrimental environmental impacts are problems. Previous work in this lab has shown that roughly 75% of processed, commercially available corn products in Ohio have been genetically modified. The current research tests for the genetic modification of whole kernel corn (canned and frozen) instead of processed foods. Processed corn products contain significantly less percentage of nucleic acids than obtained from the nucleus of a whole kernel of corn. The assay used in processed corn is incompatible with these higher percentages of nucleic acids, and was altered through experimentation with different dilution of slurries for different weights of whole corn nuclei. Using standardized biochemical practices, DNA was extracted in duplicate from store bought whole kernel corn samples and amplified through PCR to detect the CaMV 35S promoter and/or NOS terminator sequences (used in approximately 85% of genetically modified food products). Following PCR, samples were run on 3% agarose gels, along with positive and negative GM controls, and visualized with ultraviolet light following ethidium bromide staining. Initial results indicate a high percentage of genetic modification, comparable to that found in processed corn products. This work has been supported by a grant from Beta Beta Beta Biological Honor Society.

**Poster Board No. 052 THE SERPENT MOUND BRECCIA (SMB): A UNIQUE CARBONATE BRECCIA DEPOSITED WITHIN THE SEPENT MOUND IMPACT CRATER, SOUTHEASTERN OHIO.** Adam M. Hester<sup>1</sup>, [ah131807@ohio.edu](mailto:ah131807@ohio.edu), Keith A. Milam<sup>1</sup>, [milamk@ohio.edu](mailto:milamk@ohio.edu), Peter T. Malinski<sup>2</sup>, [pm193604@ohio.edu](mailto:pm193604@ohio.edu), Ohio University. <sup>1</sup>Department of Geological Sciences and <sup>2</sup>Department of Chemistry and Biochemistry, Ohio University, 316 Clippinger Laboratories, Athens OH 45701.

The Serpent Mound crater is a deformed circular area (~8 km diameter) in south-central Ohio near the intersection of Highland, Pike, and Adams Counties. The crater formed between 256-330 Ma from an extraterrestrial impact event. Confined to the crater is a carbonate breccia informally referred to as the Serpent Mound Breccia (SMB). The SMB is a matrix-supported, polymict to monomict breccia with a unique weathering profile and appearance compared to other carbonate units in the area. It is moderately-to poorly-cemented, subhorizontally oriented throughout the crater, and in at least three locations, displays an overall fining-upward sequence. Initially, multiple hypotheses were examined to account for its origin; including fault propagation, mass wasting, or fallback/resurge ejecta from the impact event. Field observations revealed a widespread lateral distribution inconsistent with brecciation by impact-related fault movements or post-impact mass wasting. Additionally, the bulk composition and mineralogy of the SMB, analyzed through X-ray diffraction (XRD) and X-ray fluorescence (XRF), does not represent geologic units expected to have been comminuted during faulting, or all of the upslope (Ordovician-Silurian) strata that would have collapsed from the nearby central uplift during impact-related mass wasting. Spearman's Rank Coefficient analyses of XRF data provided a 90-100% correlation of the SMB to Middle Silurian dolostones. This is inconsistent with the expected silica-rich geochemistry for either fallback or resurge ejecta from this post-Devonian-aged impact event. However, this strong correlation does suggest the SMB is a previously unrecognized member of one of the Middle Silurian-aged carbonate formations deposited prior to the impact event.



**Poster Board No. 053 GENETIC VARIATION IN ALDEHYDE DEHYDROGENASE 7A1 AND PYRIDOXINE-DEPENDENT EPILEPSY.** Conor D. Freeland, cdf23@pitt.edu, Dana Tirabassi, Natalie Cross, Thomas Freeland, tfreeland@walsh.edu, P.O. Box 928, Walsh University, 2020 E. Maple St., N. Canton OH 44720.

Pyridoxine-dependent epilepsy (PDE) is a recessive genetic disorder. Seizures in affected neonates are controlled by large doses of pyridoxine (vitamin B6). Though the exact location and nature of the gene defect varies among individuals, all known cases of PDE are due to defects in the ALDH7a1 gene, coding for the aldehyde dehydrogenase 7a1 enzyme, which catalyzes the catabolism of alpha-aminoadipate semialdehyde (AAAS) in the breakdown pathway of lysine. If the reaction does not occur, AAAS builds up in cells, especially brain cells. This depletes pyridoxal phosphate, thus preventing the conversion of the excitatory neurotransmitter glutamate into the inhibitory neurotransmitter gamma amino butyric acid, resulting in seizures and possible brain damage to the affected neonate. We are working with a family in which the daughter has PDE. They provide us with mouthwash DNA samples in order to identify the defective gene in this family's version of PDE. The ALDH7a1 protein sequences from various organisms were aligned in order to distinguish regions of high and low evolutionary conservation. Based on evolutionary conservation and results from other PDE patients, selected exons of the ALDH7a1 gene were amplified by PCR from a PDE patient, her parents, and an unrelated control subject. Amplification of exon 14 gave products of predicted size from all subjects. Exon 10 was amplifiable from the non-relative, but not from the PDE patient or her parents, indicating some variants of exon 10 in this family. The non-relative's DNA produced two size polymorphisms, indicating two different alleles in an unaffected individual. All amplified exons were cloned into the pCR4-TOPO vector for sequencing.

**Poster Board No. 054 IMPACT OF SPECIES, SIZE, AND ARM LOSS ON THE SPEED OF BRITTLE STARS.** Jonathan M. Price, s13.jprice@wittenberg.edu, Lauren R. Cassel, s12.lcassel@wittenberg.edu, Megan J. Gordon, s12.mgordon@wittenberg.edu, Kathleen A. Reinsel, kreinsel@wittenberg.edu, Richard S. Phillips, rphillips@wittenberg.edu, James M. Welch, jwelch@wittenberg.edu, Wittenberg University, Dept of Biology, Springfield OH 45501.

Brittle stars are known for their ability to regenerate arms lost during encounters with predators, but how the loss of the arm might affect their ability to escape additional predators is unknown. Using two species, spiny (*Ophiocoma paucigranulata*) and banded-arm (*Ophioderma appressum*) brittle stars, three hypotheses were examined: (1) larger brittle stars would move faster than smaller individuals, (2) spiny would move faster than banded-arm brittle stars, and (3) brittle stars of both species missing an arm would move more slowly than intact individuals. In a shallow subtidal area on San Salvador, Bahamas, individual brittle stars were placed in the center of a sandy elliptical arena surrounded by rocks. The time for the brittle star to move under a rock was recorded, and its speed was calculated as the distance to that rock divided by the time it took to get there. Larger brittle stars moved significantly faster than smaller brittle stars (ANCOVA;  $p < 0.001$ ). For brittle stars of the same size, spiny brittle stars were faster than banded-arm (ANCOVA;  $p = 0.001$ ). Spiny brittle stars missing one arm were significantly slower than intact spiny individuals (ANCOVA;  $p = 0.01$ ); however the speed of banded-arm individuals missing one arm was not significantly different than the speed of intact banded-arm individuals (ANCOVA;  $p > 0.05$ ). Thus, our first two hypotheses were supported. However, the third hypothesis was only supported for spiny brittle stars. Further research could investigate whether banded-arm brittle stars retain their same average speed after losing multiple limbs.

**Poster Board No. 055 STROOP EFFECT VARIANCE WITH AGE.** Joshua M Cain, j-cain@onu.edu, Bryan J Frantz, b-frantz@onu.edu, Geoffrey D Groenk, g-groenke@onu.edu, Rema Suniga, r-suniga@onu.edu, Ohio Northern University, Dept of Biological and Allied Health Sciences, 525 S Main St, Ada OH 45810.

The Stroop effect is an investigated phenomenon dealing with cognition and reaction time. This is demonstrated when a subject reads a color name printed in its own color faster than when the color name is printed in a conflicting ink color. Studies have shown that skilled readers process both the lexical and semantic representation of a word. Reaction time is measured as an index of interference in processing time. This study aimed to determine the effect of age on the reaction time involving the Stroop effect phenomenon. To demonstrate the Stroop effect, two sessions were conducted. In the first session, each subject was asked to read a set of color names written in their own color. In the second session, each subject was asked to read the same set of color names written in a different color. Mean Reaction time (= correct reading time) was recorded for each each session, and the Stroop effect was calculated as the difference between the reaction times for each age group (first grade, N=20; high school, N=20, college, N=20). An ANOVA showed that the Stroop effect was significantly different ( $F=61.67$ ,  $p < 0.0001$ , at 95% confidence level) between age groups. Paired t-tests revealed that the Stroop effect among the three age groups are statistically different from each other, in which the first graders had the largest Stroop effect compared to either high school ( $t=6.93$ ,  $p < 0.0001$ ) or college ( $t=9.74$ ,  $p < 0.0001$ ) groups. This study demonstrated that Stroop effect varies inversely with age.

**Poster Board No. 056 THE EFFECTS OF CINNAMOMUM CASSIA ON GLUCOSE UPTAKE.** Ashley N. Hoehn, a-hoehn.1@onu.edu, (Amy L. Stockert), Ohio Northern University, The Raabe College of Pharmacy, Department of Pharmaceutical and Biomedical Sciences, 402 W College Ave, Ada OH 45810.

Cinnamon, *Cinnamomum cassia*, is used to decrease glucose levels of type II diabetics (fasting glucose levels 130-150 mg/dL), yet a comprehensive study exploring the efficacy and rate of effect is needed. This project addresses the following objectives: 1) To determine the percent decrease in fasting blood glucose. 2) To determine the average time interval required for initial decrease in blood glucose (initial decrease to be determined following data collection as percent of total decrease over the course of experiment.) The above objectives are based on the hypothesis that type II diabetics supplemented with 1000 mg of cinnamon will see a decrease in blood glucose levels over the experimental time interval (12 weeks). A baseline fasting blood glucose level will be obtained for three weeks prior to beginning treatment. Group 1 (N=9) will be treated with a 1000 mg cinnamon capsule daily with breakfast. Group 2 (N=9) will receive a 1000 mg placebo capsule (prepared with sugar-free chocolate pudding). All subjects will do a fasting and two hour post-meal glucose test daily using a Abbott Freestyle glucose meter via the same method. Each subject will follow a 2000 calorie diabetic diet, recording daily nutrition with no other supplementation other than multi-vitamins. Trends in glucose levels will be analyzed by overall percent change in their initial rate of decrease and a fasting glucose level (experimenter defined  $p$  value;  $p < 0.01$ ). Initial observations from this experiment show an initial decrease in glucose levels at a faster rate than later in the experiment.

**Poster Board No. 057 EFFECTS OF ALCOHOL USE ON THE BRAIN WAVES OF COLLEGE WOMEN.** Jeremy R. Baker, s11.jbaker@wittenberg.edu, (Cathy L. Pederson, cpederson@wittenberg.edu), Wittenberg University, Department of Biology, Springfield OH 45501.

Brain damage has been associated with long-term alcohol use. Electroencephalography (EEG) was employed to look

at synchronization variations in women with various levels of experience with alcohol. EEG was used to monitor beta and theta waves in the frontal lobe of 39 right-handed college women, ages 19-22, during a memory test. Comparisons were made between binge drinkers (>3 drinks per session, n=18), light drinkers (<3 drinks, n=14), and non-drinkers (n=7), and also between those drinking in the last week (n=20), 8-30 days (n=8), and >30 days (n=11). Demographically, univariate analysis of variance revealed no significant difference in age or drug history, ( $p>0.05$ ), but showed significant difference in body mass index (BMI;  $F=4.008$ ,  $p=.027$ ). Paired sample t-tests comparing brain waves in the control and memory test showed significant difference between them for beta standard deviation ( $t(38)=-3.445$ ,  $p=0.001$ ) and peak-to-peak ( $t(38)=-2.971$ ,  $p=0.005$ ) and theta standard deviation ( $t(38)=-3.105$ ,  $p=0.004$ ). Multivariate t-tests, covarying for BMI, revealed no significant difference in frequency, standard deviation, and peak-to-peak results in either beta or theta waves ( $p>0.05$ ). Repeated measure ANOVAs compared the same wave parameters between the control and memory test, looking at possible effects of time since last drink and bingeing. No significant differences were found ( $p>0.05$ ). These results indicate no difference in beta and theta wave activities between college drinkers and non-drinkers, regardless of bingeing pattern or time since last binge. As EEG synchronization can be correlated to neurological damage, these results could indicate that alcohol-induced damage may not be found in short-term heavy drinkers.

**Poster Board No. 058 IDENTIFICATION AND PREVENTION OF MRSA TRANSFERRED BETWEEN COMMUNITY AND MEDICAL SETTINGS ON MOBILE PHONES.** Karen A. Kruzer, kak123@case.edu, Case Western Reserve University, Cleveland OH 44106.

The growth of community acquired methicillin resistant *Staphylococcus aureus* (CA-MRSA) presents a striking public health challenge. Prevalence in community and healthcare settings is rising and antibiotic resistance is increasing. It is hypothesized that if medical staff use mobile phones throughout shifts and phones are not properly disinfected, MRSA can be transferred between the community and healthcare facilities. Sterile swabs were taken from phones of 30 patient-care nursing home staff pre-shift and cultured on blood agar to identify pathogens brought into the facility. The phones were then disinfected with alcohol wipes. All plates were incubated at 37°C for 24 hours and bacteria identified through gram stains and Staphaurex. Swabs from the same 30 phones were cultured post-shift to identify pathogens acquired within the nursing home. 33.3% of phones carried pathogens into the nursing facility, with 13% positive for community acquired methicillin sensitive *Staphylococcus aureus* (CA-MSSA) and 20% positive for CA-MRSA. 23.3% carried pathogens back into the community, with 10% positive for hospital-acquired MSSA (HA-MSSA) and 13.3% positive for HA-MRSA. A *Staphylococcus* Education Program was presented to 519 high school students within the community, with effectiveness assessed through 10-question pre/post-tests. Following education, 76.1% of students understood *Staphylococcus aureus* (SA) effects, 69.9% understood superbugs, 91.5% understood prevalence, and 69.2% felt they could identify SA infections. Disinfecting mobile phones and implementing *Staphylococcus* education were effective. Effective hand hygiene, including disinfecting frequently handled objects is crucial, especially near vulnerable populations. Prevention practices involving community education combined with effective hygiene practices should reduce the number of staphylococcus infections.

**Poster Board No. 059 COMPARISON OF THE ANTIMICROBIAL ACTIVITY OF ETHANOL EXTRACTS OF THYME AND OREGANO TO THEIR MAJOR SYNTHETIC COMPONENTS ACTING ALONE OR IN SYNERGY.** Phillip N. Taylor, p-taylor.2@onu.edu, (Vicki A Motz, v-motz@onu.edu, Linda M. Young, l-young@onu.edu), Holly A Taylor, h-taylor.1@onu.edu, (Christopher P. Bowers, c-bowers@onu.edu, David H. Kinder, d-kinder@onu.edu), 209 North Gilbert St., Ada OH 45810.

**edu), Holly A Taylor, h-taylor.1@onu.edu, (Christopher P. Bowers, c-bowers@onu.edu, David H. Kinder, d-kinder@onu.edu), 209 North Gilbert St., Ada OH 45810.**

The monoterpenes, thymol and carvacrol, are phenolic compounds with antibiotic capabilities found in extracts of *Thymus vulgaris* and *Oreganum vulgare*. Thymol content is highest in thyme and carvacrol highest in oregano. This study examined the premise that herbal antibiosis is due to synergistic activity of these and other phenols by comparing herbal extracts (containing multiple components) to pure synthetic compounds. The hypothesis was that extracts of thyme and oregano work more effectively in synergy than alone, and that extracts exhibit greater antibiosis than synthetic compounds. Kirby Bauer assay was run in triplicate using ethanol extracts (0.050g herbal extract/disk) against four Gram-negative bacteria, three Gram-positive bacteria, and two yeasts. Zones of inhibition (measured in millimeters) were averaged and significant differences among treatments tested by one-way ANOVA followed by post-hoc comparisons using Student's 1-tailed t-tests at a 95% confidence level. Both thyme and oregano extracts were more effective against Gram-positive than Gram-negative bacteria but neither was effective against the yeast tested. While both extracts were significantly more effective than equivalent amounts of synthetic monoterpenes against Gram-positive bacteria ( $p=0.003$ ,  $p=0.012$ ), the inverse was true against Gram-negative species ( $p=0.131$ ,  $p=0.012$ ). Although antibiotic activity of the combined herbs was not significantly higher than the herbs working alone, efficacy of combined synthetic compounds was significantly higher than either alone against Gram-negative bacteria ( $p=0.001$ ,  $p=0.004$ ). Further testing is necessary to determine whether this effect is additive or synergistic. In this study, no synergism was evidenced by thyme and oregano extracts working in unison.

**Poster Board No. 060 SEASONAL CHANGES IN PHENOLIC CONTENT AND ANTIMICROBIAL ACTIVITY OF THYME (THYMUS VULGARIS) AND OREGANO (ORIGANUM VULGARE).** Jeannette K. Loyer, j-loyer.1@onu.edu, (Vicki A. Motz, v-motz@onu.edu, Linda M. Young, l-young@onu.edu), Brittney L. Simmons, b-simmons@onu.edu, Holly Taylor, h-taylor.1@onu.edu, (Christopher Bowers, c-bowers@onu.edu, David H. Kinder, d-kinder@onu.edu), Ohio Northern University, 402 West College Ave, Unit 2438, Ada OH 45810.

Studies have shown that thymol, a phenolic component of thyme (*Thymus vulgaris*) and oregano (*Oreganum vulgare*), exhibits antimicrobial properties on a dose response basis. The developmental stage (pre-flower, flower, post-flower, and seed-set) at harvest correlates with thymol content in both thyme and oregano. The purpose of this study is to quantify the thymol content of these herbs during varying stages of physiological development and correlate these data with their antimicrobial efficacy. The hypothesis being tested is that there is a direct correlation between phenol content and antibacterial competency and that both will increase from early season until full flowering and then decrease. Plants were grown in Ada and Marysville, OH and aerial parts harvested during each phase. Samples were dried, weighed, extracted in ethanol, reconstituted to 1.00g herbal extract/m and quantified with GC-MS. Extracts were tested for antimicrobial competency via the Kirby-Bauer method against three Gram-positive and three Gram-negative bacteria. All extracts tested exhibit greater zones of inhibition against Gram-positive than Gram-negative species with greatest antibiosis against MRSA. Early season extracts had significantly lower thymol content ( $P=.005$ ;  $N=33$ ) and antibiotic efficacy ( $p=.0009$ ;  $N=33$ ) increasing while plants are in flower. There was also an increase in both over time in control plants which did not flower indicating that the increase in thymol content is dependent upon the age of the plant rather than its physiological state.



**Poster Board No. 061 LOCATIONAL EFFECTS OF GROWING CONDITIONS AND THYMOL AND CARVACROL CONCENTRATIONS ON ANTIBIOSIS BY ETHANOLIC EXTRACTS OF THYME AND OREGANO IN THREE OHIO COUNTIES.** Brittney L. Simmons, b-simmons@onu.edu, (Vicki A. Motz, v-motz@onu.edu, Linda M. Young, l-young@onu.edu), Jeannette K. Loyer, j-loyer.1@onu.edu, Holly Taylor, h-taylor.1@onu.edu, (Christopher Bowers, c-bowers@onu.edu, David H. Kinder, d-kinder@onu.edu), Ohio Northern University 402 West College Ave, Unit 3032, Ada OH 45810.

Growing conditions correlate with concentrations of the limonene derivatives thymol and carvacrol, antibacterial phenols found in thyme (*Thymus vulgaris*) and oregano (*Origanum vulgare*). This study examines the thymol/carvacrol ratio (TCR) in plants grown in three Ohio counties (Allen, Hardin, Union) and correlates TCR with antibiotics as measured by Kirby Bauer analysis. The hypothesis is that there is an inverse TCR- rainfall relationship, and direct TCR- antibiotic relationship; and that plants grown under similar weather conditions should have similar phenolic ratios. Plants were grown in Lima, Ada and Marysville, Ohio in full sun in silty clay soil; and harvested at the end of the growing season. Samples were dried, extracted in ethanol and reconstituted to 1.00g extract/ml. Thymol and carvacrol content of extracts were quantified by GC-MS and antibiotic efficacy was determined via the Kirby-Bauer method against three Gram positive (*Staphylococcus aureus*, Methicillin-resistant *Staphylococcus aureus*, *Bacillus subtilis*) bacteria. Linear regression analysis was run and TCR for Ohio thyme plants showed a strong inverse correlation with rainfall ( $R = -.75$ ,  $N=4$ ), poor correlation with temperature ( $R = -.21$ ,  $N=4$ ) and strong direct correlation with antibiotics ( $R = .99$ ,  $N=4$ ). Ohio TCRs were compared with data from similar studies in Serbia (rainfall similar to Marysville site) and New Zealand (rainfall close to Ada) to determine potential locational impact on thymol/carvacrol ratio. The TCR was calculated for the international studies and TCR/rainfall relationships were consistent with the OH locations implying the potential to use rainfall as an indicator of potential for antibiotic use.

**Poster Board No. 062 SEQUENCE AND COMPARISON OF COLLAGEN-BINDING GENES FROM FIVE HUMAN ISOLATES OF STAPHYLOCOCCUS AUREUS.** Natalie R. Metzger, NatalieMetzger@walsh.edu, (Darlene G. Walro, dwalro@walsh.edu), Walsh University, 2020 East Maple St., North Canton OH 44720.

*Staphylococcus aureus* is a normal inhabitant of the nose and skin in healthy humans and usually does not cause infection but under certain conditions such as following surgery or trauma to the skin, may cause opportunistic infections. Genes encoding "microbial surface components recognizing adhesive matrix molecules", termed MSCRAMMs, that bind fibronectin, fibrinogen, elastin, osteopontin and collagen have been identified as virulence factors for *S. aureus*. The purpose of this study is to determine and compare the sequence of portions of the collagen-binding (*cna*) gene from several isolates and to measure the binding activity of each to collagen-coated multiwell dishes by a colorimetric assay. In this study, *S. aureus* was isolated on mannitol salt agar from the anterior nares of otherwise healthy humans and identified as coagulase-producers by the BBL™ Staphyloslide™ latex assay. Five of these isolates were further characterized by polymerase chain amplification and identified as possessing the 192-bp collagen-binding gene fragment. The 192-bp fragment of each isolate was sequenced and compared by BLAST analysis. The ability of each isolate to bind to collagen-coated plates will be evaluated by a colorimetric assay and reported. The goal of this study is to determine whether or not sequence differences in the 192-bp fragment correlate with differences in collagen-binding activities of the isolates. Not all strains of *S. aureus* possess the *cna* gene or produce the collagen-binding protein. This study will provide further insight into the conservation of the *cna* gene found in isolates of *S. aureus*.

**Poster Board No. 063 INSIGHTS INTO ANTIBIOTIC RESISTANCE RISE AND SPREAD USING BIOINFORMATICS.** Jonathon Combs, combsj@findlay.edu, Matt Hoostal, University of Findlay, Findlay OH 45840.

Many antibiotic and heavy metal efflux proteins share high levels of amino acid sequence similarity, suggesting these groups of proteins may share common evolutionary origins. Furthermore, the presence of efflux genes on both chromosomes and plasmids suggest that these genes may spread throughout bacterial communities by horizontal gene transfer (HGT). The molecular physiology of both antibiotic and heavy metal resistance genes has been extensively studied; however, their putative evolutionary homology is less understood. This research infers phylogenetic relationships among antibiotic resistance proteins AcrAB and TolC, as well as the heavy metal resistance proteins CzcABC and SilABC. Functionally characterized heavy metal and antibiotic efflux protein sequences, as well as sequences derived from published genome projects, were collected from the Genbank database. To assess potential relationships among these proteins, Bayesian inferences of phylogeny were reconstructed from multiple sequence alignments. Phylogenies inferred orthology between antibiotic and heavy metal efflux proteins with high bootstrap levels of confidence. Moreover, structural comparisons between antibiotic and metal efflux proteins demonstrated low root mean square deviations, corroborating the phylogenetic inferences of orthology and potentially validating the inclusion of multiple protein families into the phylogenetic reconstruction. Finally multiple novel instances of horizontal gene transfer were suggested by differential tree topologies between reconstructed phylogenies and published 16S rDNA phylogenies. These prospective instances of horizontal gene transfer were corroborated by differential GC% content ( $> 2$  standard deviations from mean) between efflux genes and host genomes. Notably, multiple instances of horizontal gene transfer between bacteria and eukaryotes were suggested by phylogenetic inferences.

**Poster Board No. 064 THE PREVALENCE OF MRSA IN THE SOIL OF THE BLANCHARD RIVER.** Kara N Sheerer, sheerer@findlay.edu, Bridgette T Moritz, moritzb@findlay.edu, Laura C Seslar, seslarl@findlay.edu, Mary B Talbott, talbottm@findlay.edu, (Bethany Henderson-Dean, PhD, henderson-dean@findlay.edu), 1000 North Main Street, Findlay OH 45840.

The aim of this experiment was to determine the prevalence of MRSA in the soil of the Blanchard River. The hypothesis was that there would be no significant differences in resistance patterns of the MRSA found in the Blanchard River in various locations in Hancock County. Soil samples were taken from both the riverbed and riverbank at seven different localities around Findlay, Ohio, three on the eastern side of the city, and four on the western side of the city. MRSA was isolated using the differential media, Spectra MRSA (Remel). Confirmatory MRSA tests included antibiotic disc diffusion assays and PCR analysis of the *mecA* gene. MRSA positive isolates were further classified through *spa*-typing and *PVL* gene amplification to determine if isolates were community or health-care associated isolates.

**Poster Board No. 065 ARE PATHOGENIC BACTERIA CONTAMINATING RIVER WATER FROM SURROUNDING HORSE POPULATION?** Jessica L. Panozzo, panozzoj@findlay.edu, Rachel L. Hennings, henningsr@findlay.edu, Dominica J. Way, wayd@findlay.edu, Joshua D. Hemker, hemkerj@findlay.edu, University of Findlay, 1000 North Main St, Mailbox 952, Findlay OH 45840.

Findlay, Ohio is home to many horses; Known carriers of the highly infectious bacteria *Staphylococcus aureus* and hosts of *Vibrio cholera*. Findlay's Blanchard River was tested to determine if any contamination occurred from the bacteria and if so, was it due to the horses. If the water is contaminated with *V. cholera* then the horses



and people that handle them could be in danger. The hypothesis is horses in Findlay are contaminating the water with infectious bacteria. Six fecal samples were collected from different horses, in triplicate, around the area. Eleven water samples were collected from different areas in the river, within city limits and in rural areas, done in triplicate. Serial dilutions were performed on the samples, no dilution factor acquired for the water samples; A serial dilution of  $1 \times 10^{-22}$  was used for fecal samples on MSA (Mannitol Salt Agar). MSA plates were used to differentiate between the species of *Staphylococcus*. Next TCBS (Thiosulfate Citrate Bile Salts Sucrose) agar was used to differentiate between the *Vibrio* species. Lastly, bacteria were tested with penicillin, tetracycline, gentamycin and doxycycline for antibiotic resistance. *S. aureus* was found in the water samples, but not the fecal samples. Could be either the horses weren't shedding the bacteria at time of collection, around 3 p.m., or bacteria was not shed in their feces. *V. cholera* had results opposite of *S. aureus*. Due to fecal matter not containing *S. aureus* and the water samples having the bacteria, the conclusion is horses were not contaminating the river water with infectious bacteria.

**Poster Board No. 066 COMPARATIVE ANALYSIS OF PATHOGENIC *E. COLI* (O157:H7) STRAIN IN THE BLANCHARD RIVER.** Michael T. Robbins, [robbinsm@findlay.edu](mailto:robbinsm@findlay.edu), Ashley Miller, [millera1@findlay.edu](mailto:millera1@findlay.edu), Crystal Placke, [plackec@findlay.edu](mailto:plackec@findlay.edu), Heather L. Boehmer, [boehmerh@findlay.edu](mailto:boehmerh@findlay.edu), Lauryn L. Messmer, [messmerl@findlay.edu](mailto:messmerl@findlay.edu), Melissa R. Krieg, [kriegm@findlay.edu](mailto:kriegm@findlay.edu), Theresa M. Roof, [roof@findlay.edu](mailto:roof@findlay.edu), Timothy Ericksen, [ericksent@findlay.edu](mailto:ericksent@findlay.edu), Tyler Combs, [combst@findlay.edu](mailto:combst@findlay.edu), Michael T. Robbins, (Bethany D. Henderson-Dean [henderson-dean@findlay.edu](mailto:henderson-dean@findlay.edu)), 501 Frazer St., Findlay OH 45840.

*E. coli* O157:H7 is a commonly recognized serotype that is harbored by bovine species and can cause human disease. The hypothesis is there will be increased antibiotic resistance for *E. coli* O157:H7 serotype in the urban water samples where there may be more human fecal contamination compared to rural water samples. However, there will be a greater number of *E. coli* coliforms in the rural area samples and a decrease in antibiotic resistance for *E. coli* O157:H7 serotype. Samples of water were collected from the Blanchard River in rural and urban Hancock County Ohio and tested using ColiscanMF™ (Micrology, Goshen) to identify coliform bacteria and further isolate *E. coli* colonies. *E. coli* O157:H7 was determined to be present via RIM™ *E. coli* O157:H7 Latex Test (Remel, Lenexa). Mueller Hinton agar was used to perform Kirby-Bauer disk diffusion antibiotic resistance testing. The levels of antibiotic resistance to oxacillin (10µg), ciprofloxacin (5 µg), ceftiofur (30 µg), and erythromycin (15 µg) were tested on this bacteria serotype. Resistance genes were detected using PCR. *pbpB* gene presence was tested for strains resistant to ceftiofur, *bla<sub>oxa2</sub>* gene for oxacillin resistance, and *ermA* gene for erythromycin resistance. Analysis for variance was performed using an unpaired t-test to determine differences in *E. coli* population in the rural and urban settings. Results pending further experimentation work.

**Poster Board No. 067 METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* IN HORSES.** Chelsea K Nemecc, [nemecc@findlay.edu](mailto:nemecc@findlay.edu), Sarah L Morar, [morars@findlay.edu](mailto:morars@findlay.edu), Lydia Shafer, [shaferl@findlay.edu](mailto:shaferl@findlay.edu), Caitlin E Logan, [loganc@findlay.edu](mailto:loganc@findlay.edu), (Bethany Henderson-Dean) 1000 N Main St. Findlay OH 45840.

In Methicillin-resistant *Staphylococcus aureus* (MRSA), the bacteria contain a *mecA* gene that encodes for an altered PBP-2a and thus inhibits the effects of several classes of antibiotics. MRSA can be classified as one of two major strains based on this *mecA* cassette, Hospital-Acquired MRSA (ha-MRSA strain *spa* types I, II, and III), and Community-Acquired MRSA (ca-MRSA *spa* type IV). This project will determine the prevalence and distribution of MRSA in equines in large boarding facilities

to determine transmission patterns and rates within the population. It is hypothesized that the prevalence of MRSA within the facility will be high due to a large number of horses entering and exiting the property, and the rate of transmission will be high throughout the facility due to high levels of activity. This hypothesis is based on prior studies completed in Canada, Europe, and the United States. For this project nasal isolates from 20 horses were cultured on selective media, MRSA spectra. Suspected MRSA isolates were then screened through multiplex PCR to confirm *S. aureus* isolation and the presence of the *mecA* gene. The isolates will further be *spa* typed and transmission modeling and ANOVA analysis will be used to determine patterns and rate of transmission as results become available.

**Poster Board No. 068 SALMONELLA ANTIBIOTIC RESISTANCE TRENDS IN THE BLANCHARD RIVER.** Sarah E. Higgins, [higgins@findlay.edu](mailto:higgins@findlay.edu), Brittany L. Graham, [graham@findlay.edu](mailto:graham@findlay.edu), Emily K. Ricker, [rickere@findlay.edu](mailto:rickere@findlay.edu), Courtney E. Long, [longc@findlay.edu](mailto:longc@findlay.edu), (Bethany Henderson-Dean, Advisor), The University of Findlay, 1000 North Main Street, Box 0566, Findlay OH 45840.

The goal of this experiment is to assess differential levels of antibiotic resistant strains of *Salmonella* across potential gradients of antibiotic concentrations in the Blanchard River, Hancock County, Ohio. Resistance to the antibiotics oxacillin and gentamicin is hypothesized to be higher in urban sites as these antibiotics are commonly used in human medicine. Tetracycline resistance is hypothesized to be more prevalent in rural areas as it is used in agriculture. Methods of experimentation include dilution of water samples on Hektoen Enteric agar (Difco, Maryland). One percent of colonies grown were tested for antibiotic resistance using the Kirby-Bauer method with antibiotic disks gentamicin, tetracycline, and oxacillin (Becton Dickson and Company, Maryland) and Mueller Hinton agar (Remel, Kansas). These colonies were confirmed to be *Salmonella* by PCR amplifying the DNA encoding 16sRNA, which is highly conserved among *Salmonella* strains. Initially, we have observed tetracycline resistance patterns in rural sites. Statistically, we plan to analyze the antibiotic resistance of each individual antibiotic between eastern (urban) and western (rural) localities using a two sample t-test (n=9). A one sample t-test compares zones of inhibition at each site for each antibiotic to the known inhibition standard to determine if the site, overall, is resistant to the antibiotic. This information is necessary in that it will help us to determine if antibiotic usage in the surrounding areas is creating resistant *Salmonella* strains in the Blanchard River, Hancock County, Ohio.

**Poster Board No. 069 GENERATION OF A PROKARYOTIC EXPRESSION SYSTEM FOR HUMAN SRY.** John F. Prokop, [johnprokop@walsh.edu](mailto:johnprokop@walsh.edu), (Adam Underwood PhD, [aunderwood@walsh.edu](mailto:aunderwood@walsh.edu)), Walsh University, 2020 East Maple St. NE, North Canton OH 44720.

SRY, the sex-determining region of the Y chromosome, is a transcription factor (TF) required for initiation and maintenance of male phenotype. As a TF, SRY binds and bends target DNA sequences thus regulating expression. While much is known about SRY biochemically, the mechanistic activity and targets remain elusive in both embryonic and adult systems. The objective of this project was to create a bacterial expression vector to produce SRY protein for use in future functional studies. The tested hypothesis was: Inserting the SRY coding region into the NEB™ pTYB4 expression vector will allow expression of SRY protein from *E. coli* cells transformed with this construct. Generation of the pTYB4/SRY construct began by PCR amplifying the SRY coding region followed by cleavage of amplicons with the restriction endonucleases *Nco I* and *Sma I*. Restriction fragments were then inserted into the vector using T4 DNA ligase after cleavage with the same enzymes. The pTYB4/SRY construct was then transformed into NEB™ T7 Express *I<sub>q</sub>* competent *E. coli*

cells. Transformation of the expression vector was verified with PCR, restriction fragment analysis, and direct sequencing of purified plasmid DNA. *SRY* expression was induced with 0.75 mM IPTG. The SRY fusion proteins generated contain a C-terminal chitin-binding domain that facilitates one-step purification. Successful protein expression and extraction was confirmed using SDS-PAGE and Western blot analysis. SRY proteins produced and isolated using this expression vector can now be used for future studies focusing on protein activity such as DNA binding and protein-protein interactions.

**Poster Board No. 070 EVALUATING GENOTOXIC CONCENTRATIONS OF CADMIUM AND MENADIONE ON MAMMALIAN FIBROBLASTS.** Erika P. Berger, [bergere@findlay.edu](mailto:bergere@findlay.edu), Adriana C. Casagrande, Michael A. Edelbrock Ph.D., The University of Findlay, Department of Natural Sciences, 1000 N. Main Street, Findlay OH 45840.

Currently, it is suspected that cadmium acts as a co-carcinogen that interferes with repair of oxidative damage to DNA. However, the mutagenic and toxic concentrations of cadmium on cells are poorly understood. Cells killed by toxic levels of cadmium cannot cause neoplasia, therefore identifying sub-lethal concentrations of cadmium which produce mutations is necessary for investigating cadmium's carcinogenic mechanisms. The University of Toledo provided NIH3T3 (murine) and WS1 (human) fibroblasts that were cultured and treated with cadmium (0-10 $\mu$ M) in initial eight and thirteen day exposure assays, respectively, to determine toxic concentrations of cadmium by colony survival assay. Cells were seeded at a uniform density of 600 (NIH3T3) or 1000 (WS1) cells per plate and cultured in media containing cadmium. At pre-calculated times, treated cells were fixed and stained with crystal violet and viable colonies counted. Subsequent assays investigated the ability of menadione, an oxidative stressor, to amplify the effects of cadmium. Further identical long-term assays investigated the effects of chronic oxidative stress, simulated by low, sustained menadione concentrations on cadmium treated cells. Short-term assays investigated the effects of acute stressors, simulated by bursts of high menadione concentrations for fifteen minutes. Preliminary results show a steady decline in colony survival as concentration of cadmium increases, with the sharpest decline seen after 2  $\mu$ M cadmium. Short duration oxidative burst in combination with low level (0.2 $\mu$ M) cadmium produced a survival effect above that of control cells. Further assays will more accurately pinpoint cadmium toxicity thresholds for these fibroblast lines, and further investigate the effects of oxidative stress on cadmium treated cells.

**Poster Board No. 071 MUTAGENIC EFFECTS OF CADMIUM ON MITOCHONDRIAL AND NUCLEAR DNA.** Amanda R. Ross, [rossa@findlay.edu](mailto:rossa@findlay.edu), Ashley Patton, [pattona@findlay.edu](mailto:pattona@findlay.edu), Michael A. Edelbrock, Ph.D., [edelbrock@findlay.edu](mailto:edelbrock@findlay.edu), The University of Findlay, Department of Natural Sciences, 1000 N Main Street, Findlay OH 45840.

Cadmium is known to have mutagenic effects on human genes. Cadmium has been classified as a co-carcinogen, however the direct mechanism is not known. Recent studies suggest that cadmium in combination with oxidative stress may interfere with DNA damage repair processes and cause mutations. The hypothesis of this investigation is that low levels of cadmium in combination with an oxidative agent will induce mutations in the human mitochondrial and nuclear genome. Cells were grown in culture and either treated with low levels of cadmium (<10  $\mu$ M) or with vehicle (control) for 72 hours. Subsequently, cells were treated with menadione (10 $\mu$ M), an oxidative agent, for various time increments (0, 2, 30 and 60 minutes). Total genomic DNA was extracted and PCR amplification of mitochondrial DNA gene and non-gene sequences were conducted. Sequence

analyses of the amplified DNA products will determine relative mutation frequency of cadmium treated cells, cadmium and menadione treated cells, and non-treated cells. It is expected to see differences in the frequency of mutations based upon the treatment group. Future PCR amplification and sequencing will be conducted on a nuclear genome target sequence. These results will be compared to the mitochondrial results.

**Poster Board No. 072 IDENTIFICATION AND CHARACTERIZATION OF CHITINASE ACTIVITY IN THE GUT OF THE YELLOW-BELLIED SLIDER TURTLE, *TRACHEMYS SCRIPTA*.** Katie A. Kaiser, [katie.kaiser@otterbein.edu](mailto:katie.kaiser@otterbein.edu), Annie M. Garrett, [annie.garrett@otterbein.edu](mailto:annie.garrett@otterbein.edu), (Sarah S. Bouchard, [sbouchard@otterbein.edu](mailto:sbouchard@otterbein.edu), John T. Tansey, [jtansey@otterbein.edu](mailto:jtansey@otterbein.edu)), SMC 12646, One Otterbein University, Westerville OH 43081.

The Slider Turtle, *Trachemys scripta*, is able to digest chitin, a polysaccharide of glucosamine, from the exoskeletons of invertebrate prey. However, it is unknown if this digestion can be attributed to bacterial symbionts in the gut or endogenous turtle enzymes. The purpose of this work was to establish the existence and location in the digestive tract of an endogenous chitinase and identify its optimal pH ranges. Turtles were fed either a plant or invertebrate diet and then dissected to extract tissues to be assayed for chitinase activity. Activity was assayed using a chitin substrate tagged with fluorescent 4-methylumbelliferone. Stomach, small intestine, large intestine, and pancreas tissues were tested at multiple pHs to determine optimum conditions for enzyme activity. Preliminary results suggest the highest activity occurs in the small and large intestines of turtles fed both diets. Two activity peaks were found at pH 2.5 and 5.0; additionally NaCl appears to effectively diminish activity at pH 2.5. The detection of two peaks suggests there may be two enzymes responsible for the degradation of chitinase throughout the gut of *Trachemys scripta*.

**Poster Board No. 073 THE EFFECT OF LOW AND HIGH FIBER DIETS ON DIGESTIVE PROCESSES IN THE YELLOW-BELLIED SLIDER TURTLE, *TRACHEMYS SCRIPTA*.** Devin M. Smith, [Devin.Smith@otterbein.edu](mailto:Devin.Smith@otterbein.edu), Steven Campbell, [Steven.Campbell@otterbein.edu](mailto:Steven.Campbell@otterbein.edu), (Sarah S. Bouchard, [sbouchard@otterbein.edu](mailto:sbouchard@otterbein.edu)), Otterbein University, Department of Life & Earth Sciences, 1 S. Grove St, Westerville OH 43081.

Adult Yellow-Bellied Slider Turtles, *Trachemys scripta*, consume high quantities of plant matter, which can vary markedly in fiber content. The fiber component of a diet consists of cellulose, which is broken down by microbial fermentation in the large intestine. This study examines the effects of low and high fiber diets on intake, transit time, and basking behavior. It was predicted that the turtles would have lower intake on the high fiber diet because it takes longer to ferment. It would therefore move more slowly through the digestive track, resulting in a longer transit time. It was also expected that more basking would occur on the high fiber diet because basking may facilitate digestion. Ten turtles were fed high and low fiber diets *ad libitum* in a repeated measure design for 27 days on each diet. Transit time was measured with a physical marker that was placed into the food. Preliminary results show that turtles have higher intake on the low fiber diet than on the high fiber diet. The effect of fiber on diet transit time and basking behavior is currently being assessed.

**Poster Board No. 074 THE EFFECT OF A MIXTURE OF TWO CONGENERS OF PCB, 47 AND 77 ON ENZYMES INVOLVED IN THE SYNTHESIS OF CATECHOLAMINES IN THE RAT ADRENAL GLAND.** Mahesh R. Pillai, [mpillai@bgsu.edu](mailto:mpillai@bgsu.edu), Ana M. Oyarce, [AnaMaria.Oyarce@utoledo.edu](mailto:AnaMaria.Oyarce@utoledo.edu), Lee A. Meserve, [Imeserv@bgsu.edu](mailto:Imeserv@bgsu.edu), Tami C. Steveson, [tcsteve@bgsu.edu](mailto:tcsteve@bgsu.edu), Department of Biological Sciences, Bowling Green State University, 1001 E Wooster St, Bowling Green OH 43403.

Polychlorinated biphenyls (PCBs) are endocrine disruptors that bioaccumulate in tissues. The adrenal medulla



synthesizes dopamine and epinephrine using enzymes including tyrosine hydroxylase (TH) and dopamine  $\beta$ -monooxygenase (DBM). This study investigates effects of PCB 47/77, molecules with similar structure to thyroid hormones, on DBM and TH expression in adrenals of 3-, 21- and 60-day-old rats. PCB 47/77 was administered in maternal diet at 0 (control), 12.5 or 25 ppm from gestational day 1 until pup euthanasia at days 3-, 21- and 60-of-age ( $n=3$ ). Western blots were standardized using GAPDH. Statistical analysis compared two experimental groups by one-way ANOVA and Student's t-test and more than two groups by Fisher's LSD. For all significant results,  $p < 0.05$ . Western blot analyses showed that when compared to same-age controls, PCB significantly depressed DBM in 3- and 60-day-old rats regardless of dose, but only after 25 ppm PCB in 21-day-old rats. PCB depressed TH expression significantly less in 3-day-old rats, and elevated it in 21- and 60-day-old rats regardless of PCB dose. Levels of DBM and TH expression decreased significantly with increasing age in controls. The 12.5 ppm PCB significantly depressed TH in 21- and 60-day-old rats and DBM in 60-day-old rats but not 3-day-old rats. The 25 ppm PCB significantly increased TH expression steadily with age, whereas DBM levels decreased significantly in 21- and 60-day-old rats as compared to 3-day-old rats. Overall, exposure of rats to PCB 47/77 resulted in alterations in expression of enzymes potentially affecting catecholamine synthesis, and disrupting mechanisms involved in the flight or fight response.

**Poster Board No. 075 VEGETATION AND HABITAT CHARACTERISTICS OF BOBCATS (*LYNX RUFUS*) AND COYOTES (*CANIS LATRANS*) ON A RECLAIMED SURFACE MINE (THE WILDS).** Jeffrey P. Storz, [jstorz@muskingum.edu](mailto:jstorz@muskingum.edu), Danny J. Ingold, [ingold@muskingum.edu](mailto:ingold@muskingum.edu), Barb Wolfe, [bwolfe@thewilds.org](mailto:bwolfe@thewilds.org), Muskingum University, 199 Stormont Street, New Concord OH 43762.

Reclaimed surface mines have been shown to provide suitable reproductive habitat for a variety of bird species as well as some small mammals. However, relatively little work has focused on the extent to which reclaimed surface mines are inhabited by larger carnivorous mammals such as bobcats (*Lynx rufus*) and coyotes (*Canis latrans*). From mid-May through mid-August 2010, several habitat measures were taken at both the micro- and landscape scales around 13 bobcat and 12 coyote scat on a reclaimed surface mine (the Wilds). Scat were identified by their morphology (shape and content) as well as with the assistance of a trained dog. Micro-habitat measures were taken from circular plots (15 meter radius) with the scat at the center. Coyote plots had significantly taller vegetation than bobcat plots ( $t = -3.40$ ,  $df = 23$ ,  $p < 0.05$ ). The number of bobcat plots without trees was notably higher than the number of plots with trees, whereas the number of coyote plots with and without trees was approximately equal. At the landscape level, bobcat scat were significantly farther away from lakes ( $t = 2.25$ ,  $df = 23$ ,  $p < 0.05$ ) and streams ( $t = 2.73$ ,  $df = 23$ ,  $p < 0.05$ ) than coyote scat. These findings suggest that coyotes inhabit areas with taller herbaceous vegetation nearer to trees and tend to stay closer to bodies of water than do bobcats. In a broader sense, it is evident that both species are fairly common on this reclaimed surface mine and that this habitat is at least adequate for their survival.

**Poster Board No. 076 PREFERENCE IN BAT HOUSE DESIGN BY THE EVENING BAT (*NYCTICEIUS HUMERALIS*).** Kristen M. Lear<sup>1</sup>, [kmlear@owu.edu](mailto:kmlear@owu.edu), Elizabeth C. Braun de Torrez<sup>2</sup>, [ecbraun@bu.edu](mailto:ecbraun@bu.edu), Thomas H. Kunz<sup>2</sup>, [kunz@bu.edu](mailto:kunz@bu.edu), <sup>1</sup>Ohio Wesleyan University, Dept of Zoology, Delaware OH 43015-2930 and <sup>2</sup>Boston University, Dept of Biology, Boston MA 02215-1300. People have used bat houses to attract bats since the early 20th century; however, little research has been done on species-specific preferences in house design. We attempted to create roosting sites specifically for evening bats (*Nycticeius humeralis*). This species may be especially beneficial in pest suppression because they forage within

the tree canopy, have small foraging ranges, and consume pecan nut casebearer (*Acrobasis nuxvorella*) moths, one of the most devastating insect pests that occur in pecans. In addition, evening bats are declining due to loss of large trees with suitable roosting hollows. Two bat house designs were tested for their effectiveness in attracting and maintaining evening bat colonies. Nine pairs of houses were installed in three organic pecan orchards in central Texas. Each pair consisted of one two-chamber rocket box and one standard medium three-chamber house. The presence of guano beneath each house was documented and exploratory behavior around the houses was observed using a thermal imaging camera. Bats showed a significant preference for the rocket boxes in two of ten exploratory behaviors (Mann-Whitney  $U$ ,  $W=6200.00$ ,  $n=164$ ,  $P=0.032$ ; Mann-Whitney  $U$ ,  $W=6431.00$ ,  $n=164$ ,  $P=0.033$ ) and the mean number of guano pellets was higher under the rocket boxes (Mann-Whitney  $U$ ,  $W=12202.50$ ,  $n=283$ ,  $P < 0.001$ ). Data suggest that evening bats prefer the rocket boxes, which more closely resemble their natural roosting sites. This information can be used to better attract this species to conventional pecan orchards and areas where there are no large trees with suitable roosting hollows, benefitting both farmers and evening bats.

**Poster Session 2  
Pre-College Students  
Science Center  
2:00 p.m. – 4:00 p.m.**

**Poster Board No. 001 DOES LISTENING TO DRUMMING IMPROVE MEMORY?** Adam J Lannutti, [ajldarkknight@gmail.com](mailto:ajldarkknight@gmail.com), 2939 Dunhurst Court, Grove City, OH 43123. (Our Lady of Perpetual Help)

Music affects human behavior, and one of the obvious effects is on memory. The purpose of this study was to investigate the effects of drum music—one of the simplest forms of music—on iconic and echoic memory, forms of memory important in learning. It was hypothesized that listening to music would improve short-term memory. This experiment required a recording of a drum playing “Doodler’s Delight,” 3x3, 4x4 and 5x5 grids, a group ( $n=15$ ) of 8<sup>th</sup> grade test subjects, and seven random numbers. Random squares were shaded in one of each of the grids. Then each subject was shown the shaded grid for three seconds and asked to fill in blank grids based on their iconic memory of the shaded grid observed with or without the drum recording playing. Separately, seven random numbers were spoken to 8<sup>th</sup> grade subjects ( $n=8$ ) with and without the drum recording playing. Fifteen seconds separated each spoken number. The subjects were then asked to recite the seven numbers based on their echoic memory. The drum recording appeared to decrease average performance (by 9 and 1%, respectively) with the 4x4 and 5x5 grids. A 10% increase in average accuracy was observed with the 3x3 grids. The random number test resulted in a more dramatic difference: a 66% decrease in accuracy. The hypothesis was not supported. In all tests, the recording appeared to cause the subjects to take more time to think to overcome the distraction.

**Poster Board No. 002 BIRD BEAKS; COMPARISON OF MALE AND FEMALE NORTHERN CARDINAL BEAKS.** Kyle M. Davis, [Kdavis716@embarqmail.com](mailto:Kdavis716@embarqmail.com), 12885 Centerburg Rd., Sunbury OH 43074 (Big Walnut Middle School).

The characteristics of all species vary. Such variation is the basis for natural selection. In their classic study of Darwin’s Finches the Grants showed that beak size varied and that beak size in combination with variation in rainfall could determine survival of individuals. This research examines the gender difference in beak size and within gender variation in Northern Cardinals (*Cardinalis cardinalis*). Beak length was measured with digital calipers placed along the culmen from the point on the forehead where the feathers parted and the bill emerged to the tip of the



bill. One male, five female, and six juvenile cardinals were caught in mist nets west of Ashley, Ohio and measured during October 2009 – January 2010. Seventeen male and 10 female specimens were measured in the Ohio Wesleyan Museum of Zoology. Live birds were weighed and death weights on specimen tags were recorded. Males (44.88g) and females (45.12g) weighed the same, but males (14.6 mm) had longer bills than females (12.5 mm). Juveniles (44.67 g) weighed the same as adults and their bills (12.6 mm) were similar in length to those of females. However, bills of live juveniles were dark, whereas those of live adults were red to orange. Although males and females eat sunflower seeds and cracked corn at winter feeding stations, the difference in beak size may reduce competition at other times of year.

**Poster Board No. 003 RESEMBLANCE OR REBELLION: A STUDY OF PARENTAL POLITICAL INFLUENCE.** Lauren C. Thomas, [Itsweetpea@hotmail.com](mailto:Itsweetpea@hotmail.com), 7 Warwick Lane, Athens OH 45701. (Athens High School)

The purpose of this experiment was to determine whether a closer relationship between parents and children and more political awareness in families influenced teenagers' political beliefs. A pair of surveys was created—one for teenagers and the other for one of their parents. Each teenager-parent pair of the twenty that participated was asked to fill out their respective survey, answering questions about their political viewpoints, household political awareness (i.e. how often political topics were discussed) and parent-teen relationships. In order to analyze the data collected in this experiment, the agreement rate percentage for each pair (the number of times a teenager agreed with his/her parent on questions) was determined and used for further calculations. The average percentage of agreement rate for all the teenager-parent pairs who said they often discussed issues was 61.67%, compared to 49.22% for pairs who occasionally discussed issues and 43% for pairs who rarely discussed issues. However, when a pair disagreed on the frequency of political discussion, the agreement rate was between 71-71.33%. 68.75% of teens with close or very close relationships with their parents had a 50% and greater agreement rate on political issues, compared to only 50% of teens with a not very close or not very close at all relationship. In conclusion, a close relationship between parents and their children, as well as political awareness, affects teenagers' political viewpoints; however, there does not seem to be a major difference in families with political awareness and those without.

**Poster Board No. 004 THE EFFECT OF UV-C RADIATION ON CATALASE ACTIVITY IN STAPHYLOCOCCUS EPIDERMIDIS AND IN VITRO.** Andrew N. Abboud, [mma@woh.rr.com](mailto:mma@woh.rr.com), 748 Oak Lea Drive, Tipp City OH 45371. (Tippecanoe High School)

The effect of ultraviolet radiation on catalase activity has not been widely studied. *Staphylococcus epidermidis* is an occasionally pathogenic contaminant of medical prostheses. The purpose of this study was to determine the effect of a germicidal dose of UV-C radiation on catalase activity in *Staphylococcus epidermidis* and on the decomposition of hydrogen peroxide by catalase *in vitro*. It was hypothesized that a germicidal dose of UV-C radiation inhibits catalase activity *in vivo* and *in vitro*. Ten bacterial cultures of *Staphylococcus epidermidis* were tested for catalase activity before and after UV-C irradiation. All samples tested positive for catalase immediately after UV-C exposure. One sample was irradiated at a bactericidal dose of 60 minutes at 10cm from the light source, as evident by absence of sub-culture growth. This sample was positive for catalase activity immediately after UVC irradiation, demonstrating that bacterial death occurred before catalase was inhibited. The decomposition of hydrogen peroxide by catalase was tested *in vitro* under the same germicidal dose of 60 minutes at 10cm from the light source and was compared to a control. The Paired Wilcoxon Signed-Rank Test performed at the 5% significance level shows that the mean oxygen evolution rates of the control reaction, 0.219mL/sec, and the variable reaction, 0.214mL/sec, were

not significantly different, indicating that UV-C radiation did not inhibit catalase activity *in vitro*. These results do not support the hypothesis that a germicidal dose of ultraviolet radiation to *Staphylococcus epidermidis* inhibits catalase, as demonstrated by the persistence of activity *in vivo* and *in vitro*.

**Poster Board No. 005 VITIS LABRUSCA ANTHOCYANINS, THEIR IDENTIFICATION AND THEIR ANTIBACTERIAL EFFECTS ON CAPRA HIRCUS HOOF ROT BACTERIA.** Sarah M. Cox, [coxpj6@roadrunner.com](mailto:coxpj6@roadrunner.com), 2614 Lick Run Road, Chillicothe OH 45601. (Zane Trace High School)

Cloven-hooved animals, specifically *Capra hircus*, hoof rot is a common health problem and an economic liability. *Fusobacterium necrophorum* and *Arcanobacterium pyogenes* are common bacterial causes of hoof rot. Anthocyanins, pigments found in grapes, are polyphenols proven to have antibacterial effects. This experiment sought to treat hoof rot utilizing environmentally safe grape anthocyanins. The project's purpose was to identify the primary anthocyanins found in *Vitis labrusca* (Catawba cultivar) and to determine if these anthocyanins have antimicrobial properties against two common hoof rot bacteria. The hypotheses included: 1) the grape extract would contain at least 15 different anthocyanins; 2) the grape anthocyanins would have antibacterial effects on *F. necrophorum* and *A. pyogenes*; 3) The higher anthocyanin concentration would directly correlate with more extensive antibacterial inhibition zones. There were 21 individual anthocyanins identified in the grape extract. *V. labrusca* anthocyanins were extracted and identified primarily as delphinidin-3-glucoside and cyanidin-3-glucoside using HPLC gas chromatography. *C. hircus* hoof cultures were grown in an anaerobic chamber. *F. necrophorum* and *A. pyogenes* were identified using biochemical tests including Gram stain methods, catalase activity, automated testing, and oxidase activity. Bacterial identifications were also confirmed by sequencing 16S Ribosomal RNA gene. Two strengths of anthocyanins and a control of 0.05% CH<sub>3</sub>OH and 5% Hydrochloric acidified water were concentrated onto disks and placed on isolated cultures of *F. necrophorum* and *A. pyogenes* to determine the antimicrobial effect. *F. necrophorum* had inhibition zones to both anthocyanin strengths. *A. pyogenes* showed resistance to all anthocyanin strengths. Providing a safer, environment-friendly alternative to the traditional treatments of hoof rot is important both economically and ecologically.

**Poster Board No. 006 THE EFFECTS OF CONGRUENT AND INCONGRUENT FACIAL EXPRESSIONS ON REMEMBERING THE EMOTIONS OF OTHERS.** Willa G. Kerkhoff, [WillaGK@gmail.com](mailto:WillaGK@gmail.com), 501 E. High St, Mount Vernon OH 43050. (Mount Vernon HS)

People use many different levels of communication when remembering the emotions of others. Using an internet survey, this project investigated how well a subject remembered another's emotions when the facial expression was congruent or incongruent with the stated emotion. Volunteer participants (N=96) were drawn from the Mount Vernon, OH community and from extended family using an email request. Subjects viewed faces coupled with a statement made by the pictured person about how they felt. The subjects were allowed to spend as much time as they wanted on the images, but they could not go back to previous images. They then answered questions about how the pictured person felt (recognition) and why they felt that way (recall). Scores were recorded for congruent and incongruent questions, and then compared those scores between men (N=37) and women (N=59), and between different age groups divided by decades (10-20, 20-30, etc.). Overall, subjects did slightly better on both recall (+0.17 on average out of 8) and recognition (+0.43) questions when the facial expression was congruent with the emotion expressed. Women had a higher average score (+0.8) than men, indicating that women may have greater sensitivity to the feeling of others than men. In general, performance on both

recall and recognition questions decreased by ~2.5 between the age groups 10-20 and 40-50. However, in older subjects (50-60 and 60+, N=17 and 11, respectively), the average recall score (~3 -3.5) remained similar to younger adults for incongruent facial expressions, but actually increased (to > 4.0) for congruent facial expressions. Perhaps as a person's memory becomes less reliable, they focus on remembering faces rather than words. Human social interactions involve multiple levels of communication, and they depend on our ability to recall the thoughts and feelings of others. Thus, studying how these different levels of communication contribute to memory formation will help us to understand how our minds function in social environments.

**Poster Board No. 007 P-SELECTIN TARGETED DRUG DELIVERY NANO-PLATFORM FOR VASCULAR DISEASE.** Gurbani Kaur<sup>1</sup>, gkaur2013@gmail.com, Christa Modery<sup>2</sup>, c1m38@case.edu, Madhumitha Ravikummar<sup>2</sup>, mxr120@case.edu, (Anirban Sen Gupta PhD<sup>2</sup>), axs262@case.edu, <sup>1</sup>Hathaway Brown School, 19600 North Park Boulevard Shaker Heights OH 44122, <sup>2</sup>Case Western Reserve University, Department of Biomedical Engineering, Cleveland OH 44106. (Hathaway Brown School)

Cardiovascular diseases affect approximately 82 million Americans. A significant clinical event in cardiovascular pathology is arterial thrombo-occlusion leading to ischemia, myocardial infarctions, and stroke. Current interventional procedures like angioplasty/stenting or bypass grafting often lead to recurrent thrombosis and restenosis, while current systemic pharmacotherapy with anticoagulatory or antiplatelet drugs suffer from limitations of short drug plasma half-life, insufficient disease-site drug concentrations, and harmful hemorrhagic side effects. We hypothesize that a thrombus-targeted nanoscale drug delivery platform will reduce these limitations while enhancing site-selective therapy. For thrombus targeting, we chose to target activated platelets, which play a major role in clot formation. Specifically, we chose to target P-selectin, expressed only on activated pro-thrombotic platelets. We synthesized a P-selectin targeting peptide, DAEWVDVS, using solid phase chemistry and characterized it using mass spectroscopy. For the model delivery system, we used lipid bilayer vesicles called liposomes. The peptide was chemically conjugated to lipid and the conjugates were incorporated into fluorescently-labeled liposomes using standard reverse phase evaporation and extrusion. Final unilamellar liposomes were 150nm in diameter, confirmed by dynamic light scattering. Platelet-binding of liposomes was tested by incubating them on a monolayer of activated platelets under static and dynamic flow conditions using a parallel plate flow chamber. Epifluorescence microscopy images were taken and surface-averaged fluorescence intensity showed a two-fold increase in binding and shear-stable adhesion of the peptide-modified liposomes to activated platelets compared to unmodified liposomes ( $p < 0.05$ , N=10, Student's t-test). These results establish the potential of P-selectin-targeted liposomes as platform vehicles for vascular site-selective drug delivery.

**Poster Board No. 008 A STUDY ON SOYBEAN POPULATION LIMITATIONS.** Mariah Joy Cox, coxpj6@roadrunner.com, 2614 Lick Run Rd, Chillicothe OH 45601. (Ross County Christian Academy)

Soybean plant populations can vary considerably without affecting the final seed yield. It is best to plant enough seeds to insure an optimum yield, but not to overplant and waste seeds and money. Plant density can cause significant effects upon plant growth and development. Considering soybean seed cost and the ability of soybeans to conform for wide plant spacing; utmost attention should be given to seeding rates. Different soybean plant densities were evaluated by counting the number of soybean plant leaves to determine whether density affected the plant's health. The hypothesis was that ten soybeans in a one gallon pot would grow adequately and not show overcrowding or overpopulation symptoms, but twenty soybeans in a one gallon pot would show increased

plant overpopulation signs. Four different soybean planting variations were utilized starting with five, ten, twenty, and thirty seeds per separate one gallon pots. Each pot was watered every four days and was grown for four weeks under a plant grow light with 3000k color temperature. Every day, plant growth was observed and the number of leaves was counted. The results showed pots with five, ten and twenty seeds per pot produced plants with more leaves than the pots with thirty seeds. Therefore, the pots with fewer plants had more leaves per plant showing some evidence that the hypothesis was correct. Further studies are warranted with longer durations to determine if there are differences in stalks, branches, height of podset and pods per plant to consider differences in plant yield.

**Poster Board No. 009 DOES CHANGING THE SAMPLE SIZE AFFECT THE VALIDITY AND RELIABILITY OF A PREVIOUS EXPERIMENT EXPOSING UNSAFE AMOUNTS OF LEAD IN LIP GLOSS?** Mary B. Carrigan, carrigan2013@gmail.com, 6751 Shadowcreek Dr, Maumee OH 43537. (Central Catholic HS)

In 2008, an experiment was conducted which determined that lead (Pb) was present in lip gloss. This resulted in an average lip gloss application exceeding the FDA's safe limit for Pb in children's food products, which is 0.5 micrograms per milliliter. With attention being given to Pb in cosmetics, the 2008 results raised concerns that Pb in lip gloss could be a health hazard. Therefore, a repeat study using a larger sample size (n=10 in 2008 vs. n=20 in 2010) was conducted to test the reliability and validity of the previous results. It was hypothesized that the results of the 2008 experiment would be confirmed and that enlarging the sample size would improve the reliability and validity of the estimates used to draw conclusions about potential ingestion of Pb in lip gloss. The sample size was doubled from n=10 in the 2008 study to n=20 in the 2010 study. The Pb testing (sodium sulfide and Pb hydrolysis reaction yielding Pb sulfide, which produces a yellow-brown color indicator) and the lip gloss application procedures were duplicated and in 2010 the average application (amount of lip gloss applied in grams) decreased by a statistically significant amount, (0.097g 2008 to 0.025g in 2010.) at  $p = 0.0005$ . Even with this decrease in the average application from 2008 to 2010, it was calculated that the amount of Pb present in the average application still exceeded the safe limit for Pb in children's food products. The results of the 2008 study were reliable and replicated with precision and accuracy. This is important because many girls use lip gloss daily and are not aware of the potential risks of contaminants in the products they buy.

**Poster Board No. 010 COMPARISON OF LIGHT ENERGY REFLECTED BY FACETED VERSUS ROUNDED SURFACES.** Aron S. Aziz, saiz22@aol.com, 6711 Hawksnest Court, Westerville OH 43082. (Columbus Academy)

How does an object's shape affect the scattering of light waves? It is hypothesized that an object with sharper angles and more faceted surfaces will reflect the least amount of light energy back toward the source. The reflection of light waves is affected greatly by the shape of objects. Faceted and angular shapes scatter light waves; rounded shapes reflect waves back toward the source. To test this hypothesis, five wood models, increasing in number of facets and sharpness of angles from one rounded surface to seven angular facets, were placed individually inside the test box, along with a flashlight and a lux meter. The average results, in lux, are as follows (listed rounded to most faceted): Model A, (18.0); B, (17.6); C, (16.6); D, (8.2); E, (8.6); Control (empty), (3.0). The hypothesis is supported by this data. Results suggest that faceted surfaces impact electromagnetic light scattering more than sharper angles (the main difference between D and E, which were extremely similar). Further experiments in a controlled laboratory setting with more precisely constructed and measured models shaped in a



consistent progression from round to faceted would be the next step in investigating how light is reflected by different surfaces.

**Poster Board No. 011 THE CORROSION MECHANISM OF ALUMINUM (AL) IN AQUEOUS SOLUTIONS.** Emily A. Wells, [emenergy@earthlink.net](mailto:emenergy@earthlink.net), 1589 Bending Tree Drive, New Carlisle OH 45344 (Carroll High School)

Swimming pools can create a corrosive environment for aluminum products. Chlorine (Cl), salt (NaCl), acid (HCl) and dissimilar metals in pool water can cause aluminum products, such as floating lounge chairs, to corrode. Evaluation of corrosion factors is necessary before designing products for this environment. The cause of aluminum corrosion was evaluated using materials common to swimming pool environments including individual solutions of: 1) distilled water; 2) distilled water and salt (NaCl); 3) distilled water and chlorine (5 ppm); 4) distilled water and stainless steel screws (such as those which hold aluminum loungers together); and 5) distilled water, chlorine, salt and stainless steel screws (5ppm Cl, 130 mg NaCl in four liters). It was hypothesized that corrosion was caused by a material in the control (distilled water). Fifteen aluminum blanks (50.8mm x 25.4mm x 6.35mm) were placed into each solution. Every two weeks, for ten weeks, three individual samples were removed from each solution and massed. The solutions without stainless steel screws showed a sine wave pattern of weight loss with an average mass change of 3 mg to 32 mg. It was concluded that chlorine attacked the passive layer. Solutions with stainless steel screws showed corrosion rates with an average mass change of 9 mg to 22mg. The stainless steel screws acted as a cathode reduction for corrosion of the aluminum anode and created a passivation layer, thus protecting the aluminum from chlorine attack. Ten samples viewed under microscope (900x) showed evidence of general, crevice, and intergranular corrosion.

**Poster Board No. 012 CHEMICALLY MANIPULATING THE POTENTIAL OF AN ELECTROLYTIC CELL.** William K. Coors, [theflash@scientist.com](mailto:theflash@scientist.com), 5967 Bridgetown Road, Cincinnati OH. (Elder High School)

Green energy is a big news topic, making research analyzing the decomposition of water a growing field of study. Safe production of oxyhydrogen (HHO) may enable an internal combustion engine to produce surplus electricity that can be stored in a battery. The objective of this study was to examine how two different electrolytes, sodium bicarbonate ( $\text{NaHCO}_3$ ) and lithium carbonate ( $\text{Li}_2\text{CO}_3$ ), would react using two different plate configurations in a fuel cell. In this experiment, 2 electrolytic cells were created using Ball jars. In one jar 6 metal plates were stacked in this configuration, + - + - + - (1:1) and the other, - + - + - (1:2). The hypothesis was that the  $\text{Li}_2\text{CO}_3$  in soda water would produce HHO at a faster rate with the 1:2 set-up than the 1:1. This was not supported by experimentation; HHO was produced much faster with the 1:1. A second hypothesis was that the  $\text{NaHCO}_3$  in tap water would be unaffected by the different plate set-ups. This was supported by experimentation. Additional knowledge was gained from this experiment: the cell's temperature increased the longer the current was passing through it, and more current was drawn from the battery charger; also, when  $\text{NaHCO}_3$  and  $\text{Li}_2\text{CO}_3$  were added to tap water, the  $\text{Li}_2\text{CO}_3$  dissolved. The gas production increased in comparison to  $\text{NaHCO}_3$  alone but decreased in comparison to  $\text{Li}_2\text{CO}_3$  in soda water.

**Poster Board No. 013 THE EFFECTIVENESS OF TURMERIC IN REVERSING THE TOXICITY OF PERCHLORATE IN DAPHNIA MAGNA.** Samer A Alkhalili, [suzanwadi@yahoo.com](mailto:suzanwadi@yahoo.com), 4691 Fairway Lane, Sylvania OH 43560. (Maumee Valley Country Day School)

Perchlorate, a naturally occurring and manmade chemical, is a serious threat to human health and water resources. This project explores the toxicity of perchlorate

on *Daphnia magna* and the effectiveness of turmeric in reversing the effect of this toxicity. It is hypothesized that perchlorate will increase the heart rate of *Daphnia magna* and turmeric will reverse this effect. An initial dose-ranging experiment using 0.001 M, 0.01 M and 0.1 M potassium perchlorate was conducted to determine the optimal concentration of perchlorate to use for the study. A *Daphnia* was placed in the cavity of the slide containing two drops of test solution for 1, 15 and 30 minutes. The *Daphnia* heart rate (beats per minute) was measured under dissecting microscope at 0, 1, 15 and 30 minutes. The count for each of 5 *Daphnia* was repeated five times. In 0.001M perchlorate, the average heart rate (AHR) was 240, 249, 254, and 246 bpm at 0, 1, 15 and 30 minutes, respectively. In 0.01M perchlorate, the AHR was 238, 276, 304, and 304 bpm at 0, 1, 15, and 30 minutes, respectively. In 0.1 M perchlorate, the AHR was 308, 328 and 341 bpm at 0, 1 and 15 minutes, respectively. After 30 minutes, all *Daphnia* perished in the 0.1 M perchlorate solution. The 0.001 M had no effect. As a result of these preliminary experiments, the 0.01M perchlorate solution for 15 minutes exposure was used for the rest of the experiment. The counter effect of turmeric was assessed in two ways: First, a 0.05M turmeric solution was added after exposing the *Daphnia* to 0.01M perchlorate for 15 minutes. AHR dropped from 320 to 248 bpm at 1 minute and to 129 bpm after 15 minutes. Second, *Daphnia* were placed in a solution containing both 0.01M perchlorate and 0.05M turmeric. AHR dropped from 377 bpm, to 247 at 1 minute and to 183 bpm at 15 minutes of exposure. In the event of an acute exposure to high perchlorate levels due to industrial accidents, turmeric represents a natural, potent antidote that can immediately reverse the effect of perchlorate in *Daphnia*.

**Poster Board No. 014 WHICH DEICER (ROCK SALT OR CALCIUM CHLORIDE) WILL FIRST CAUSE DAMAGE TO THE METALS, MILD STEEL, COPPER & BRASS?** Brent Andrew McFarland, [brentmcfar@gmail.com](mailto:brentmcfar@gmail.com), 2684 St Rt 307 E, PO Box 7, Austinburg OH 44010. (Geneva Middle School)

This experiment was conducted to determine which of these two deicing materials, rock salt or calcium chloride, will first produce damage (physical harm) to the common metals, mild steel, copper and brass. The hypothesis was that the rock salt deicer would damage the metals faster than the calcium chloride. Mild steel, copper and brass were utilized for the experiment as samples because they are also utilized in the manufacturing of vehicles which can be damaged when exposed to deicers. Two sets of metals cut to size measured approximately  $44.45 \times 25.4$  mm were submerged in 120 ml of water mixed with 28 g of either calcium chloride or rock salt for one hour each day. This was an estimated length of time a vehicle would be driven on a deiced road. The samples were then set outside the remaining twenty-three hours. This experiment was conducted from 11/28/2009 to 1/14/2010 and the metals were examined daily. Similar, unexposed metal samples were used as a check in  $\text{H}_2\text{O}$  as a control. The calcium chloride and rock salt samples exhibited a change in color on 12/5/2009. The calcium chloride samples showed verdigris forming on the brass and copper on 12/9/2009, and the mild steel sample showed corrosion beginning on 12/27/2009. The rock salt samples showed corrosion to all metals starting on 12/9/2009. The results were that the rock salt first caused damage (physical harm) to the metals indicating the hypothesis was correct.

**Poster Board No. 015 IGNITION AND BURNING CHARACTERISTICS OF THREE FUELS: GASOLINE, KEROSENE AND DIESEL FUEL.** Abigail L. Myers, [MyersA13@embarqmail.com](mailto:MyersA13@embarqmail.com), 4251 N County Line Rd, Sunbury OH 43074. (Big Walnut Middle School)

Fuels are used for transportation, heating, and the energy needed for many things. Fuels are refined from crude oil and are converted from chemical energy into heat energy through combustion. This experiment investigated the



burning rate of gasoline, kerosene, and diesel fuel to determine which burns faster. The hypothesis was: the less dense the fuel the faster it will burn; therefore, gasoline with carbon chains from C4-C10 will burn the fastest, then kerosene at C10-C19, and diesel at C9-C21. The main experimental materials were: safety equipment, fuels, containers, igniters, timers, plus photographic equipment. The three fuels were measured (22 ml each) and poured into identical containers. Fireplace matches were used to ignite the fuel, and the flame was timed until it burned out for each of the three trials. It was observed that only gasoline burned; the fire was timed in minutes and seconds at 11:18 (minimum), 12:06 (median), 12:23 (maximum) for an average of 11:56. Kerosene and diesel didn't burn, and were poured back into the original measuring container as a check. [Additional research indicated all fuels have to reach the flash point, or the temperature at which enough vapor is generated so the fuel will burn. In the experimental conditions (below 33°F) only gasoline was above its flash point of -40°F. The flash point of kerosene is 120°F and diesel is 131°F. Additional work could use a hotter igniter or a hot plate to get all fuels to the flash point to research which fuel burns the fastest.]

**Poster Board No. 016 A SECURITY HASH FUNCTION BASED ON MODIFIED LOGISTIC MAP (MLMSH). Michael D. Fu, michael.fu1993@yahoo.com, 2985 Iowa Ct, Beaver Creek OH 45434 (Beaver Creek High School)**

A hash function is a mathematical procedure that takes a block of input data and returns a hash digest value of a fixed length. They are universally employed in cryptography, specifically in digital signature, message authentication, and other security information contexts. However, after conventional hash functions such as MD5 and SHA-1 were successfully attacked, the development of a new breed of hash function became necessary. This paper proposes a new hash function called Modified Logistic Map Security Hash (MLMSH). This new hash function utilizes a chaos system to generate pseudo-random behavior, while in actuality the function itself is completely deterministic. MLMSH produces a 256-bit digest from any plaintext with length less than  $2^{64}$  bits, and employs a recursive 'Modified' Logistic Map. The end product of the hash function is a 256-bit hash digest. Analysis of the hash function and its digest indicate all of the traditional characteristics associated with hash functions, such as a slight change in the input data resulting in a completely new hash value. Statistical analysis shows that the mean changed bit number 'D' and the mean probability 'P' of the bit changing are both very close to the ideal values of 128 bits and 50%, respectively. This indicates the strength of the algorithm in terms of the random nature of the hash digest. Performance analysis of the speed of MLMSH shows that MLMSH is 100% faster than MASH-2, and is competitive with SHA-1 when the file size is less than 5K bits. The algorithm is also easy to realize, making MLMSH a practical and effective alternative to current hash functions.

**Poster Board No. 017 WHICH TOOTHPASTE BRAND MOST EFFECTIVELY REMOVES STAINS? Haley R. Pasquinilli, afilichia@aol.com, 644 S. Eureka Ave., Columbus OH 43204. (Our Lady of Perpetual Help)**

The objective for this project was to determine which toothpaste brand best removes stains. It was hypothesized Brand A removes stains better than other brands tested. Testing materials included porcelain tiles, five different whitening toothpastes, five soft bristled toothbrushes, five staining substances; red dye, grape juice, coffee, pop, and red wine. Tiles were soaked in each stain for 48 hours then air dried. Tiles were then brushed with each of the different toothpastes. Tiles were brushed for one week, fifty strokes per toothpaste, each brushing, twice daily; 12 hours apart. Tiles were examined daily for changes in whiteness and brightness. Pictures were taken after each brushing to compare and document the whitening results. At the end of the two week trial period, 15 adults evaluated the stain

removal ability of each toothpaste brand on a scale of 1-10. The results were compared to the original form of the tile; the "Control Tile." Then results were compared to each individual "Control Tile;" the stained tile of each stain, prior to the addition of stain removal products. The effectiveness of each toothpaste score was averaged. The data indicated that toothpaste A removed stains the best with an average rating of 8 out of 10, toothpaste E averaged second; rating 6 out of 10, toothpaste B averaged third; rating 5 out of 10. Toothpaste D and C averaged last; rating 4 out of 10. The hypothesis was supported. Based upon these results, toothpaste A performed better in removing stains than the other brands.

**Poster Board No. 018 NIP THE DRIP. Rayan Muhsen, muhsens@bex.net, 4857 Rudgate Blvd, Toledo OH 43623. Toledo Islamic Academy, 5225 W. Alexis Rd, Sylvania OH 43560. (Toledo Islamic Academy)**

This project was chosen because saving water is important. The purpose of this project is to see how much water is wasted from a dripping tap. People should care about saving water because even as the world's population grows on this planet, the amount of water stays the same. Therefore we have to conserve the water on this planet to make sure everyone has enough. Before conducting the research, the hypothesis was that 5 gallons of water was wasted in one day by one dripping faucet. To investigate the amount of water wasted in the average home from one dripping tap, a measuring cup was placed under the dripping tap and then timed for one hour. Then the amount of water collected was multiplied by 24 to get the daily total. The results were unbelievable: in one day, 1.624 gallons of water were wasted. So after getting these results, the hypothesis made was proven incorrect. Further, an investigation was made to calculate the amount of water wasted in an entire street, assuming that each house has a dripping faucet. The results were that 53.625 gallons of water were wasted each day.

**Poster Board No. 019 SATELLITES: AVAILABLE OR BLOCKED? Sarah K. Mayo, panthers10@zoominternet.net, 309 Township Road 1135, Proctorville OH 45669. (Chesapeake HS)**

A GPS receiver receives signals from satellites which are approximately 20,000 km above the surface of the earth. Significant work is being done to model availability of satellites at different locations and under different conditions (such as building blockage in urban canyons). Experience has shown that satellites are available with mild blockage. Research with electro-magnetic models shows that this is from things called "diffraction" and "wave creep." The purpose of this study was to track satellites using a GPS receiver and to determine whether satellite signals would be available even when the direct path was blocked by a metal object. Signals received below a 51 degree angle were tracked and recorded. The angle was determined by the inverse tangent of the angle formed between an antenna and the edge of a 55-gallon metal drum. It was hypothesized that satellite signals would be available even when blocked by a metal object. For this study, a GPS receiver was placed in a vertical metal drum. The GPS antenna was placed in the center so that the edge of the metal drum blocked satellites lower than a 51 degree angle. Satellites were tracked by the GPS receiver on two different days (N=2). Signals lower than a 51 degree angle were recorded. Massive amounts of data were logged using Hyperterminal, and excel was used to analyze and plot the data. Experimental results show that satellites were tracked on both days below the 51 degree cut-off angle supporting the original hypothesis. The data also shows that the variance in the readings gets somewhat higher with lower elevations. This study shows that a GPS can be programmed to receive lower SNR readings, thus, providing more accurate results when used in cities.

**Poster Board No. 020 USING HYDROPOWER TO TRANSPORT WATER FROM AN ARTESIAN WELL OVER VARIOUS ELEVATIONS FOR AGRICULTURAL PURPOSES.** Robert F. Bouscher, [sabouscher@gmail.com](mailto:sabouscher@gmail.com), 652 Reimer Rd. Wadsworth Oh 44281. (Wadsworth High School)

The energy of moving water in rivers and streams has been used throughout history to perform work: transporting goods and people, powering machinery, and generating electricity. The purpose of this investigation was to determine over a thirteen week summer period if a spiral waterwheel pump could transport  $4.44 \times 10^6$  liters of water over a 3.7m hill to a nearby 0.73 hectare pond by using only the water flow of a stream exiting an Artesian well that produces 346.4 liters of water per minute. Due to natural causes, i.e. evaporation and absorption, the pond level drops as much as 0.61m, which is equivalent to a loss of 33.88 liters of water per minute. An experiment was devised to test how the spiral waterwheel pump's controlled variables, hose length-standard 16mm diameter garden hose, number of coils, and diameter of wheel, affected the output and the height that water could be raised. It was hypothesized that the larger the diameter wheel, the longer the length of the hose, and the greater the number of coils would result in the largest output and maximum height. The 1.2m diameter wheel with 30.5m of hose (the largest configuration constructed) produced 148-828ml per minute at low to mid RPM (4.5-10) throughout most of the trials. At the end of all the tests, it was determined that the water could rise 4.5m, but the pump lacked the output needed to keep the pond full throughout the summer. Future investigation with larger diameter hose is recommended for greater output.

**Poster Board No. 021 THE EFFECT OF BLADE LENGTH ON WIND TURBINE POWER GENERATION.** Leigh Ann Fairley, [lfairley@laurelschool.org](mailto:lfairley@laurelschool.org), 26930 Lake Rd, Bay Village OH 44140. (Laurel School)

A wind turbine can never be 100% efficient. Because wind must pass through the blades of a wind turbine and the blades can never "stop" the wind, efficiency is much less than 100%. In order to maximize the efficiency of a wind turbine, this project attempted to find out how varying the length of the blades of a model wind turbine would affect the power generated. The wind turbine was constructed using the modified plastic skeleton of a pinwheel, gears, pulleys, and a small generator mounted in an aluminum frame. The pinwheel provided a fixed pitch for each of 3 blades. Blade sets were made of balsa wood in four lengths: 15, 22.5, 30, and 45 centimeters, each in similar proportions. Wind was provided by a 50 cm (20") box fan generating a wind speed of 27 km/hr. All parameters except blade length were held constant. Trials were performed: voltage (V) (N=45) and current (I) (N=10) were measured with a multimeter. The process was repeated with all four blade lengths. Power was calculated:  $P=IV$ . The results show that with all other variables held constant, the power generated decreased as the blade length increased. The 15 cm blades averaged 161.9 mW generated and the 45 cm blades averaged 20.2 mW generated. A wind speed of 18 km/hr produced proportionally similar results (not published). In fact, a longer turbine blade can produce higher power, but not by varying blade length alone. By changing wind speeds, changing blade pitch, and altering generator design and gearing, greater power should be achievable from a longer blade.

**Poster Board No. 022 THE CONCENTRATION OF PEO IN PEO/PVA NANOFIBER BLENDS TO OBTAIN A CONSTANT DISSOLUTION RATE OF FLUORESCIN DYE OVER TIME.** Abigail M. Tanner, [absters26@yahoo.com](mailto:absters26@yahoo.com), 764 Hancock Ave, Akron OH 44314. (St. Vincent-St. Mary HS)

Nanofibers are defined as having at least one dimension of 100 nm or less. Currently they are produced by an electrospinning process. Nanofibers are being used in tissue engineering scaffolding, wound dressings, haemostatic devices and drug delivery systems. Scientists

are seeking improved methods of delivering difficult to absorb medications into the body. Different types of nanofibers are being investigated to determine which will most effectively release a drug or chemical into the body. The problem being investigated is how varying the concentration of PEO (Polyethylene Acid) in PEO/PVA (Polyvinyl Alcohol) nanofiber blends will affect the dissolution rate of fluorescein dye from the nanofiber blends. The hypothesis is that the concentration of PEO in PEO/PVA nanofiber blends is increased the dissolution rate of fluorescein dye will increase in a linear manner over time. The main materials and supplies used were PEO/PVA nanofiber blends, fluorescein, PBS (Phosphate Buffered Saline), incubator, gram balance, pipettes, electrospinning station, cuvettes, and a UV-Visible light spectrophotometer. The methods used include nanofibers being electrospun, incubated in PBS, and then sampled at 15 minute intervals. The samples were then scanned on a UV-Visible light spectrophotometer and the results analyzed. The 1:1 PEO/PVA nanofiber blend had the highest dissolution rate (emission rate) and percentage of fluorescein and an average dissolution rate (emission rate) at 329043.511 AU. The results indicate the 1:1 PEO/PVA nanofiber blends may be the best nanofiber blend to be used in drug release mechanisms using actual medications (antibiotics) in future studies.

**Poster Board No. 023 AN ENGINEERED INVENTION: ENHANCING MOBILITY FOR PARAPLEGICS USING VOICE-ACTIVATED CYBER-ENABLED BUILDINGS LINKED TO SMART WHEELCHAIRS.** Samantha B. Santoscoy, [samanthascoy@gmail.com](mailto:samanthascoy@gmail.com), Caroline B. Aronoff, [caroline.aronoff@gmail.com](mailto:caroline.aronoff@gmail.com), Chad Rockey, [chadrockey@gmail.com](mailto:chadrockey@gmail.com), Eric Perko, [exp63@case.edu](mailto:exp63@case.edu), Tony Yanick, [tony\\_yanick@case.edu](mailto:tony_yanick@case.edu), Wyatt Newman, [wsn@case.edu](mailto:wsn@case.edu). (Hathaway Brown School)

The purpose of this project was to enhance mobility of those suffering from paraplegia by inventing and building a novel cyber-enabled building (smart building) in correspondence with a cyber-enabled wheelchair, actuated through voice commands. The procedure was as follows. The building was modified to interact with wheelchair users through a Wi-Fi and computer system linking the wheelchair to the building and original speech process software to enable the system. The project focused on the door aspect of the building in which wheelchair users would say "open" or "close" into a microphone, initiating the door to open or close. In the case of this engineering project, the data are the completed invention of the cyber-enabled building, including both software written by and hardware built by the team. The voice-activation code, programmed in LabView™ and developed using Microsoft Speech™, consisted of an event structure that would send a value of one (open) or zero (close) to the door via UDP, a process eventually altered for Python™ and Sphinx™. An Arduino™ was programmed to communicate through a Linksys™ bridge using TCP and wired using a transistor switch. In addition to the door and wheelchair, other physical components consist of a pneumatic actuator that pulls the door open plus electrical and pneumatic circuits to power the smart building. All of this was programmed and built by the team at Case Western Reserve University. The cyber-enabled building functioned as designed 100% of the time in each of the 10 trials with a smart wheelchair.

**Poster Board No. 024 A STUDY OF THE OPTIMUM TESTING CONDITIONS FOR GALACTOSEMIA SPECIFICALLY ENZYMATIC CONCENTRATION AND TIME.** Kristin N. Ronzi, [knronzi@aol.com](mailto:knronzi@aol.com), 25600 Farringdon Ave, Euclid OH 44132. (Hathaway Brown School)

Galactosemia is a disease due to an absence of the GALT-4 enzyme required to break down the galactose sugar. The disease must be detected within the first 72 post-natal hours, thus requiring an expedient method of testing. This project was designed to determine the proper time and enzymatic concentration for the optimum testing conditions. The hypothesis was that if the enzymatic concentration is



increased, then the data will linearize better. Using a pH 7 phosphate buffer solution (PBS) along with galactose solutions with concentrations of 0mM, .1mM, .2mM, .4mM, .8mM, 1.6mM, and 3.2mM 4  $\mu$ L of the samples were added to 2  $\mu$ L of the galactose oxidase solutions with 2mg, 3mg, and 4mg of using an electrochemical workstation. The data for the 2mg solution didn't linearize indicating insufficient enzyme levels for the reaction to occur. Both the 3mg and 4mg solutions allowed the linearization of the data points for each of the respective concentrations, however the 4mg solution was significantly better than the 3mg based upon the R<sup>2</sup> value of the resulting line of best fit. In comparison of the 100 second and the 120 second graphs, it was determined based upon the linearization of the data that the optimum testing conditions were using 4mg enzyme at 120 seconds thus supporting the hypothesis. Due to the sensitivity of the equipment, a margin of error from the instrumentation could have affected this experiment. In future tests, different variables will be explored by altering the pH of the PBS.

**Poster Board No. 025 THE STUDY OF HOW TRIANGLE SHAPE AFFECTS THE LOAD CAPACITY OF A TRUSS. Jonathan M. Unger, ungerfl@wowway.com, 13427 Gerald Drive, Middleburg Heights OH 44130. (Incarnate Word Academy)**

This experiment was conducted for the purpose of discovering which triangle in a truss maximizes load capacity. The truss is used in designing bridges, roofs, and other structures. The experiment tests triangles of 60°-60°-60°, 45°-45°-90°, and 30°-60°-90°. The hypothesis was the 60°-60°-60° truss would maximize load capacity due to its steepest diagonal members. The truss bridges had identical height, length, and width, with a 1:7 height to width ratio. The bridges were constructed with 10mmx10mm tubes, strips, and gusset plates made from standard manila file folders. The experiment was conducted by placing 130g penny rolls into a bucket suspended from the middle of a wooden board which distributed load across the bridge. The board, bucket, and bridge weight were considered when calculating each bridge's total load capacity. As load was applied, the sound of dried glue crackling in the bridges was an indicator of its elasticity. Longer crackling time before buckling meant more elasticity. Elasticity had a direct correlation to the maximum load capacity and the length of upper chord members. The 30°-60°-90° bridge crackled longest, had 20cm upper chord members, and had the highest load capacity of 9075g. The 45°-45°-90° bridge crackled for the least time, had 12cm upper chord members, and had the lowest load capacity of 5970g. The hypothesis was incorrect. In conclusion, length of upper chord members determines the maximum load capacity of a truss. Longer upper chord members provide elasticity for sustaining loads longer before failure.

**Poster Board No. 026 ROAD FRICTION AND FUEL CONSUMPTION. Aman Kumar, kumarhome@yahoo.com, 4637 Forest Ridge Dr, Mason OH 45040. (Mason HS)**

The overarching objective of this research was to observe how a road's friction affects the fuel consumption of a vehicle using an electrical model car. Usually, there is an increased focus on the fuel efficiency of cars due to increasing gasoline prices since a significant amount of money is being spent on road construction. This project's hypothesis was that a road's friction would affect the fuel consumption of a vehicle. Trials (n=20) were conducted in duplicate on a straight track of 6.44 meters in length with four different friction surfaces (wood, smooth cement, cement road, and asphalt road). A 0.72 kg electrical car was driven 250 times (1.6 km) on each surface to test energy consumption. The project assumed that greater friction would translate into higher temperatures of the model car. Car amperage and voltage were measured to find the total watts of energy used, which was converted to equivalent miles/gallon (mpg). Car temperatures were measured using an Infrared camera to document loss of energy due to heat. Analysis of data in both sets of experiments showed that the wood surface ( $\mu$ = 0.4) had the best fuel efficiency (31.9 mpg) out of all of surfaces

while the cement road ( $\mu$  =1.02) had the least fuel efficiency (26.2 mpg). Smooth concrete generated most heat loss as measured by vehicle temperature increase. This research concludes that building roads with construction materials that have a lower coefficient of friction be considered.

**Poster Board No. 027 CO<sub>2</sub> IN GASSES: THE AMOUNT OF CO<sub>2</sub> WE EMIT EVERY DAY. Spencer E Dirrig, sed@columbus.rr.com, 4440 Millwater Drive, Powell OH 43065. (Olentangy Hyatts Middle School)**

CO<sub>2</sub> is released when people breathe and drive automobiles. But how much is released? The goal of this experiment was to compare the amounts of CO<sub>2</sub> in ambient air, human (exhaled breath) exhaust, and automobile exhaust in comparison to pure CO<sub>2</sub> (100% carbonic acid). Approximately 220 cm<sup>3</sup> of each gas was introduced to bromthymol blue indicator solution, a solution used to detect CO<sub>2</sub>. If the solution changed color from the initial blue to yellow, then the acid CO<sub>2</sub> was present in the gas. If the solution did not change color, there was little or no CO<sub>2</sub> in the gas. If the solution did change color to yellow, ammonia was added to neutralize the acid until the solution returned to its original color. The more ammonia that was needed to neutralize the acid, the more CO<sub>2</sub> there was in the gas. An average of 106 drops of ammonia was added to neutralize the acid in the solution after introducing pure CO<sub>2</sub>. An average of 22 drops of ammonia was added to neutralize the acid after introducing automobile exhaust, and an average of 4 drops of ammonia was added to neutralize the acid after introducing human (exhaled breath) exhaust. This confirmed that pure CO<sub>2</sub> contained the largest amount of CO<sub>2</sub>. The introduction of ambient air did not affect the solution, thus, the amount of CO<sub>2</sub> in ambient air was too small to measure by this method. Results show the vehicle used in the experiment released 450% more CO<sub>2</sub> than human exhaled breath.

**Poster Board No. 028 A CHEMICAL AND BIOLOGICAL COMPARISON OF INDIAN-GUYAN AND SYMMES CREEK: TWO STREAMS WITH WATERSHEDS SIMILAR IN LAND USE AND DIFFERENT FLOW RATES, LAWRENCE COUNTY, OH. Robert G. Hinshaw, bosco71193@aol.com, 9604 County Road 107, 33 Roman Harbor, Proctorville OH 45669. (Fairland High School)**

The flow rates of Indian-Guyan Creek and Symmes Creek were recorded by measuring the flow velocity and cross-sectional area at two sites on each stream roughly three miles (site 1) and eight miles (site 2) from each mouth. Each site was measured six times from September to December of 2009 using the method for determining volumetric flow rate outlined by the EPA. The water quality of each site was determined using a Water Quality Index (WQI), generated by measuring dissolved oxygen, *E. coli* bacteria, turbidity, nitrates, temperature change, and pH, and a Pollution Tolerance Index (PTI), generated by a population survey of benthic macroinvertebrates. It was hypothesized that if two streams with watersheds similar in land use and different flow rates are tested chemically and biologically for water quality, then the stream with the greater flow rate will have a higher water quality due to dilution. In each test, the flow rates of Symmes Creek were higher than those of Indian-Guyan Creek. In test 3, the flow rates of Indian-Guyan Creek (sites 1 and 2) were 17.61 and 15.95 cubic feet per second and those of Symmes Creek were 78.02 and 57.04 cubic feet per second. These measurements confirmed Symmes Creek had a higher flow rate than Indian-Guyan Creek. The WQI and PTI values of Symmes Creek were neither consistently higher nor lower than the values of Indian-Guyan Creek. However, Symmes Creek had consistently higher levels of *E. coli* (test 3: 850 and 950 colonies/100ml) and turbidity (<15 and 15 NTU) than Indian-Guyan Creek (450 and 350 colonies/100ml, and 10, 0 NTU).

**Poster Board No. 029 SALT WATER AND PLASTICS: MIXTURE OR COMPOUND? Rachel E. Yurchisin, reyurchisin@adelphia.net, 4501 Oak Park Ave, Cleveland OH 44109. (Padua Franciscan High School)**



In August, 2009, Katsuhiko Saido discovered, "that plastic in the ocean actually decomposes as it is exposed to the rain and sun and other environmental conditions..." This experiment tested if one of the "other environmental conditions," mainly the salinity of ocean water, would affect the decomposition of high density polyethylene (HDPE). Three trial samples of 300ml each of freshwater, 35% Deep Ocean Synthetic Sea Salt solution, and a super-saturated solution labeled as 100% Deep Ocean Synthetic Sea Salt solution were created by using distilled water and synthetic sea salt, and were placed into glass containers. The samples were tested for the presence of carbonate, sulfate, and chloride ions, phosphates, and nitrates by using a chemical pollution qualitative ion test kit. The salt water samples tested positive for the presence of sulfates, chlorine, and carbonate ions. Single, 2.5cm<sup>2</sup> pieces of HDPE were cut, physical characteristics observed, and placed into the water samples and sealed for thirty days in Styrofoam™ containers. Each water and salt solution sample was retested using the qualitative ion test kit to determine if contaminants were released. Any physical changes of the HDPE samples were noted. The tests recorded no change from initial experiment and no reaction occurred to indicate the presence of any contaminants after the designated time period. The HDPE did not undergo any chemical change or physical decomposition and the water quality of the water sample remained the same. The experiment conducted suggests that short-term exposure to salt water does not break down HDPE.

**Poster Board No. 030 THE INSULATING PROPERTIES OF NATURAL MATERIALS.** Garretson M. Oester, goester01@cinc.com, Walnut Hills High School, 5673 Euclid Road, Cincinnati OH 45236.

Synthetic insulating materials have been used in home construction for decades. Even with the recent trend toward environmentally friendly building materials, flexible fiberglass insulation and Styrofoam® sheet insulation dominate in home and business construction. The hypothesis was that a natural material could be a more efficient thermal insulator than standard R-13 fiberglass wall insulation. The insulation materials tested were water, wool, Styrofoam® packing peanuts, starch-based packing peanuts, cotton batting, cotton balls, and peat. These materials were tested in a model wall constructed using 2" x 4" lumber with ½ inch plywood exterior and interior walls. The space the test material was placed was 3.5" deep by 15" wide, the width and depth of R-13 insulation. The heat source, a 90-watt light, was mounted 11 inches (27.9 cm) from the exterior side. A thermocouple was mounted on the interior side of the model wall to measure the temperature increase over 60 minutes. The control was the model wall with no insulating material, air only. The temperature increase for each material was: air, the control, (5.9 ± 1.9°C), uncompressed R-13 fiberglass insulation (3.6 ± 0.4°C), water (2.3 ± 0.1°C), wool (2.3 ± 0.8°C), Styrofoam® packing peanuts (2.2 ± 0.5°C), starch-based packing peanuts (2.2 ± 0.6°C), cotton batting (1.9 ± 0.2°C), cotton balls (1.3 ± 0.2°C), and peat (0.2 ± 0.2°C). All the natural materials tested in this study outperformed R-13 fiberglass insulation. These results support the hypothesis that natural materials exist that are more efficient than standard R-13 fiberglass wall insulation.

**Poster Board No. 031 ANALYSIS OF USED TEA LEAVES USING FOURIER TRANSFORM INFRARED AND NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY.** Kanithra C. Sekaran, sandalraj@gmail.com 7345 Popham Place, Solon OH 44139 (Solon Middle School)

Spent tea residue has been postulated as a potential oil source for biodiesel production. The goal of this study was to qualitatively identify hydrocarbons present in different commercially available spent tea. Spent tea was air-dried and mixed with a solvent (methylene chloride) to extract

the organic components. The solvent was evaporated and the residue was analyzed to identify the hydrocarbons present in it using Fourier Transform Infrared (FTIR) and Nuclear Magnetic Resonance (NMR) spectroscopy. The characteristic peaks were compared with those present in canola oil. Signals were observed for various hydrocarbon functional groups in spent tea. The mean mass of the residual oil content obtained after extraction from various spent tea were estimated. FTIR spectroscopy identified the presence of functional groups like alkanes (<719, 1093, 1164, and 1377 and 2852 cm<sup>-1</sup>), alcohols (3009 cm<sup>-1</sup>), carbonyl (1746 cm<sup>-1</sup>) and alkenes (1465 cm<sup>-1</sup>) in the oil extracted, which were closely matching the FTIR wave frequencies found in canola oil, used as a reference. Similarly, peaks in the <sup>1</sup>H and <sup>13</sup>C NMR spectra of the oil from spent tea was closely matching with those for canola oil. The mean mass of oil extracted from each 5g sample of Oolong®, Lipton®, and Tajmahal® tea were 0.028g, 0.027g and 0.02g respectively. Therefore, the presence of oil confirms that spent tea is a potential source of biodiesel.

**Poster Board No. 032 DO ANTIBIOTIC DRUG COMBINATIONS PROMOTE ANTIBACTERIAL RESISTANCE?** Anamika Veeramani, malar44133@yahoo.com, 9388 Chesapeake Dr, North Royalton OH 44133. (Incarnate Word Academy)

This project investigates if the use of multiple antibiotics to cure a single episode of infectious disease could increase the risk of antibacterial resistance. *Escherichia coli* and *Staphylococcus aureus* were chosen as test bacteria. Ampicillin and tetracycline were selected as the drug combination and their potential for promoting antibacterial resistance was tested. First, benchmark susceptibility tests were conducted for test bacteria against gentomycin, streptomycin, vancomycin, penicillin, and bacitracin individually and in combination with ampicillin using the Kirby Bauer Disk Diffusion method. Next, each of the two test cultures was exposed to the drugs individually, and then to their combination in test tubes containing LB broth. Positive growth control was set up in a test tube containing only the bacteria and LB broth. The cloudy assays that indicated bacterial growth were transferred to agar plates and colonies were counted using serial dilution method. Two trials of above, for 50 and 5 µg/ml tetracycline concentrations were conducted. The above experiments were then repeated, but this time the first antibiotic, ampicillin was washed off after exposing the bacteria to it, by adding sterile water, centrifuging contents and pouring out the water. The bacterial growth tests and colony counts for the last set of experiments showed that *Escherichia coli* resisted ampicillin-tetracycline antibiotic combination, at concentration levels of 256 milligrams/ml (A)-5 µg/ml (T) and dosage amounts of 20ml (A) - 5ml (T). The average *Escherichia coli* colony count on agar plate of 56.7 sq cm area was 18 when exposed to tetracycline alone and 28 when exposed to ampicillin and tetracycline. *Staphylococcus aureus* was completely susceptible to the antibiotics combination. The above results indicate that antibiotic combinations at certain concentration and dosage levels can promote antibiotic resistance in specific bacteria.

**Poster Board No. 033 HOW DOES EYESIGHT AFFECT YOUR BALANCE, DELAWARE COUNTY, OHIO.** Hannah C. Hess, lhess6@columbus.rr.com, 4738 Rutherford Rd, Powell OH 43065. (St Mary School)

This project can assist people with balance and eyesight issues. After learning about it, they can determine if their eyesight is poor thus affecting their sense of balance. The investigative approach used three balance tests; two tests were dynamic with movement and one was static. Subjects were required to have normal (20/20 to 20/50) or corrected eyesight. The hypothesis was when eyesight is gone your balance will get worse. Static Test: Nine (100%) of the male/female subjects age 10-11 stood on one leg for two minutes. Blindfolded, three subjects (33%) lasted for 15-45 seconds while six (67%) lasted for 15 seconds or less.

Dynamic Line Test: 100% of subjects walked straight. Blindfolded, two subjects (22%) went predominantly in a straight line, six subjects (67%) varied 18 inches and one subject (11%) varied 24 inches left. Dynamic Circular Rotation Test: With eyesight, three subjects stayed within 12 inches and six stayed within 18 inches of the center of a circle. Blindfolded, one subject (11%) stayed within 12 inches, seven (78%) varied 18 inches, and one (11%) varied 24 inches of center. Further testing of eight male/female adults over 40 years of age produced similar percentages. The main variation noted was found that the younger subjects stood on one leg a full two minutes while the older subjects as a group, could not. It was noted that the Dynamic Circular Rotation Test requires close supervision to obtain accurate data. Through testing, when a subject's eyesight was taken away, their balance worsened.

**Poster Board No. 034 AN EXAMINATION OF THE CORRELATION BETWEEN THE CYTOKINE ELISA AND ELISPOT METHODS OF ANALYSIS OF MALARIA SENSITIVITY IN INFANTS IN MSAMBWENI, KENYA.** Alyssa M. Bryan, Connie Zhou, alyssa.m.bryan@hotmail.com, 8211 Timber Trail, Chagrin Falls OH 44023. (Hathaway Brown School)

Through analysis by Cytokine E.L.I.S.A. and EliSpot, Kenyan infant follow-up samples were tested to determine the presence of the malaria parasite as identified by the immune response indicator interferon gamma (IFN- $\gamma$ ). Cytokine E.L.I.S.A. is a method used to measure the concentration of the antibodies specific to the cytokine by fluorescence, whereas EliSpot is the measure of the cells infected by the parasite in the sample. This analysis compared the results of samples tested on both assays to determine whether there was a correlation between the two methods. It was hypothesized that the two would show concordance, where if one sample was positive by one assay, it was also by the other. A positive sample was deemed as when the measured fluorescence exceeded twice the positive control in E.L.I.S.A. or the count exceeded eight in EliSpot. It was found that the two methods of analysis for IFN- $\gamma$  had a concordance rate of 54.2%, as just over half of the samples tested (N=42) across all conditions were in accord. The condition with the least concordance was MSP1-42 (FVO), with four out of eighteen samples matching, or 22.2%, and the most concordant were Schizont and RBC, each of which had six out of eight samples, or 75%, matching. Acknowledging that EliSpot has a tendency of over-counting, particularly because of background interference and greater sensitivity, the results supported the hypothesis as the correlation existed, however further work must be done with a larger sample size to ensure that both assays are responding equally.

**Poster Board No. 035 ONCOGENES AND TUMOR SUPPRESSOR GENES: BIOMARKERS FOR LUNG CANCER.** Erik L Bao, erikb1993@gmail.com, 9621 Ash Ct, Cincinnati OH 45242. (Sycamore High School)

Lung cancer is the leading cause of cancer-related death, responsible for 1.3 million deaths worldwide annually, warranting a need to identify new pathogenic targets for therapeutic and prevention purposes. Proper utilization of current genomic data can provide novel insights into the pathogenesis of complex diseases. The hypothesis of this project was that lung cancer is triggered by the unbalanced expression of certain oncogenes and tumor suppressor genes in the lung. A two-faced bioinformatics approach was utilized: microarray analysis and database research. First, a microarray set of normal (n=17) and adenocarcinoma (n=190) samples was downloaded from Gene Expression Omnibus, a genomics data repository. Standard Student T-Test was used to compare relative gene expressions between cancer and control groups; 65 genes exhibited  $\geq 3.0$ -fold change in expression. Then, known genes associated with lung cancer (n=602) were collected from database search. A gene ranking score for level of association with lung cancer was formulated based on features including number of publications, SNP

frequency, genome-wide association studies, and level of lung enrichment. The 65 genes with a weighted score of 45 or higher from the database analysis and the top 65 genes from the microarray analysis were combined and subject to interactions analysis and functional classification. The mutual set of 48 genes forming an interactions web included well-known cancer TSGs (CAV1, WIF1) as well as previously unreported lung-selective TSGs (AGER, FCN3, SCGB1AZ) and oncogenes (SPP1, S100P). The comprehensive integration of transcription analysis with genome-wide disease database search provided a novel gene signature for lung cancer.

**POSTER BOARD NO. 036 REUSABLE SHOPPING BAGS: ARE THEY GROWING CONTAMINATED?** Anne E Brennan, kristinbre@msn.com, 8937 Groveside Dr, Strongsville OH 44136. (Our Lady of the Elms)

To determine whether there is a relationship between the number of times a non-laundered, reusable cloth shopping bag is used and the amount of contaminants found; and to determine if different grocery items will affect the bags levels of contamination. The hypothesis: Reusable, non-laundered cloth shopping bags would become more contaminated after each usage and those containing mixed produce would be significantly more contaminated than those containing boxes and cans. Over five weeks, five shopping trips were conducted and, during each trip items were placed in five reusable cloth bags; two of which contained boxes and cans, two contained mixed produce (cucumber, pepper, lettuce, peach, potato), and one acted as a control. After each trip the inside bottom of the five bags were swabbed with liquid medium, placed in pre-treated Petri dishes, and left at room temperature in a laboratory. CFUs were counted prior to the trips, and at 24 and 48hrs. Contamination in produce bags was high through all five tests, with CFUs rising in weeks 1-3, declining slightly week 4 before increasing week 5. The CFUs colors, shapes and sizes had some uniformity but also varied weekly. Produce Bag 1 at 48hrs had an average reading of 20,642 CFUs over five tests while Box/Can Bag 1 at 48hrs had an average of 33 CFUs. Conclusions were that reusable cloth shopping bags became contaminated with microorganisms but contamination was not directly proportional to usage and bags containing mixed produce were considerably more contaminated than bags containing boxes and cans.

**Poster Board No. 037 JAPANESE KNOTWEED, (FALLOPIA JAPONICA) AN ALTERNATIVE BIOFUEL.** Juan D. Dunlap 39777 National Road, Bethesda OH 43719. (East Richland Schools)

In societies seeking to decrease the use of fossil fuel sources, biofuel has emerged as one attractive alternative. One issue has been the displacement of farm land for food production in favor of growing corn or soybeans for biofuel. Research in biofuel production includes exploration into the use of non-food sources of vegetation. The purpose of this project was to compare both caloric output and ash residue using uniform leaf pellets made from either Japanese Knotweed (*Fallopia japonica*) leaves, pin oak leaves (*Quercus palustris*), or sugar maple leaves (*Acer saccharum*) to discover which would be the most efficient biofuel energy source. It is hypothesized that Japanese Knotweed (*Fallopia japonica*), a prolific, invasive plant, would produce more caloric energy and less ash based on research indicating differences in the leaves' epicuticular wax content. The experiment involved burning a 0.5gram home-made pellet (N=40) for each leaf type in a calorimeter, recording the highest temperature reached, and measuring the remaining ash with a triple beam balance. Chemical energy was calculated by using the formula  $Q_{\text{water}} = mc\Delta T$ . The average caloric value produced by the Knotweed was 1192.12 calories, followed by Oak = 919.5, and Maple = 841.25. The remaining ash content for Knotweed = .20 grams, Maple = .23, and Oak = .32. The data confirmed that the Japanese Knotweed pellets produced more caloric energy and less ash content than the Oak or Maple leaf pellets suggesting that this invasive species has potential for use as a biofuel.



**Poster Board No. 038 TESTING FENCING FOILS FOR FATIGUE LIFE. Nicholas A. Mohr, nicketh1@gmail.com, 2567 Westmont Blvd., Columbus OH 43221. (Upper Arlington High School)**

Since 1937, 8 deaths worldwide have occurred in fencing. The main cause of this is that when fencing blades break they can create a sharp fracture, which can penetrate protective equipment, seriously injuring the fencer. The purpose of this study was to determine a threshold number of touches by a fencing blade so that the blade can be retired before it can fracture in a bout. This study focused on Foil, one type of sword used in fencing. Three spring steel blades and two maraging steel blades were tested to find the number of touches at which they break by cyclically loading them to an amplitude of 4.80 cm in order to match a bend radius of 20 cm, an average hit in a fencing bout. Before they were cyclically loaded, the blades first had a .6mm by 1.0 mm by .3 mm dent machined into them, identical to one found on a used fencing blade. The three spring steel blades fractured at 2301, 1400, and 1577 cycles respectively, while the two maraging steel blades fractured at 5838 and 8752 cycles. These findings led to a number of 804.2 cycles for spring steel and 3173 cycles for maraging when two standard deviations are subtracted from the mean in order to make the data safe for 97.7% of the time. This means that foils should be discarded when they reach this number, to reduce injuries and fatalities in fencing.

**Poster Board No. 039 RADIATION EMBRITTLEMENT OF POLYMERS DURING SPACE EXPOSURE. Grace T. Yi, gyi13@gmail.com, Gianna G. Mitchell, gmitchell13@hb.edu, Aobo Guo, aguo11@hb.edu, Claire E. Ashmead, cashmead12@hb.edu, 5375 Portchester Drive, Hudson OH 44236. (Hathaway Brown School)**

Understanding degradation patterns of space materials is essential for designing durable and stable space components for many spacecraft, from space stations to communications satellites. As a result of space radiation, micrometeoroid and debris impacts, atomic oxygen interaction, and thermal cycling, the outer surfaces of space materials degrade when exposed to the low Earth orbit (LEO) space environment. The objective of this study is to measure altered material properties of space exposed polymers, as it was theorized that radiation and thermal cycling exposure in space would cause polymer embrittlement. As a part of the Materials International Space Station Experiment 5 (MISSE 5), 39 flexible PEACE (Polymer Erosion and Contamination Experiment) polymers were flown aboard the International Space Station in LEO from 26 July 2005 to 15 September 2006. Because the samples were flown in a nadir, or Earth-facing position, the samples received relatively low doses of ionizing particle radiation combined with thermal cycling. In order to determine the extent of embrittlement, the samples were bend tested at the NASA Glenn Research Center. Twenty flight samples have been bend tested to date. Bend testing successively uses smaller mandrels, which are cylindrical pieces of hardened steel, to apply surface strain to samples placed on a semi-suspended pliable platform. The bend test procedure starts with bending the flight samples with the space-facing surface under tensile strain and uses optical microscopy to closely examine the samples for surface cracking. Out of the 20 flight samples tested, 8 experienced surface cracking during the bend test, even though they were exposed to relatively low quantities of radiation (approximately 2.75 krads(Si)). The bend test was also conducted on 20 pristine counterparts, none of which cracked. These results indicate that even low doses of radiation cannot be overlooked when designing materials for use in space and force engineers to reevaluate materials previously thought to be adequate for space use and travel.

**Poster Board No. 040 KILLER IMMUNOGLOBULIN-LIKE RECEPTORS (KIR) GENE POLYMORPHISM AND BKV INFECTION IN KIDNEY TRANSPLANT RECIPIENTS. Leat S. Perez, leatperez@aim.com, Medhat Askar, askarm@ccf.org, Aiwon Zhang, zhanga@ccf.org, Amy Nowacki, nowackia@ccf.org, 690 Radford Road, Richmond Heights OH 44143. (Beaumont School)**

Active BK virus (BKV) diagnosis arises in immunocompromised patients and can produce tubulointerstitial nephropathy (BKVN). This study analyzed the role of inhibitory and activating killer immunoglobulin-like receptor (KIR) genes. KIR genes produce proteins that interact with the major histocompatibility complex (MHC) Class I molecules and donor's human leukocyte antigen (HLA) ligands. Several reports have associated cytomegalovirus, human immunodeficiency virus, hepatitis C virus, and herpes simplex virus infection outcomes with KIR genotypes. It was hypothesized that analyzing KIR genotypes would indicate the likelihood of acquiring post-transplantation BKV infection. The study retrospectively analyzed (n=199) kidney transplant patients with BKV. KIR genotyping employs reverse Sequence Specific Oligonucleotide Probe (rSSOP) Luminex based assay and/or Sequence Specific Primer (SSP) assay. The patient's blood and urine BKV levels were measured, and then used as evidentiary data. The donor's HLA typing was used to determine the formation of known HLA/KIR ligands. KIR haplotypes were inferred from genotypes and analyzed. Depending on the KIR genes presented by the recipient, inhibitory or activating ligands form. After applying statistical chi-squares and t-tests, there was no association, in this cohort, between viremia or viruria and KIR genotype or the presence of corresponding HLA ligands (p-value=0.39). KIR gene polymorphism in this population was not associated with increased risks of BKV viral activation post-transplant. This study was restricted by small sample size and limited subjects with BKV viremia; larger studies could provide more information on role of KIR gene polymorphism and BKV viral infection.

**Poster Board No. 041 UNTREATED HYPERTHYROIDISM AND POST-OPERATIVE OUTCOMES IN NON THYROIDAL SURGERY. Dilara Hatipoglu, Dhatipoglu12@hb.edu, 25434 Bryden Road Beachwood OH 44122. (Hathaway Brown School)**

Hyperthyroidism is the overactivity of the thyroid gland—an important gland that controls energy use, synthesis of proteins, and controls response to other hormones. It is not well known if patients with untreated hyperthyroidism who undergo non-thyroidal surgeries are at higher risk for postoperative complications. The purpose of this study was to assess any outcomes within three months of operation for patients with untreated hyperthyroidism undergoing a non-thyroidal surgery. Post-surgical complications screened were angina, myocardial infarction, arrhythmia, respiratory failure, sepsis, and death. The evaluation consisted of a randomized group of patients consisting of 59 females and 13 males with an average age of 64.22 and 66.77, respectively. The data obtained showed that 11 out of 72 patients (14%) had a complication postoperatively, similar to anticipated risk for patients without any thyroid problems going through similar surgeries. None had myocardial infection, sepsis, or death within 3 months of surgery. The observed complication rate was higher in females (17% vs 8 %); however, this may be due to the fact that hyperthyroidism is more common in females than males and the subject cohort had more females. Results obtained can help in determining risk of taking an untreated hyperthyroid patient for non thyroidal surgery, especially for non elective surgeries needed for untreated hyperthyroid patients. This study is limited due to the use of a small number of patients over a short amount of time.

**Poster Board No. 042 WHERE TO TURN FOR HEARTBURN: PHARMACEUTICAL ANTACIDS OR HOME REMEDIES. Osama A Alkhalili, suzanwadi@yahoo.com, 4691 Fairway Lane, Sylvania Ohio 43560. (Maumee Valley Country Day School)**

It is hypothesized that some home remedies are as effective as or even better than some of the pharmaceutical antacids in reducing acidity, which can cause heartburn. Prescribed doses of each of four pharmaceutical antacids (Alka-Seltzer™, Tums EX™, Roloids Extra™, and Tums Regular™) and two home remedies (baking soda and milk) were tested to determine their effectiveness as antacids. Each antacid tablet was dissolved in a flask containing



simulated gastric juice solution (0.1M hydrochloric acid). The solution was then back-titrated using 0.1 M sodium hydroxide solution and phenolphthalein indicator until the point of neutralization was reached. The number of drops of sodium hydroxide solution required for neutralization was counted and recorded. The same procedure was followed using half a tablespoon of baking soda and one cup of whole milk respectively. The procedure was repeated five times for each substance tested. The average number of drops of sodium hydroxide required for neutralization was 137 drops when using Alka-Seltzer™, 86 drops when using Tums Regular™, 59 drops when using Tums EX™, 33 drops when using Roloids Extra™, 155 drops for the control using distilled water, 74 drops when using baking soda and 156 drops when using milk. Roloids Extra™ was the most effective antacid substance tested followed by Tums EX™. Baking Soda was more effective than either Tums Regular™ or Alka-Seltzer™. Milk, in the quantity used, was not an effective antacid substance. These results support the hypothesis that some home remedies such as baking soda are as effective or more effective at neutralizing acids than some of the pharmaceutical antacids.

**Poster Board No. 043 REGULATION OF CARDIAC LIPID UTILIZATION BY KRUPPEL-LIKE FACTOR 15. Shamanthika J. Shelkay, sshelkay13@gmail.com, Domenick A. Prodocimo Ph.D., dap17@case.edu, Mukesh K. Jain M.D., 583 Southampton, Copley OH 44321. (Hathaway Brown School).**

The heart utilizes both fat and glucose to meet its energy demands. In the healthy myocardium, fatty acids (FA) are the predominant fuel source with glucose serving as the chief energy substrate under pathological states. This metabolic switch has been linked at the gene regulatory level wherein a family of transcription factors termed peroxisome proliferator-activated receptors (PPARs) regulates the expression of FA oxidation (FAO) gene products. Our laboratory recently described the zinc finger transcription factor Kruppel-Like Factor 15 (KLF15) as a critical regulator of glucose metabolism in the liver. This study tested the hypothesis that KLF15 is a novel molecular regulator of cardiac FA metabolic gene expression. Gene expression analysis revealed a perturbation in genes which regulate FAO in murine hearts with KLF15 germline deletion, as well as in cultured cardiac myocytes with both adenovirus overexpression (5,000 fold induction) and short-hairpin knockdown (95% reduction) of KLF15. Interestingly, a significant ( $p < 0.05$ , student's *t*-test) 40% reduction in PPAR $\alpha$ , a PPAR subtype, expression was observed with KLF15 loss of function both *in vivo* and *in vitro*, whereas the selective PPAR $\alpha$  agonist WY-14643 does not alter KLF15 levels. Finally, KLF15 knockdown in cardiac myocytes prevented the PPAR $\alpha$ -dependent induction in FAO gene expression. Taken together, these data suggest KLF15 regulates cardiac lipid utilization through a mechanism that involves PPAR $\alpha$  dependent regulation of FAO gene products, and this work has the potential to aid in the discovery of novel drug targets to improve FAO and cardiac function in patients with heart failure.

**Poster Board No. 044 HIGH ABI EFFECTIVENESS AS A DIAGNOSTIC TOOL IN PREVENTING HEART DISEASE. Karthik B Chakravarthy, chikki95@yahoo.com, 2385 Edgewater Drive, Beaver Creek OH 45431. (Ferguson Middle School)**

The objective of this effort was to devise a set of noninvasive blood pressure tests to evaluate heart health, and deduce whether hypertension, cholesterol or diabetes poses the highest risk for developing arterial disease. It was hypothesized that high cholesterol would be a major factor leading to heart/arterial disease. 55 candidates between the ages of 30-65 years from the general population were each subjected to 4 tests, using a sphygmomanometer and a handheld Doppler ultrasound, totaling 15 minutes. 1) A difference in systolic pressure >20mm Hg between right and left arm, and 2) difference in systolic pressure >20mm

Hg between right and left ankles was each categorized as 'fail', signifying possible blockage in subclavian artery. 3) An Ankle Brachial Index (ABI) – ratio between ankle systolic pressure to brachial systolic pressure in either legs >=1.4, indicating stiff arteries, was categorized as 'fail'. 4) Drop in systolic pressure >10mm Hg at either ankles, after two minutes of lower leg back and forth oscillation from the knee down, was categorized as 'fail'. The 4 tests' results revealed a direct correlation between a 'fail' in the ABI test to a 'fail' in at least one or more of the other tests. Candidates who passed ABI test had passed all the other tests. Therefore, instead of multiple tests, ABI could be used as a conclusive, single-test tool to predict heart disease. Also, hypertension was the leading cause among the failed candidates, as it speeds up the hardening of arteries, increasing the risk of arterial disease.

**Poster Board No. 045 VACCINATION OF MICE LACKING CD4+ T CELLS WITH AN ADENOVIRUS VECTOR RESULTS IN IMPAIRED HUMORAL AND CELLULAR IMMUNE RESPONSES-IMPLICATIONS FOR HIV/AIDS PATIENTS. Himanshu D Savardekar, Himanshu.Savardekar@gmail.com, 5888 Ivystone Ct, Dublin OH 43016. (Dublin Coffman HS)**

This study used a model vaccine, adenovirus expressing eGFP (Green Fluorescence Protein), in CD4+ T cell depleted mice to determine the potential for successful vaccination of an AIDS-like immune system. The CD4 depleted mice should be deficient in their ability to generate a humoral immune response, but able to mount a cellular immune response after vaccination. Humoral and cellular immune responses following vaccination with Ad5-eGFP (Adenovirus) in CD4+ T cell depleted mice and wild type mice were examined in 10 C57 BL/6 mice (n=10). Five mice underwent CD4+ T cell depletion with 100ug of depleting antibody (GK 1.5) at days -3, 0, 3, 7, and day 14 after vaccination. All ten mice were vaccinated with  $1 \times 10^8$  particles of Ad5-eGFP at day 0 and were sacrificed at day 21 for splenocyte and serum collection. An enzyme-linked immunosorbent assay (ELISA), used sera to measure humoral responses, indicated that antibodies to eGFP were detectable for all five wild type mice at >1:500 dilution, while undetectable at a 1:50 dilution in the CD4 depleted mice. Enzyme-linked immunosorbent spot (ELISpot), used to measure the cellular immune response via IFN-gamma production by the T cells, indicated a minimal cellular immune response to eGFP in the CD4 depleted mice as compared to wild type mice. There was a statically significant ( $p=0.0085$ ) decrease in the number of IFN-g spot forming cells (SFC) per million splenocytes specific for eGFP in the CD4 depleted mice compared to the wild type. Flow cytometry confirmed the depletion of CD4+ cells in splenocytes with an average of 0.9% CD4+T cells in the CD4 depleted mice and 70.9% CD4+ T cells in the wild type mice. The CD4+ T cell depleted mice were unable to generate a sufficient humoral or cellular immune response after vaccination with adenovirus expressing eGFP which refuted the hypothesis. Further studies should focus on alternative methods of stimulating cellular and humoral immune responses after vaccination in the absence of CD4+ T cells such as using a more potent inducer of innate immunity such as the vaccinia viral vector.

**Poster Board No. 046 FOXO3A TRANSCRIPTION FACTOR'S EFFECTS ON MUSCLE ATROPHY IN RUNT PIGLETS. Sachin R Rudraraju, sachin.rudraraju@gmail.com, 3938 Hampshire Ave, Powell OH 43065. (Olentangy Liberty High School)**

Foxo3a is a major transcription factor implicated in muscle atrophy. The inactive form of Foxo3a is pFoxo3a. The investigator aimed to identify differences between the expression of Foxo3a in low-birth-weight, or runt, piglets versus normal-birth-weight piglets. It was hypothesized that Foxo3a was expressed more in runt piglets than normal-birth-weight piglets. Three pairs of piglets, from three litters, were used; in each pair, one was a runt and the other normal-birth-weight. Samples of muscles from each piglet were taken. Hematoxylin stains the

background cells blue. Anti-rabbit Foxo3a and pFoxo3a primary antibodies anneal to their respective transcription factor. A Biotinylated Universal secondary antibody anneals to the primary antibody and is stained brown by the DAB wash. In the resulting slides, bundles of muscle fibers were clearly visible. In each bundle, one larger type I fiber was surrounded by several smaller type II fibers. In the cases of normal-birth-weight piglets, it was found that pFoxo3a stained evenly throughout the bundles. Foxo3a was stained evenly throughout the bundle. In the cases of runt piglets, pFoxo3a stained evenly throughout the bundles. Foxo3a, however, was stained specifically in the type I fibers. This leads to the conclusion that type I fibers in 'runt' piglets are being degenerated to a higher extent than the same fibers in normal-birth-weight piglets. Although immunohistochemistry can help identify such patterns as above, it is difficult to measure relative levels of the transcription factors in each sample of tissue. A western blot could measure the amounts of Foxo3a and pFoxo3a in the tissue.

**Poster Board No. 047 H1N1 A – A SERIOUS THREAT OR NOT? Aarti Kumar, kumarhome@yahoo.com, 4637 Forest Ridge Dr, Mason OH 45040. (Mason HS)**

The threat of H1N1 generated significant attention in 2009 and was declared a "Pandemic". This project's hypothesis was that H1N1 is not a serious threat to public health. The analysis of the Center for Disease Control (CDC) laboratory specimen data shows that influenza activity more than doubled in 2008 compared to 2007 and 30% of these laboratory samples were H1N1 positive. These data should have raised an alarm earlier. In 2009 the fatal cases in US were 1.1%, which were similar to Mexico but less than Canada (3.5%). Worldwide fatality was 0.1% making H1N1 primarily a North American influenza. Worldwide Case Fatality Rate (CFR) was less than 0.2% for H1N1, which is significantly lower vs. other pandemics like the 1918 flu with a CFR of 9% and SARS CFR of 7%. This Influenza Like Illness (ILI) analysis shows that the ILI was high in 2009 but was lower than non-pandemic year peaks of 2002-2003. Clinical Attack Rate (CAR) for H1N1 was 25%, which is significantly lower than the 1918, 1957, and 1968 flu. Of the 210 student surveyed at the Mason High School, 82% felt "H1N1 Pandemic" was non-threatening. Top 10 symptoms of H1N1 felt by respondents were similar to the seasonal influenza except for "feelings of weakness". "Fear of Unknown" made many of the respondents uneasy. However, H1N1 did result in behavioral change as shown through over 50% increase in sanitation habits (like repetitive hand washing) of respondents. Data analysis proves that the hypothesis was correct.

**Poster Board No. 048 ABILITY OF FABRICS TO CAPTURE BACTERIA. Colleen M Moloney, moloneydachs@woh.rr.com, 4204 Country Glen Circle, Beavercreek OH 45432. (Carroll High School)**

The purpose of this experiment is to discover which fabric, cotton, wool, polyester, nylon, or silk, is the best at minimizing the spread of *Staphylococcus aureus* bacteria. *Staphylococcus aureus* causes skin infections, ranging from mild contagions to severe Methicillin Resistant *Staphylococcus aureus* (MRSA). The author hypothesized that wool minimizes the spread of bacteria the best because of its thickness and absorbency, followed in order by cotton, polyester, nylon, and silk, which allows the spread of the most bacteria because of its thinness and low absorbency. The five fabric types were tested under three variables. These were dry, moistened with sterile water sprayed through an atomizer at room temperature, and moistened with a safe *Staphylococcus epidermidis* bacteria solution sprayed through an atomizer at room temperature. The fabrics were laid on nutrient broth agar for 5 seconds and then removed. Then the Petri dishes were incubated at 35° Celsius for 24 hours. Through the three trials of investigation, a pattern was found. In each trial bacteria

colonies in 1x1 cm sections of the 3x3 cm samples were counted through a magnifying microscope then multiplied by nine to acquire an estimated value for the whole sample. Then an estimated average colony count of the three trials of each fabric was calculated. Nylon (2325 colonies) and silk (2754 colonies) were found to allow the most spreading of bacteria. Next, polyester (2244 colonies) varied in the allowance of spreading of bacteria. Wool (1131 colonies) and cotton (1011 colonies) fluctuated as the fabrics that allowed the least spreading of bacteria. In conclusion the author's hypothesis was partially correct. Comparing the above results reveals that cotton is the fabric that allows the least spreading of bacteria.

**Poster Board No. 049 ANTIBIOTIC RESISTANT BACTERIA IN BURLINGTON LAKE AND SYMME'S CREEK, LAWRENCE COUNTY, OHIO. Timothy J. Beavers, tb291708@ohio.edu, 108 Aaron Drive, South Point OH 45680. (South Point High School)**

The goal of this project was to determine the levels of antibiotic resistance in the bacteria of Burlington Lake and Symme's Creek in Lawrence County, Ohio. Previous studies have correlated high concentrations of antibiotic resistant bacteria with perturbed habitats; this may be of interest where aquatic organisms are captured and consumed by humans. A previous study compared the levels of antibiotic resistance among bacteria from both sites. Bacteria from Symme's Creek were more resistant to Ampicillin®, Ciprofloxacin®, and Tetracycline® while bacteria from Burlington Lake were more resistant to Erythromycin®, Streptomycin®, and Sulfamethizole®. The hypothesis of the project was that the lake and creek bacteria's resistance levels would increase due to continued selection for resistant strains. This experiment was conducted by collecting 100 mL water samples and plating the samples on R2A agar with 12.5 µg/mL Tetracycline®. Pure colonies were isolated. Afterwards, a minimum inhibition concentration (MIC) assay was conducted on isolates. The results were that bacteria from Burlington Lake were, on average, more resistant to all of the examined antibiotics than those of Symme's Creek. Average MIC values for Burlington Lake isolates were 13,730.6 vs. 50 µg/mL Ampicillin®, 1,357.8 vs. 4 µg/mL Ciprofloxacin®, 4,505.8 vs. 12.5 µg/mL Tetracycline®, 1,550.3 vs. 8 µg/mL Erythromycin®, 4,360.1 vs. 25 µg/mL Streptomycin®, and 19,288.9 vs. 128 µg/mL Sulfamethizole®. Results ultimately showed that MIC levels were averagely higher than the previous year for all antibiotics except Sulfamethizole®. Identification and further characterization of bacterial isolates is in progress.

**Poster Board No. 050 A COMPARATIVE ANALYSIS OF BACTERIA IN MEN'S AND WOMEN'S WALLETS. Micaela O. Connors, mic40@comcast.net, 69529 Highland Avenue, Bridgeport OH 43912. (St. John Central High School)**

Hands and paper money are known carriers of bacteria. Bacteria thrive in warm, moist, dark environments. The purpose of this experiment was to determine whether bacteria were present in the bill section of men's and women's wallets; and, if so, whose wallets were warmer and whose held more bacteria. Several variables were considered including gender and internal wallet temperature. Temperatures were taken with an infrared thermometer and specimens collected from the bill section of 30 wallets; 15 men's and 15 women's. Three culture plates were inoculated for each wallet, including two nutrient agar plates and one Trypticase Soy Agar with 5% sheep's blood plate. Control blanks were exposed at each of two specimen collection sites; and, specimens were collected/cultured from the bill section of one new wallet for each gender. One nutrient agar culture from each wallet was incubated at the mean temperature of the gender group (men's at 26.7°C and women's at 19.8°C); and the remaining two culture plates (for each gender's wallets) were incubated at 37°C. All culture plates were incubated for 48 hours (N=90 for wallets and N=12 for controls). Colony counts were performed at 24 and 48 hours. The



results of the experiment were that bacteria were present in 93% of the wallets; the average temperature of the men's wallets (at 26.7°C) was higher than the women's (at 19.8°C); and, more bacteria were found in men's wallets (with a combined colony count of 1,358 from 45 plates) than in women's (at 468 from 45 plates).

**Poster Board No. 051 UTILIZATION OF THE PHOSPHONATE COMPOUNDS PBTC AND HEDP BY CYANOBACTERIA.** Amy M. Johnson, paulmjohnson@wcnet.org, 1000 Gustin Ave., Bowling Green OH 43402. (Bowling Green High School)

Cyanobacteria possess the unique ability to utilize phosphonates as a source of phosphorus by degrading phosphonates into usable phosphates. This leads to a delivery of phosphate into watersheds that can contribute to excessive algal growth. The ability of cyanobacteria to utilize the phosphonate compounds 2-Phosphonobutane-1, 2, 4 – Tricarboxylic Acid (PBTC) and hydroxyethylidene phosphonic acid (HEDP) was tested to examine the ability of these compounds to stimulate algal growth. These compounds are added to cooling water in power plants to prevent scaling of pipes, and thus contribute to harmful phosphorus levels in the watershed. Water containing cyanobacteria was taken from Lake Erie. One set of bottles of water was amended with 10 µM PBTC, another set with 5 µM HEDP, one set was unamended (the negative control), and another set was amended with 10 µM inorganic phosphate (the positive control). The growth of the cyanobacteria was monitored for 3 weeks by *in vivo* fluorescence using a fluorometer to determine relative concentrations of algal cells. This procedure was repeated a second time. The end of the first experiment revealed that there was not a greater amount of growth in the bottles amended with phosphonates. At the end of the second experiment the average algal growth for HEDP was not greater than the negative control; however the bottles amended with PBTC did exhibit greater growth, after an initial delay in growth. The data supported the hypothesis that PBTC stimulates algal growth but does not support the hypothesis that HEDP stimulates algal growth. The data also raised the possibility that PBTC may initially inhibit algal growth.

**Poster Board No. 052 DO BESTSELLING ADULT, CHAPTER OR PICTURE BOOKS FROM THE PORTSMOUTH PUBLIC LIBRARY CONTAIN THE MOST BACTERIAL CONTAMINANTS.** Mary M. Martin, mmmmarymarlene99@gmail.com, 7613 Sun Hill Drive, Portsmouth OH 45662. (Wheelersburg High School)

The purpose of this experiment was to discover which group of New York Times National Bestselling Books from the Portsmouth Public Library contained the most contaminants. (contaminants were any growth of bacteria or fungi). The three groups of books that were tested include Adult Paperback Mass-Market Fiction, Children's Chapter Books, and Children's Picture Books ranked on October 9, 2009. The hypothesis was that bestselling picture books would contain the most contaminants. To test the hypothesis, five books under each category were checked out from the Portsmouth Public Library with sterile gloves. After each book was obtained, individual sterile swabs and gloves were used to collect separate samples of potential contaminants from the bindings, edges and page 5 of each of the individual books. The swabs were then applied to a 5 percent sheep blood agar and left in a room kept at 72 degrees Fahrenheit. After seven days, the colonies were counted and identified by clinical microbiologist, Dr. Timothy Cassity, PhD. In total, fifty colonies of contaminants were found on adult paperback books, thirty-one were found on chapter books and twenty-two were found on picture books. Concluding the experiment, the hypothesis was not supported by the experiment for there were more colonies of contaminants on Adult Paperback Mass Market Fiction Books from the Portsmouth Public Library.

**Poster Board No. 053 EFFECTS OF DIFFERENT STORAGE ENVIRONMENTS ON APPLES TREATED WITH PRESERVATIVES.** Micaela S. Rockwell, blesssblonde1994@live.com, 63796

**Barnesville St., Barnesville OH 43713. (East Richland Christian High School)**

The purpose of this project was to discover in what environment SmartFresh® (preservative) treated apples had the longest time without deterioration; room temperature, cold storage, or refrigerator. The hypothesis was the treated apples in cold storage would have the longest shelf life, refrigerator stored apples second, and room temperature stored apples the shortest shelf life. 153 apples were picked and SmartFresh® treated. The apples were divided into 3 groups and placed in crates in their storage environments. The apples' soluble solids level, pressure level, and the starch to sugar conversion were tested. These steps were repeated with 3 apples from 3 storage environments. The three readings were averaged for each test. Tests were done for seventeen weeks once a week. The constants included the apple variety, tests, testing methods, and instruments. The variable was the storage environment. The hypothesis was partially correct. Room temperature apples had a soluble solids level of 12.6%, a pressure level of 6 psi, and a starch to sugar conversion of 8.3 on the pictorial chart. The apples in cold storage had a soluble solids level of 11.6%, a pressure level of 6.7 psi, and a starch to sugar conversion of 6.7 on the pictorial chart. The refrigerated apples had a soluble solids level of 11.4%, a pressure level of 7.1 psi, and a starch to sugar conversion of 6.3. These results show that apples in room temperature had the shortest storage time without deterioration, cold storage the second longest, and refrigerated the longest shelf life.

**Poster Board No. 054 A MECHANISM FOR BACTERIAL SURVIVAL USING *mprF*.** Saaket M. Pradhan, saaketpradhan@yahoo.com, 7659 Wryneck Drive, Dublin OH 43017. (Dublin Coffman High School)

The bacterial cytoplasmic membrane is a semi-permeable, phospholipid layer that controls the movement of molecules across the cell. Modification of this membrane has been proposed as a bacterial strategy for antimicrobial resistance. For example, the *mprF* gene found in *Bacillus subtilis* is responsible for changing the negatively-charged cell membrane by adding positively charged lysine to the membrane phospholipid. This modification changes the overall charge, the viscosity, and the permeability of the membrane. The modified membrane not only provides protection to bacteria from antimicrobial substances but has been speculated to provide protection from environmental stresses. The objective of this project was to find if *mprF* has any effect on the bacterial tolerance to environmental stresses such as high salt conditions. Two strains of *Bacillus subtilis*, wild type with *mprF* gene, and mutant lacking the gene, were grown in Luria-Bertani broth (LB) containing varying concentrations of NaCl such as 0%, 2%, 4%, and 6%. The LB with 0% NaCl was used as a control. The bacterial growth was monitored by measuring the optical density at 600 nm in a spectrophotometer, over 6 hours. The optical density of both cultures was similar at 0% NaCl concentration throughout six hours. However, as the concentrations of NaCl increased up to 6%, the wild type *Bacillus subtilis* strain with the *mprF* showed a higher optical density than the mutant strain. This experiment was repeated six times and the results were consistent. These results demonstrate that the wild type strain (+ *mprF* gene) grows better in the presence of NaCl than the mutant strain, especially at higher concentration such as 6% NaCl. The results of this experiment indicate that the *mprF* gene is involved in bacterial tolerance to high salt conditions.

**Poster Board No. 055 FAST FOOD RESTAURANT TABLETOPS VS. CASUAL DINING RESTAURANT TABLETOPS: WHICH CONTAINS MORE BACTERIA?** William A. Ittenbach, rick.ittenbach@gmail.com, 7431 Miami Hills Drive, Cincinnati OH 243. (Archbishop Moeller High School)

The purpose of this study was to compare tabletop bacteria



counts between fast food (orders placed and food received at a counter) and casual dining (orders taken and food delivered to customers at a table) restaurants. Restaurants are a perfect place for bacteria to live because the tabletops have all of the necessities for life (food, stable environment, water, homeostasis, etc.). If a commonly used surface is not cleaned well, then the surface is likely to hold many bacteria. As families in the U.S appear to be eating out a lot, lack of cleanliness and poor personal hygiene are two factors that contribute to the likelihood that more bacteria will be found in the fast food chains rather than casual dining restaurants. RODAC plates were used to take samples of tabletop bacteria from six different restaurants (3 fast food, 3 casual dining). The samples were taken on 15 and 16 December 2009. The samples went immediately to Cincinnati Children's Hospital and were incubated at 36.7 degrees Centigrade for 48 hours. The casual dining tabletops contained an average of 1.28 colonies per cm<sup>2</sup> while the fast food tabletops contained an average of 1.14 colonies per cm<sup>2</sup>. No statistically significant difference in colony counts was observed between the two types of restaurants ( $p = 0.81$ , Kruskal-Wallis test). The colony counts were considered by clinical microbiologists to be acceptable-to-good. Based on this limited sample, there appears to be minimal risk of infection at either of the two types of restaurants.

**Poster Board No. 056 BACTERIAL RESISTANCE AFTER OVERUSE OF ANTIBACTERIALS. Catherine E. Lok, Catherine\_llok101@yahoo.com, 8470 SH 67, Upper Sandusky OH 43351. (Upper Sandusky High School)**

Recent use of antiseptics has drastically increased, so it is important to observe the resistance of bacteria that antibacterials cause. This investigation is designed to determine if bacteria create a resistance to antibacterials and if so, pass on the resistance to future generation after repeated exposures to those antiseptics. The bacteria were exposed to two kinds of antiseptics. The results of the antibiotic sensitivity panels were the dependant variable that changed with the numbers of exposures. (independent variable) From stored samples, *Escherichia coli* and *Staphylococcus aureus* were streaked for isolation on soy agar (5% sheep blood). A sensitivity test was made from this bacteria. The results of this bacteria served as the control since it was not yet exposed to the antiseptics. (Purell™ [active ingredient, ethyl alcohol] and Bodycology™ [active ingredient, Tricolsan]) Once the Bodycology™ was diluted to 1:1000 and Purell™ without dilution, the bacteria were repeatedly exposed to these antiseptics. An antibiotic sensitivity test was performed at the end of the 24 exposures for Bodycology™ and 28 exposures to Purell™. One resistance occurred. The resistance occurred in *Staphylococcus aureus*. *Staphylococcus aureus*'s resistance went from susceptible to intermediate for Clindamycin, a bacteriostatic antibiotic after 28 exposures to the Bodycology™ antibacterial hand soap. The other bacteria exposed to antiseptics did not produce resistance. Resistance occurs in a matter of year, so further exposures to antiseptics may further prove bacterial resistance caused by overuse of antibacterials. This study can be valuable to medical professionals along with the general public to caution antiseptic overuse.

**Poster Board No. 057 CANCER: THE EFFECTS OF RESVERATROL ON TCP-1 CELLS. Shefali S. Shah, shefali100@yahoo.com, 469 Private Drive 10463, Proctorville OH 45669. (Fairland High School)**

Cancer is a group of diseases that result from the uncontrolled growth and spread of abnormal cells. Resveratrol, a phytochemical, is thought to slow the growth of cancer cells. This project treated thyroid cancer cells (TCP-1) with different concentrations of Resveratrol (control, R25, R50) to observe the drug's effect on the cells. The cells were studied under a microscope to examine cell shape and percent concentration (confluent). Elongated cell shape and lower confluent indicated slowed growth.

The cells' RNA was also extracted to examine a certain oncogene (Nis at 312 base pairs). Using Polymerase Chain Reaction (PCR), the Nis oncogene was processed and exposed to a film; thicker exposed bands confirmed that Nis was further restored to the original genetic makeup. It was hypothesized that TCP-1 cells treated with higher doses of Resveratrol (N=3) would be noticeably healthier. The control had an 80% confluent of the original cancerous cells, and Nis was unchanged (the thinnest exposed band). The culture with 25 μL Resveratrol had a mixture of round and stretched cells and a 50% confluent. The cells' oncogene band was slightly thicker. The dish with 50 μL Resveratrol had a 30% confluent of elongated cells and the thickest oncogene band. In conclusion, cells treated with larger concentrations of Resveratrol were noticeably healthier and had slowed growth. This research is the first step in discovering an alternate cancer treatment. Unlike many standard treatments, Resveratrol has no known side effects. However, only *in vitro* experiments on Resveratrol have been conducted.

**Poster Board No. 058 THE OPTICAL PROPERTIES OF GOLD NANOPARTICLES. Benjamin F. Grant, grantbf@mail.uc.edu, Garrett L. Bergen, bergengl@mail.uc.edu, 306 Cherry St, Blanchester OH 45107. (Blanchester High School)**

The goal of this project was to determine the absorption wavelength of gold nanoparticles and the differences between 3 liquids. Liquid 1 was Tetrachloroaurate Trihydrate, liquid 2 was created by letting liquid 1, mixed with Sodium Citrate Dihydrate, sit out overnight, and liquid 3 was created by heating and stirring liquid 1 with Sodium Citrate Dihydrate. Liquids 2 and 3 are gold nanoparticles. The desire was to know the difference between the 3 different liquids. The hypothesis was that liquid 1 (the macro particles) would have a significantly different absorption wavelength than liquids 2 and 3 (the nanoparticles). The experiment was done with 8-50mL beakers, 1 Pneumatic Trough, 1 Hot Plate, Ice, Table Salt, 2-100mL graduated cylinders, 3-50mL graduated cylinders, 3-25mL graduated cylinders, 1 Laser Light, 4 Thermometers, 1 UV-1650PC Double Beam Spectrophotometer, and 1 Compact 2 Centrifuging Machine. A Tyndall test was performed on the three liquid which were then ran through a spectrophotometer. After they were put in the spectrophotometer it was discovered that the absorption wavelength of Liquid 1 was 424nanometers, the absorption wavelength of Liquid 2 was 534.5 nanometers, and the absorption wavelength of Liquid 3 was 521.5 nanometers. In conclusion, there was no significant difference in the absorption wavelength between the macro and nanoparticle solutions. All 3 were colloids and liquid 1 was gold particles and liquid's 2 and 3 were gold nanoparticles.

**Poster Board No. 059 THE EFFECTS OF THE ANTIPSYCHOTIC DRUG PALIPERIDONE (9-HYDROXYRISPERIDONE) ON DOPAMINE RELEASE IN THE RAT PREFRONTAL CORTEX. Marin, E Eberlein<sup>1</sup>, meberlein12@gmail.com, Tara. A. Byrd<sup>2</sup>, Elizabeth. A. Pehek,<sup>3</sup> <sup>1</sup>Hathaway Brown School, 19600 North Park Boulevard, Shaker Heights OH 44122, <sup>2</sup>Res., Cleveland VA Med. Ctr, Cleveland OH & <sup>3</sup>Psychiatry and <sup>3</sup>Res., Case Western Reserve Univ/Cleveland VA Med. Ctr., Cleveland OH. (Hathaway Brown School)**

Antipsychotic drugs may act therapeutically in the prefrontal cortex (PFC), a brain area implicated in schizophrenia. 9-hydroxyrisperidone (9-OH-RISP, paliperidone) is a newly approved antipsychotic drug that is the primary active metabolite for the compound risperidone (RISP). It is believed that both drugs have therapeutic effects due to the combination of dopamine (DA) D2 and serotonin (5-HT) 5-HT2A receptor subtype blockade. Previous work has shown that stress increases DA release in the PFC and a 5-HT2A antagonist can block this release. The present study investigated whether 9-OH-RISP or RISP can block stress-induced DA release. Extracellular samples were collected every 20 min and

measured using high performance liquid chromatography to quantitate DA levels in 40 rats. After a baseline period of 3 hours, a 10  $\mu$ m concentration of either 9-OH-RISP or RISP was infused into the PFC for 120 min. The control animals continued to receive infusions without the drug. Rats were gently petted for 20 min after the drug or control was administered. This served as a mild stressor and increased DA release to 300% of baseline for control animals in the first 20 min sample. Infusion of either RISP or 9-OH-RISP reduced this increase in DA to 180% and 190%, respectively. These results suggest that 9-OH-RISP and RISP act similarly to decrease stress-induced DA release. Specifically, the decrease in stress-induced DA release may have been due to the blockade of 5-HT<sub>2A</sub> receptors in the PFC. These findings may have relevance therapeutically since abnormal dopaminergic function has been implicated in schizophrenia.

**Poster Board No. 060 A SCREEN FOR GENES THAT MAY PLAY A ROLE IN MOTOR AXON GUIDANCE IN *DROSOPHILA MELANOGASTER*.** Sarah C. Forcier, sforcier12@gmail.com, 19600 North Park Blvd, Shaker Heights OH 44122. (Hathaway Brown School)

*Drosophila melanogaster* are commonly used in scientific research as model systems because they are small, reproduce quickly and abundantly, have only four chromosomes, and are incredibly genetically amenable. For this study, a library of RNA interference transgenic *drosophila* lines was utilized to identify genes involved in motor axon guidance. It is hypothesized that genes playing a role in motor axon guidance may be identified by variations from the wild-type phenotype in the intersegmental nerve and segmental nerve when that gene's function is silenced by RNAi. Flies carrying the neuronal driver, C155-GAL4, and UAS-Dicer were crossed to transgenic lines carrying a variety of UAS-gene<sup>RNAi</sup>. The embryonic progeny were fixed in formaldehyde, stained with an antibody specific to motor neurons, and analyzed with a Zeiss Axioplan microscope. In the cross C155-GAL4 driving UAS-gene<sup>RNAi</sup> and UAS-Dicer, GAL4 is a yeast protein that binds to the Upstream Activating Site (UAS), resulting in the expression of the downstream gene/sequence, such as Dicer and gene<sup>RNAi</sup>. When these are misexpressed, Dicer cleaves the double-stranded RNA, creating interfering RNA that bind and cleave target mRNA, rendering it incapable of performing its normal function. Of 26 independent RNAi lines scored, there was no variation from the wild-type phenotype in 100% of the screened lines. However, the positive result of this data is that, because in most cases genetics research is done by process of elimination, headway has been made in the search for genes that play a role in motor axon guidance, thus advancing future work in this field.

**Poster Board No. 061 SPORT DRINKS VS FRUIT JUICES: MAXIMIZING ELECTROLYTIC REPLENISHMENT WHILE MINIMIZING CALORIC INTAKE.** Nishantika Bhattacharya, bhatta1379@yahoo.com, 1379 Abbeyhill Dr, Worthington OH 43085. (Kilbourne Middle School)

The purpose of this experiment was to determine a fluid that would stimulate a person's body after vigorous exercise without making that person weak afterwards. When a person perspires, many different compounds and minerals are lost, including electrolytes. Some of them are: sodium, chloride, magnesium, phosphate, sulfate, potassium and bicarbonate. Electrolytes are charged particles of a soluble in the blood that play an important role in body functions such as nerve conduction and muscle contraction. Without restoring these electrolytes, one's body can become weak after exercise. Some people drink water after exercising, but water lacks the electrolytes. Sport drinks and juices are high in these compounds but can have excessive amounts of calories from sugar. The objective of this test was to get the 10 most popular athletic drinks and find out which one had the most electrolytes for the least calories. Five of these drinks were sports drinks and the other five fruit juices. To do the test, a digital ammeter, 2 red wires, 1

black wire and a glass container were needed. The strategy was to establish an electrical circuit with the ammeter, the battery and the liquids, each in its own glass container to measure conductivity. The hypothesis was that Sport Drink B was the best since it had 0 calories and many electrolytes. All 10 liquids were tested 20 times each, for a total of 200 trials. A calculation of all the averages of all tests for each drink was made, and then compared to come up with a conclusion: Sport Drink B supplied the greatest ratio of electrolytes per sugar rendering it the best choice for athletes. It had the most electrolytes out of all the liquids and no calories. Higher electrolytic value isn't necessarily always better; ideally the concentration should match the lost in sweat. Everyone's body is different so based on factors such as weight, age, the time and duration of the exercise and the perspiration lost; a person should re-fuel himself/herself accordingly.

**Poster Board No. 062 DO SPROUTING LENTILS HAVE HIGHER AND BETTER QUALITY PROTEINS THAN DRY SEEDS: A PROSPECTIVE STUDY.** Dhweeja Dasarathy, srinivasan.dasarathy@gmail.com, 391 East St Andrews Drive, Highland Heights, OH 44143. (Birchwood School)

Lentil seeds are the primary source of proteins and amino acids in the diet of vegans. Germinating lentil seeds have greater protein content than dry seeds and are of higher quality due to ease of digestion. Five different legume seeds: soybean, green soy, kidney beans, navy beans, and chick peas were studied at room (25° C); cold (4°C) and warm (37°C) temperatures. Solutions for germination included faucet water, 5% sugar and an essential amino acids mixture (2% each w/v). Germination time in hours (h), sprout length measured on the 3rd day, dry and final sprouting weights were recorded for each condition. A precisely weighed amount (50 mg) of each seed was dissolved in 0.5M potassium hydroxide and protein content measured. Commercial yeast solution was added to 20 mg of each seed and time to dissolve the seed recorded. All experiments were performed twice using 4 seeds of each type under each condition and expressed as mean  $\pm$  standard deviation. Soybean and green soy beans sprouted the earliest (12.3 $\pm$ 8.6 h and 14.3 $\pm$ 11.6 h) under all conditions. Seeds germinating in the amino acid solution had the lowest germination time (10.8 $\pm$ 2.1 h), greatest increase in protein content (89.4 $\pm$ 44.2%) and fastest yeast digestibility (28.6 $\pm$  12.4 sec) followed by faucet water for lower germination time (14.6 $\pm$ 7.9 h), increase in protein content (72.8 $\pm$ 37.6%) and time for digestion (38.6 $\pm$ 14.9 sec). Sugar solution delayed germination under all conditions (19.6 $\pm$ 6.5 h). Protein content per gram of weight was higher (9.6 $\pm$ 4.1 mg/g) in sprouting than dry seeds (4.3 $\pm$ 2.1 mg/g).

**Poster Board No. 063 WHICH STANDARD VISCOSITY LEVEL YIELDS OPTIMAL LUBRICITY?** Anna K. Mayo, mayo16@zoominternet.net, 309 Township Road 1135, Proctorville OH 45669. (Chesapeake HS)

Optimal lubricity represents the greatest reduction in friction between two interacting surfaces. Lubricity cannot be directly measured, so tests have to be conducted to quantify a lubricant's performance. Viscosity is a measure of the internal resistance of a fluid to flow. The purpose of this study was to alter the viscosity levels of oil samples and test for optimal lubricity. It was hypothesized that the oil sample with the lowest viscosity level would yield optimal lubricity. Three cans of base oil with differing viscosity levels were provided by a nationally known oil company. Using a Viscosity Blending Chart, samples from the three cans were mixed to yield six oil samples (N=6) each with differing viscosity levels – sample 1 being the least viscous, and sample 6 being the most viscous. Using a ramp, each sample of oil was tested. After covering the ramp with the oil sample to be tested, a round metal weight (812g) was released at the top of the ramp. The time until it reached the bottom of the ramp was measured. The test was repeated eight times for each of the six samples. Averaged results were: dry ramp, 1.32 seconds; sample

1, 1.00 second; sample 2, 1.38 seconds; sample 3, 1.53 seconds; sample 4, 1.54 seconds; sample 5, 2.88 seconds; and sample 6, 5.03 seconds. The oil sample with the lowest viscosity level yielded the fastest time supporting the original hypothesis. Experimental data was analyzed using a computer spreadsheet and x-y scatter plot. This study shows that when working with interacting surfaces in relative motion, viscosity and lubricity need to be considered to minimize wear.

**Poster Board No. 064 FORCE VS. VELOCITY IN SWIMMING. Cherylyn M. Geers, cherylyn.geers@gmail.com, 3721 Dust Commander Dr, Hamilton, OH 45011-5525. (Home-Schooled)**

This project investigated the correlation between the speed of a swimmer and the force that the swimmer is exerting on the water. It was hypothesized that the force would increase with the speed. The force exerted was measured with an electronic meter at three different velocities, with each corresponding to a different stroke cycle time. The average velocities were 1.03 m/s for 1.5 s, 1.06 m/s for 1.4 s, and 1.13 m/s for 1.3 s. The average forces measured were 79.9 N, 82.2 N, and 81.6 N, respectively. This shows an increase and then a slight decrease in the force. The standard deviations for the forces were 5.31 N, 5.48 N, and 6.70 N for 1.5 s, 1.4 s, and 1.3 s, respectively. Since the standard deviations were greater than the differences between the forces, the force appears to be independent of the stroke rate.

**Poster Board No. 065 MEASURING AND COMPARING THE POTENTIAL ENERGY OF NUTS. Allison M. Siragusa, 12ASiragusa@beaumontschool.org, 7965 Bainbrook Drive, Chagrin Falls OH 44023. (Beaumont School)**

With fuel and oil being of much value in today's world due to their impending scarcity, scientists are looking at alternative fuel and energy sources, such as energy that comes from the food we eat. This project utilized an experiment to measure the potential energy of three different types of nuts: almonds, pecans, and cashews, and determined which type of nut contained the greatest quantity of potential energy, measured in both kilocalories and BTU (British thermal unit). Potential energy is defined as the energy stored within a system. The hypothesis of this project stated that all three types of nuts will produce a certain amount of energy. Peanuts will produce the greatest amount of energy. Almonds and cashews will produce the least amount of energy. To measure the potential energy of the nuts, an enclosed and insulated model was designed. The model consisted of a can containing 50g of water suspended above a flaming nut that was positioned on top of an aluminum-foil covered cork. The flaming nut heated the suspending water. The potential energy was measured by taking the difference between the starting and ending temperatures of the water divided by the mass of the nut. This experimental determination yielded a measurement of the number of BTUs. The result was converted to kilocalories by multiplying potential energy in BTUs by 3.97. Ten trials were performed for each type of nut, which produced a total of 30 trials. Almonds produced an average of 10.5 kilocalories or 41.6 BTUs, pecans produced an average of 9.25 kilocalories or 36.7 BTUs, and cashews produced an average of 8.43 kilocalories or 33.6 BTUs. These experimental results demonstrate that the hypothesis was incorrect and that almonds had the most potential energy, rather than pecans.

## Notes

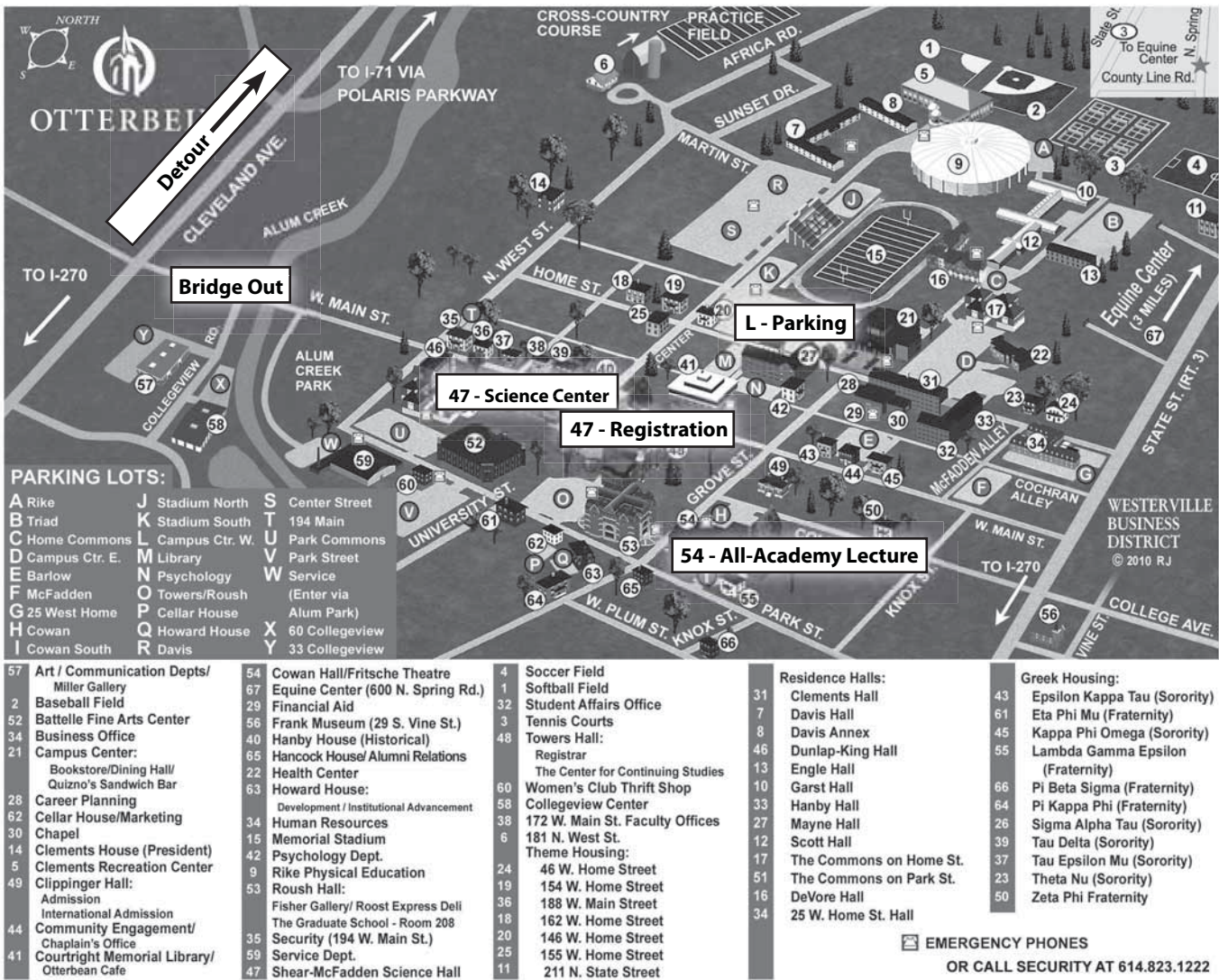


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**Directions to the Campus of Otterbein University, Westerville, OH**

Registration, and Podium and Posters Sessions will be in the Science Center (McFadden and Schear Halls), 155 W. Main Street, Westerville, Ohio 43081

Be aware that the Main Street bridge is closed west of the Science Center. This will impact visitors approaching Otterbein from Cleveland Avenue, who will be detoured north on Cleveland Ave. to County Line Road and back toward campus on N West St. **During this outage, consider using the OH-3 Westerville exit on I-270 and go north on State Street to Main Street to avoid the detour.**

**From the NORTH**, take I-71 south to Gemini Place. After the exit, turn left on Gemini Place, turn right onto Orion Place, turn left on Polaris Parkway past Cleveland Avenue to Africa Road (2 miles). Turn right on Africa Road, which becomes N. West St. Travel approximately

1.5 miles on Africa Rd./N West St. Turn left on W Home Street, travel 0.2 miles to the parking lots west and east of the Campus Center.

If traveling from the **SOUTH** on I-71, Route 315, or Route 23, take I-270 East (Wheeling) on the North side of Columbus. Follow I-270 to OH-3 north (exit 29) toward Westerville. Travel 2 miles north on State Street and turn left (West) on Main Street. Travel 0.2 miles and turn right (North) toward the Campus Center for parking

If traveling from the **EAST or WEST** on I-70, take I-270 North toward Cleveland. Travel 8 miles on I-270 and exit on OH-3 north (exit 29) toward Westerville. Travel 2 miles north on State Street and turn left (West) on Main Street. Travel 0.2 miles and turn right (North) toward the Campus Center for parking.



The Ohio Environmental Science  
& Environmental Engineering



Scholarship Program  
APPLICATION

Program description: <http://www.ohiosci.org/OESEESCHOLARSHIPS.htm>

Online, Adobe PDF fill-in application: <http://www.ohiosci.org/ScholarshipApplication.pdf>

Deadline: Mail First Class. **Postmarked by June 1.**

Page 1 of 2

\$1,250 two year programs and \$2,500 for four or five year programs, non-renewable.

THESE MERIT BASED, NONRENEWABLE, scholarships will be given to undergraduate students admitted to and enrolled in Ohio state or private colleges and universities who can demonstrate their knowledge and commitment to careers in environmental sciences or environmental engineering. Students must be in the final year of the program by the autumn term. Awardees will be selected by an Academy appointed panel using a blind review process. Scholarships may be used for tuition, fees, books, personal protection equipment, tools, instruments and field equipment but not housing.

1. Check Title \_\_\_\_\_ Ms. \_\_\_\_\_ Mr.
2. First \_\_\_\_\_ 3. Middle \_\_\_\_\_ 4. Last \_\_\_\_\_
5. Home Address \_\_\_\_\_
6. City \_\_\_\_\_ 7. State \_\_\_\_\_ 8. ZIP \_\_\_\_\_
9. EMAIL \_\_\_\_\_ 10. Home phone (\_\_\_\_\_) \_\_\_\_\_
11. Last four digits of Social Security No. \_\_\_\_\_
12. Year in school by autumn term: \_\_\_\_\_ 2nd \_\_\_\_\_ 4th \_\_\_\_\_ 5th
13. College or university in which you will be enrolled \_\_\_\_\_
14. Academic major \_\_\_\_\_ 15. Expected graduation date \_\_\_\_\_
16. Advisor's full name \_\_\_\_\_ 17. Office phone (\_\_\_\_\_) \_\_\_\_\_
18. If selected, are you willing to participate in annual follow-up surveys for three years after receipt of a scholarship? \_\_\_\_\_ YES \_\_\_\_\_ NO
19. May the Academy release your name and resume to potential employers? \_\_\_\_\_ YES \_\_\_\_\_ NO

**PLEASE ATTACH APPROPRIATE SUPPORTING INFORMATION TO RESPOND TO THE FOLLOWING:**

20. Academic record with an overall GPA of at least 3.0. Your current GPA \_\_\_\_\_ on a 4.0 system. Please attach a current (full) transcript and circle the GPA. Transcript must include all courses taken to-date. Enclose an "OFFICIAL" transcript with your original signed application and unofficial copies in the 6 identical sets. Alternatively attach only a sealed transcript if that is your school's policy.

21. Attach a maximum two page vita, biosketch, or resume that includes the following elements, in this order: contact information, education, employment and/or internships (basic information only), honors/awards, professional memberships, publications (full citation), presentations given and professional meetings attended, and community service.

**Continued on page 2**



22. Repeat First and Last Name \_\_\_\_\_

**Applicants from four-year colleges:**

Each of the following essays may not exceed one two-sided page, double spaced, 12 point font, 1" margins.

23. Attach an essay (not exceeding one two-sided page, double spaced, 12 point font, 1" margins) to describe your reasons for choosing a career in environmental science or environmental engineering and how this scholarship will help you.

24. Attach an essay detailing any original research, scholarship, employment and/or internships, or other unique contributions to environmental science or environmental engineering.

25. Attach an essay describing your extracurricular activities and participation in organizations that demonstrate your leadership and interpersonal skills and social responsibility.

**Applicants from two-year colleges:**

Please combine your response to requirements 23, 24 and 25 into a single essay that covers as many of the points as possible with the length not to exceed three two-sided pages, double spaced, 12 point font, 1" margins.

26. Attach two letters of recommendation from education or environmental professionals, addressed to Scholarship Review Committee. One must be from a faculty member at your institution. They may be sealed or unsealed copies.

27. \*Amount Requested \$ \_\_\_\_\_

**\*Maximum: \$1,250 for two year programs and \$2,500 for four or five year programs, non-renewable.**

28. Date needed \_\_\_\_\_

Scholarship checks will be sent to the college financial aid office. All applicants will be notified of the scholarship recipients.

***I certify that all information provided is true and accurate, I authorize independent verification, and I understand that if awarded a scholarship, information contained in this application may be released to the media.***

29. SIGNATURE \_\_\_\_\_ 30. DATE \_\_\_\_\_

Please enclose a self-addressed, stamped postcard to acknowledge receipt of your application.

**QUESTIONS?** Phone (614) 488-2228 • Email [oas@iwaynet.net](mailto:oas@iwaynet.net)

MAIL FIRST CLASS a complete, original signed copy with stapled attachments and 6 identical, two-sided, collated and stapled (please do not bind in a folder or cover) copies (7 total) **postmarked by June 1.**

**Environmental Science Scholarships  
The Ohio Academy of Science  
PO Box 12519  
Columbus OH 43212-0519**

THE OHIO ACADEMY OF SCIENCE

**Registration Form**

120<sup>th</sup> Annual Meeting

April 15-16, 2011

Otterbein University

**Advance registration must be received by April 8, 2011**

ALL MEETING ATTENDEES MUST REGISTER: Access to sessions by name tag only. Name tag, information packet and receipt will be available at the meeting. Please return the completed registration form along with the appropriate fees to the address below.

STUDENTS, SPOUSES, OR RELATIVES: A special discount schedule has been approved to promote and encourage participation of undergraduates, pre-college students, non-science spouses or relatives. All students, non-science spouses, parents or relatives must register using a separate form. This registration does not include membership or meals.

**Each person must use a SEPARATE REGISTRATION FORM**

**Please copy this form as needed.**

An Adobe PDF online fill-in form is available at  
<http://www.ohiosci.org/OtterbeinRegistrationForm.pdf>

**PLEASE PRINT OR TYPE**

Check: \_\_\_\_\_ Ms. \_\_\_\_\_ Mrs. \_\_\_\_\_ Mr. \_\_\_\_\_ Dr.

Name \_\_\_\_\_  
First Middle Last

Job Title \_\_\_\_\_

School, Organization, Agency, Institution, or Employer  
\_\_\_\_\_

Is the following a home address? \_\_\_\_\_ Yes \_\_\_\_\_ No

Students MUST use home, dorm or apartment address.

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_ Ohio County \_\_\_\_\_

Work Phone (\_\_\_\_\_) \_\_\_\_\_

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**MAIL FORM WITH PAYMENT TO:**

The Ohio Academy of Science  
PO Box 12519  
Columbus OH 43212-0519  
FAX 614/488-7629

**Registration Fees**

Please check appropriate categories. One fee covers the entire meeting. Payment must be received by April 8, 2011 to avoid higher rates. On-site registration will be accepted at the higher rate by credit card or check ONLY. ONLY first authors have pre-paid registration when they submitted their abstracts and DO NOT NEED to return this form. First authors are already registered for the meeting.

CURRENT MEMBER REGISTRATION RATE		<b>After Apr. 8</b>
_____ Professional	\$65	\$70
_____ Retired	\$40	\$45
_____ Student	\$25	\$30

**NON-MEMBER PROFESSIONAL AND RETIRED REGISTRATION**

Includes membership

_____ Professional	\$ 140	\$145
_____ Retired with Journal	\$ 80	\$85
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_____ College Student with Journal	\$ 65	\$70
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_____ College student	\$20	\$30
_____ 5-10 students each	\$15	\$20
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**NON-SCIENCE SPOUSE, PARENT OR A RELATIVE OF A FIRST AUTHOR**

_____ Spouse, parent or relative	\$10	\$20
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**SATURDAY, APRIL 16, SACK LUNCH**

_____ Sack Lunch during panel discussion	\$5	\$N.A.
--	-----	--------

Please use a separate form for each MEMBERSHIP RENEWAL

_____ Family	\$85
_____ Regular Member	\$75
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_____ Student (Age 17 & under) w/OJS	\$40
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TOTAL ENCLOSED \$ \_\_\_\_\_

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\_\_\_\_\_ This copy confirms a FAXed registration

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Signature \_\_\_\_\_

**REGISTRATION POLICIES**

120<sup>th</sup> Annual Meeting  
*The OHIO ACADEMY of SCIENCE*  
Hosted by Otterbein College, Westerville, Ohio

April 15-16, 2011

Advance registration must be received by April 8, 2011 to qualify for lower rates.

**ALL attendees must register.**

An Adobe PDF online fill-in form is available at <http://www.ohiosci.org/ONURegistrationForm.pdf>

ALL MEETING ATTENDEES: Access to sessions by name tag only. Name tag, information and receipt will be available at the meeting. Please return the completed registration form along with the appropriate fees to the address printed below.

ONLY first authors have pre-paid registration when they submitted their abstracts and DO NOT NEED to return this form. First authors are already registered for the meeting. However, you do need to order a lunch if you wish.

STUDENTS, SPOUSES, PARENTS OR RELATIVES: To promote and encourage participation of undergraduates, pre-college students, non-science spouses, parents or relatives, a special discount schedule has been approved. All students, non-science spouses or relatives must register using a separate form. This registration does not include membership or meals which must be paid separately.

\$10 by April 8; \$20 thereafter.

DISCOUNTED RATES FOR STUDENTS WHO ARE NOT FIRST AUTHOR: (Does not include membership.)

1-4 from same institution \$20 by April 8; \$30 thereafter.

5-10 from same institution \$15 by April 8 ; \$20 thereafter.

11 or more from same institution \$10 by April 8; \$20 thereafter

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