

123rd Annual Meeting • *The Ohio Academy of Science* • Walsh University • April 5, 2014

The OHIO JOURNAL of **SCIENCE**

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April Program

Abstracts



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FUTURE ACADEMY MEETINGS

2015 April 4th at the Capital University,
Columbus, OH

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Cover photo of the Paul and Carol David Campus Center, Walsh University
- Provided by Walsh University

The Ohio Academy of Science 123rd Annual Meeting

Hosted by
Walsh University
2020 East Maple St
North Canton, Ohio, 44720
April 5, 2014

Theme: *Encouraging Tomorrow's Innovators*

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!

Walsh University welcomes you to the 123rd 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 **March 28, 2014**. Please use the Registration Form on the last page or online at <http://www.ohiosci.org/am-registration>.

Mail completed form and fee to:
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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.

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Saturday, April 5: Registration in the center lobby of The Barrette Business and Community Center.

7:30 AM-2:00 PM. On-site registration at a higher rate by check, VISA, or MasterCard. We discourage cash.

PARKING ON CAMPUS: Watch for signs and see map in program. Please park in lots on the southside of The Barrette Business and Community Center.

SMOKING POLICY: Smoking is not permitted in any building.

HOUSING: See options: http://www.tripadvisor.com/Hotels-g50767-North_Canton_Ohio-Hotels.html

MEALS: Saturday, April 5 - Box lunches may be pre-ordered with registration for \$10.00 each and may be picked up prior to the All Academy Lecture at 11:00 am. The box lunches will be the only opportunity for food within The Barrette Business and Community Center.

GENERAL SCHEDULE

Saturday, April 5, 2014

7:30 AM-2:00 PM	Meeting Registration in center lobby of The Barrette Business and Community Center
9:00 AM-11 :00 AM	Morning Podium Sessions and College and Professional Poster Sessions in The Barrette Business and Community Center
11:00 AM	Box lunch pick up at Registration

11:15 AM

All-Academy Lecture

The Barrette Business and
Community Center - Ballroom

***Entrepreneurship in the Sciences***

JOSEPH A. BAUER IS A GRADUATE OF WALSH University, who went on to obtain his PhD in Chemistry from The University of Akron. Dr. Bauer completed post-doctoral training at the Lerner Research Institute and continued his research on translational hematology and oncology at the Taussig Cancer Center and The Cleveland Clinic. The focus of Dr. Bauer's research has been to identify drug targets and develop therapeutics as well as to improve targeted drug delivery in cancer patients.

More recently, Dr. Bauer has started both a private business to advance the treatment of human cancer (BNOAT Oncology, Inc.) and a research foundation (Bauer Research Foundation, Inc.) to improve the treatment of cancer in animals. Both of these organizations are located in Akron, OH. Currently, Dr. Bauer holds more than 90 scientific patents worldwide.

12 :45-3:00 PM Afternoon Poster Session in
Ballroom of The Barrette Business
and Community Center

1:30 - 3:00 PM Career Symposium in the Betzler
Conference Room

3:00 - 4:30 PM Board of Trustee Meeting
The Barrette Business and
Community Center

Our Institutional Host

For nearly 3000 students from 15 states and 24 countries, the search for the right college has led them to Walsh University. Here, on the 136-acre main campus and satellite campuses in Akron, Medina, Canfield, and just outside of Rome, Italy, they have found that learning transcends the classroom, caring faculty help students aim higher, and leadership requires more than intellect. As an independent, Catholic university, we encourage individuals to act in accordance with reason guided by the example and teachings of Jesus Christ. Our aim is to develop students' mind, body and spirit - this is Walsh's distinguished tradition and the heart of its appeal.

Word about Walsh's unique character and feel, together with its 60 undergraduate major programs, award-winning athletics and vibrant student life, is spreading fast. This year, the university is celebrating nine consecutive years of record-setting enrollment.

With outstanding academic facilities, chapel and residence halls, a new health and wellness complex, and unique programs in areas such as bioinformatics and museum studies, students have a wide variety of options to make their mark at Walsh University.

As a Catholic University welcoming students of all faiths, Walsh continues to pursue its enduring mission: the creation of leaders through service to others. Volunteer work is not simply encouraged; it is required as part of the university's core curriculum. Walsh students build homes for Katrina victims in New Orleans, tutor and mentor school children, prepare taxes for low-income families, distribute meals, work to prevent recidivism among nonviolent offenders and perform missionary work around the world.

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Faculty Host and Local Arrangements Chair

DR. MICHAEL DUNPHY

Chair, Division of Math & Sciences; Professor of
Chemistry
Walsh University

The Ohio Journal of Science has become a hybrid, Open Access publication.



BY UNANIMOUS VOTE on December 17, 2012, the Executive Committee approved moving *The Ohio Journal of Science* to a hybrid model: Rapid publication, Open Access online articles plus an annual, single printed volume and an April Annual Meeting Program Abstracts issue in print and online.

According to Suber (2004; see end of this plan):

“Open-access (OA) literature is digital, online, free of charge, and free of most copyright and licensing restrictions. What makes it possible are the internet and the consent of the author or copyright-holder.

In most fields, scholarly journals do not pay authors, who can therefore consent to OA without losing revenue. In this respect, scholars and scientists are very differently situated from most musicians and moviemakers, and controversies about OA to music and movies do not carry over to research literature.

OA is entirely compatible with peer review, and all the major OA initiatives for scientific and scholarly literature insist on its importance. Just as authors of journal articles donate their labor, so do most journal editors and referees participating in peer review.”

In brief, this plan recommends the following to begin immediately for *The Ohio Journal of Science*:

- Continue the Journal as a peer-reviewed, refereed article, multidisciplinary international publication. The goal is to publish—as rapidly as possible—original contributions to education, science, engineering, technology, or their applications.
- The Journal will consider solicited Book Reviews and Research Reviews, and unsolicited Brief Notes and Research Reports.
- Publish articles in Adobe PDF format online as soon as they are approved in page form.
- Publish a single, annual printed volume that would accumulate articles previously published online in the past 11 months.
- Publish a printed Annual Meeting Program Abstracts issue and post immediately on-line as has been the practice.
- Accept full color illustrations in the Open Access online version of the Journal but convert to B&W for the print version unless authors pay for full color costs in the print version.

- Increase the page charges from the current rate of \$85/page (\$120 for non-members) to \$100/page (\$200 for non-members). Grandfather in with the old fee any manuscripts currently in review. We have not increased rates in many years; the new rates are substantially below most Open Access journals. See http://www.lib.berkeley.edu/scholarlycommunication/pdfs/oa_fees.pdf.
- Retain the on-line layout/format essentially the same, with some adjustments in type size and style for improved, on-line viewing.
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- The new Journal would be full Open Access without password permission.

Links to online directories of Open Access journals:

- Directory of Open Access Journals (DOAJ): Lists more than 3000 journals available as open access. Accessed 14 January 2013 <http://www.doaj.org/>
- Directory of Open Access and Hybrid Journals: Each title listed in the directory indicates whether the publisher allows authors to pay a publication fee to make an article immediately available. Accessed 14 January 2013 <http://www.doaj.org/doaj?func=subject&cpid=20&hybrid=1>
- SHERPA/RoMEO: This directory lists publisher copyright and self-archiving policies. Listings also indicate whether the publisher has a "paid access" option with direct links to the specific publisher policies on paid access. Accessed 14 January 2013 <http://www.sherpa.ac.uk/romeo/>

Reference

Suber P. 2004. A Very Brief Introduction to Open Access. Accessed 18 January 2013 <http://www.earlham.edu/~peters/fos/brief.htm>

Brief Schedule of Abstracts

See **First Author index** on page 46-47
and **Fields of Interest index** on page 47

All events are held in The Barrette Business and
Community Center

Podium Sessions 9:00 - 11:00 AM

Aquatic Biology & Ecology and Water Quality

Room 125

See page 6

Biology & Microbiology

Room 126

See page 7

Environmental Science

Room 135

See page 9

Taking Science to Market: Entrepreneurship in Today's Economy

Room 136

See page 10

Poster Sessions

Located in the Ballroom

Morning - College and Professional

9:00 – 11:00 AM

See page 11

Afternoon - Pre-college

12:45 – 3:00 PM

See page 27

Career Symposium

Located in the Betzler Conference Room

Sponsored by BioOhio

1:30 – 3:00 PM

Professionals with a diverse scientific background
will discuss their careers and opportunities for current
students in science.

See page 11

Notes

9:00 – 11:00 AM
Podium Session - Session 03 –
Aquatic Biology & Ecology and Water
Quality
The Barrette Business and Community
Center – Room 125

09:00 FRESHWATER DINOFLAGELLATE BLOOMS. Susan Carty (scarty@heidelberg.edu), Department of Biological and Environmental Sciences, Heidelberg University, 310 E Market Street, Tiffin, OH 44883.

Dinoflagellates are unicellular aquatic protists capable of forming almost unialgal populations called blooms. Some marine and estuarine dinoflagellate species produce “red tides”, but freshwater species, while sometimes producing unpleasant odors and taste, are generally non-toxic. Objectives for this report include: (1) reviewing the literature regarding the genus *Ceratium hirundinella*, the most commonly reported blooming species; (2) reviewing other bloom forming dinoflagellate species reported in the literature; and (3) reporting on two species not previously reported as blooming. Directly contacting individuals dealing with blooms and seeking identification of the bloom-forming dinoflagellate species supplemented literature derived information. *Ceratium hirundinella* has long caused blooms in temperate lakes and reservoirs in Europe, North America and Asia. Recently species of *Ceratium* are invading neotropical reservoirs and forming blooms. Dinoflagellate species in the genera *Peridiniopsis*, *Parvodinium*, *Gymnodinium*, and *Woloszynskia* have been reported causing blooms and discoloring the water. *Thompsodinium intermedium*, a rarely reported species, has been found in bloom condition in Texas, Wisconsin, Ohio and Belize at concentrations up to 4.7×10^4 cells/mL. *Kansodinium ambiguum*, a species only reported once each from Kansas and Texas, was found blooming in Florida. Dinoflagellate species need to be carefully identified when found in blooming condition.

09:15 CHARACTERIZATION OF THE ALGAL AND MACROINVERTEBRATE COMMUNITIES OF TWO VERNAL POOLS AT TIDD-OAKES FARM, HARDIN COUNTY, OHIO. Kelsey T. R. Weidner (k-weidner@onu.edu), Nicole L. Berry (n-berry@onu.edu), Jamie L. Bonino (j-bonino@onu.edu), Schelby K. Rosebrook (s-rosebrook@onu.edu), Leslie A. Riley (l-riley.1@onu.edu) (advisor), Robert G. Verb (r-verb@onu.edu) (advisor), Department of Biological and Allied Health Sciences, Ada, OH 45810.

Although much attention has been given to the critical importance of vernal pools to amphibian reproduction and conservation, less work has examined the significance of lower trophic level organisms such as macroinvertebrates and algae to the functioning of these systems. In May of 2013, two large vernal pools were visited at the Ohio Northern University Tidd-Oakes Farm, a nature reserve in Hardin County, Ohio, USA, to determine their algal and macroinvertebrate community composition and their corresponding physicochemical conditions. At each vernal pool, basic environmental parameters were recorded (e.g., pH, specific conductance, temperature) and pool morphometric characteristics were measured (e.g., depth, perimeter). In addition, periphyton residing on leaf litter and loose sediments was sampled using cores and benthic macroinvertebrates were sampled using kicknets. In the lab, algae were identified to genus and invertebrates to family. Preliminary analysis indicates that water chemistry between these sites was circumneutral (pH 6.4-7.2) and of low specific conductance (40-91 $\mu\text{S}/\text{cm}$). Pool physical characteristics, such as depth and perimeter differed between the two wetlands. Additional

characterization will include the calculation of community indices (e.g. diversity indices) and several multivariate statistical techniques to elucidate factors that influence community structure.

09:30 VARIATION OF ALGAL AND MACROINVERTEBRATE COMMUNITY STRUCTURE IN RESTORED WETLANDS WITH VARYING WATER INPUTS. Lucas C. Erickson (l-erickson@onu.edu), Lance Alley (l-alley@onu.edu), Jessie Elsass (j-elsass@onu.edu), Kilian Tyson Mayer (k-tysonmayer@onu.edu), Leslie A. Riley (l-riley.1@onu.edu) (advisor), Robert G. Verb (r-verb@onu.edu) (advisor), Department of Biological and Allied Health Sciences, Ada, OH 45810.

Water chemistry greatly influences aquatic organism distributions. In west-central Ohio, the influence of carbonate bedrock systems leads to an influx of minerals such as calcium and magnesium (i.e., hard water) which can influence community composition and alter water chemistry character. As a result of the variation along this water quality gradient (e.g., soft to hard water) the organismal components may vary. The primary objective of this study was to compare macroinvertebrate and algal community structure of restored wetlands along a gradient of predominately precipitation-fed (soft water) to spring-fed (hard water) wetlands. The study was conducted at Putnam Wetlands, a 60-acre wetland restoration project located in Hardin County, Ohio. Putnam Wetlands is composed of several small marshes and is situated along an elevational gradient of land (7-m/0.5-km). Along this elevational gradient, water sources to the restored wetlands change. Upland wetlands are filled by precipitation, while the lower wetland areas rely predominantly on groundwater springs. Three representative wetlands were sampled from Putnam Wetlands in August of 2013: a lower, groundwater-fed marsh; an intermediate marsh; and a higher, precipitation-fed marsh. At each wetland three sites were sampled for basic water chemistry, epipellic and epiphytic algae, macroalgae, and macroinvertebrates. Samples were returned to the lab where algal specimens were identified to genus and macroinvertebrates were identified to the family level. Basic metrics of community structure will be calculated (e.g., taxa richness) and additional univariate and multivariate analyses will be used to integrate the abiotic and biotic datasets and to elucidate possible differences between these wetland systems.

09:45 STREAM COMPARISONS BETWEEN GLACIATED AND UNGLACIATED REGIONS OF OHIO. Shannon Boys (s-boys@onu.edu), Kyle Timbrook (k-timbrook@onu.edu), Tyler Thomas (t-thomas@onu.edu), Samuel Schroeder (s-schroeder@onu.edu), Leslie A. Riley (l-riley.1@onu.edu) (advisor), Robert G. Verb (r-verb@onu.edu) (advisor), Terry Keiser (t-keiser@onu.edu) (advisor), Department of Biological and Allied Health Sciences, Ohio Northern University, Ada, OH 45810.

Geology, physiographic history, and land use are among the most important factors influencing aquatic community structure and distribution in surface waters, especially lotic systems. In Ohio, there are well defined regions of the state that have been directly impacted by glaciers (e.g., Till Plains) and areas without any direct glaciation (e.g., the Unglaciaded Allegheny Plateau). The objective of this investigation was to ascertain differences in aquatic community structure, in streams systems with different physiographic histories. Three streams habitats from the Till Plains and Unglaciaded Allegheny Plateau were selected. At each sample site sampled for basic stream physical and chemical parameters were recorded with water samples being transported to the laboratory for further analysis. In addition, epipellic and epilithic algae, macroalgae, macroinvertebrates, and fish (via electroshocking) were collected. Organisms not identified in the field were transported back to the lab for further taxonomic resolution. Algae were identified to genus, invertebrates to family, and fish to species when possible. Basic calculations of community structure will be calculated

(e.g., diversity indices), and additional univariate and multivariate analyses will be used to integrate the abiotic and biotic datasets and to elucidate possible differences between these streams and the influence of their respective geologic histories.

10:00 HARMFUL ALGAL BLOOM MONITORING IN OHIO BY CITIZENS TO ENHANCE STATE AND LOCAL MANAGEMENT EFFORTS, PROTECT HUMAN HEALTH AND STRENGTHEN STEWARDSHIP. Dana M. Oleskiewicz (oleskiewicz@windstream.net), Ohio Lake Management Society, 8440 E. Washington St. #206, Chagrin Falls OH 44023, 330-466-5631; Robert D. Davic (r_davic@yahoo.com), Ohio State University; John R. Beaver (j.beaver@bsaenv.com), BSA Environmental Services, Inc; and Erin Manis (e.manis@bsaenv.com), BSA Environmental Services, Inc.

Harmful Algal Blooms (HABs) have recently emerged as a health risk in the United States. The Citizen Lake Awareness and Monitoring (CLAM) program, sponsored by the Ohio Lake Management Society (OLMS), developed and field tested monitoring protocols for citizens to gather HAB information. Lakes were selected based on interested CLAM participants. For three seasons, volunteers collected water samples from beach shorelines using modified Ohio Environmental Protection Agency (EPA) procedures twice a month, July – September. A metal bucket on a string, thrown 2 meters out from land, captured water 10 cm below surface at three locations along a 5 – 10 meter transect and water was collected in a glass jar. Composite samples were cooled and sent by mail for analysis within 48 hours to BSA Environmental Services, Inc., Beachwood, Ohio where the concentrations of microcystin and cylindrospermopsin and the abundance of cyanobacteria genera were determined. Monitors also measured seasonal Secchi transparency, nutrients, and chlorophyll *a* at designated open water sites. These results are stored in an interactive online database; www.eyesonthewater.org/olms. Toxin data were shared weekly with project collaborators to protect lake communities. Side-by-side testing with project staff was performed to ensure quality assurance. Of the 19 lakes monitored, only Grand Lake St. Marys and Buckeye Lake exhibited consistently high microcystin values, above the 20 ppb threshold for a ‘no contact’ warning promoted by Ohio EPA. Monitoring by local residents on a volunteer basis provides for a cost-effective means to survey for HABs. Strong multi-agency partnerships have emerged from program efforts, while citizen participation has cultivated local stewardship yielding more effective lake management.

10:15 COMPARISON OF CHLOROPHYLL *a* ANALYSIS METHODS IN LAKE ERIE. Rebecca K. McGrail (rebecca.mcgrail@email.stvincent.edu), Box 616 Saint Vincent College 300 Fraser Purchase Rd. Latrobe PA 15650. Justin D. Chaffin (chaffin.46@osu.edu). Franz Theodore Stone Laboratory, The Ohio State University, P.O. Box 119, 878 Bayview Rd. Put-in-Bay OH 43456.

Several organizations in Michigan and Ohio monitor chlorophyll *a* concentration (chl_a), a surrogate of phytoplankton biomass, in Lake Erie to quantify algal blooms. However, these organizations employ four different collection methods: integrated sample from 0–2 m, integrated sample from 0–8 m, integrated sample to twice the Secchi depth (2xSD), and the Ohio Environmental Protection Agency (OEPA) method of pooling samples from three depths. Differences in collection may be problematic when data is shared among agencies. This study compared the sampling methods to determine correction factors among data sets. A total of 358 samples were collected at 24 sites in Lake Erie during summer 2013. Plankton from water samples were collected on GF/F filters and frozen until extraction. Chlorophyll *a* from the filters was extracted with dimethyl sulfoxide and quantified by absorbance. Relationships among the collection methods were investigated by normalizing chl_a for each site and date to the 0–8 m sample chl_a concentration, which ranged

from 3.9 to 127.8 mg/m³. Normalized values ranged from 0.191 to 6.136 for the 0–2 m method, 0.183 to 1.677 for the 2xSD method, and 0.513 to 1.367 for the OEPA method. Comparison of the 0–8 m sample chl_a concentration and normalized values of other methods showed high variance at chl_a less than 25 mg/m³, but variance decreased at higher concentrations. In conclusion, conversion factors among collection methods are not possible at this time because differences among methods were too large, especially at low chl_a concentrations.

10:30 NUTRIENT DYNAMICS IN LAKE ERIE DURING HARMFUL ALGAL BLOOM INITIATION. Kayla M. Miller^{1,2} (kaylamm@bgsu.edu), Douglas D. Kane^{1,3}, Justin D. Chaffin¹, Franz Theodore¹, ¹Stone Laboratory Ohio State University, Columbus OH 43212-1156, ²Bowling Green State University, and ³Defiance College.

Soluble reactive phosphorus (SRP) is one of the primary nutrients that limits algal growth. In order to determine if SRP was regenerated from lake sediments as they went anoxic, the researchers collected data from sites located in the western, Sandusky, and central basins of Lake Erie during the beginning of stratification initiation (late June) and hypoxic/anoxic period (late September) in 2013. Concentrations of SRP were below detection levels at the beginning of stratification using the ascorbic acid technique. In late September, mean total phosphorus (TP) concentrations averaged 12.756 µg/L at water surface and 11.958 µg/L one meter above bottom. For the two latest dates of sampling, TP values increased at surface but not at bottom samples at the same sites. This observation likely occurred due to the presence of the cyanobacterial bloom at the time. During the time of stratification initiation, mean nitrate concentrations decreased from 497 µg/L to 396 µg/L at water surface and from 396 µg/L to 380 µg/L one meter from the bottom within a month. Using data collected from 2010-2013, there are observed linear trends with decreasing hypolimnion thickness (June: $p = 0.04$, $r^2 = 0.22$; July: $p = 0.02$, $r^2 = 0.35$) and increasing hypolimnion depth (June: $p = 0.06$, $r^2 = 0.18$; July: $p = 0.07$, $r^2 = 0.22$), with low-ice years (2011 and 2012) having deeper and thinner hypolimnia. These trends are likely due to the decrease of winter ice cover as a result of increased regional winter air temperatures and may also affect algal and nutrient dynamics in the lake.

9:00 – 11:00 AM

**Podium Session - Session 04 -
Biology & Microbiology
The Barrette Business and Community
Center – Room 126**

09:00 WRESTLING WITH TOPICAL SKIN INFECTIONS. Emily Markey (e-markey@onu.edu), Linda M Young (l-young@onu.edu), Vicki A. Motz (v-motz@onu.edu), Department of Biological Sciences Ohio Northern University 402 West College Ave, Unit 2369 Ada, OH. 45810.

Following a request from the National Wrestling Coaches Association to develop best practice guidelines for minimizing skin infections among collegiate wrestlers, a two-part IRB approved microbial monitoring project of the Ohio Northern University wrestling program was initiated. Thirty percent of the general population are carriers of *Staphylococcus aureus* with a smaller proportion as carriers of Methicillin-resistant *Staphylococcus aureus* (MRSA). Monthly nasal swabs were performed on the ONU wrestlers, trainer and coach. In a BSL-2, specimens were inoculated on MSA and incubated at 37°C in 5% CO₂ for 24 hours. *Staphylococcus aureus* was confirmed

by positive coagulase testing (Bacti-staph agglutination assay) on yellow MSA colonies. MRSA screening of these samples was performed using a McFarland standard suspension and applying a 10 µl aliquot to Mueller-Hinton agar with 4% oxacillin. Growth after 24 hours incubation was a presumptive positive result and verified with Vitek analysis by the New Vision Medical Laboratory. Participants testing positive were referred to an infectious disease specialist to eliminate colonization and reduce MRSA spread to teammates. To date, four presumptive positive wrestlers have been identified with a hypothesized increase throughout the wrestling season as ONU grapplers encounter contaminated competitors. Environmental samples were also collected from mats, scales, and locker rooms, grown on blood agar, EMB, and MSA to quantify microbial load and identify common contaminants representing potential skin pathogens. At the ONU Wrestling Invitational Tournament hourly sampling will be conducted on eight mats treated with different antimicrobial products. Findings will be used to generate best practice guidelines for facility disinfection to minimize microbial load and consequently, the incidence of skin infections in wrestlers.

09:15 CHARACTERIZATION OF MULLEIN FLOWER EXTRACTS AND ANTIMICROBIAL EFFECTS AGAINST BACTERIA ASSOCIATED WITH EAR INFECTIONS. Adriana Jones (a-jones.3@onu.edu), Kalie Gargano (k-gargano@onu.edu), Vicki Motz (v-motz@onu.edu), Christopher P Bowers (c-bowers@onu.edu), Linda M Young (l-young@onu.edu), David H Kinder (d-kinder@onu.edu), Ohio Northern University, 402 W college Ave Unit 1814, Ada OH 45810.

The flowers of Common Mullein (*Verbascum thapsus* L.) were used by the Cherokee as an oil infusion to treat children's earaches; they are used similarly by herbalists today. Validating scientific studies have not been conducted. This study investigated the efficacy of mullein flower extracts in inhibiting growth of *Streptococcus pneumoniae*, the most common causative agent of ear aches and compared this activity to antimicrobial activity against bacteria not specifically associated with earaches. Flowers from four sites were extracted in 95% ethanol for one week, filtered, dried and reconstituted to one gram of extract/gram of flower. Kirby Bauer testing, performed in triplicate, indicated that flower extracts were minimally inhibitory against *Staphylococcus epidermidis* (zone of inhibition (ZI) = 6.2 + .21), and methicillin resistant *Staphylococcus aureus* (MRSA) (ZI = 8.67 + 1.03), but ineffective against *Pseudomonas aeruginosa* and *Escherichia coli*. However, significant ($p < 0.05$ by ANOVA, with post hoc Students' t-test) inhibition of *Streptococcus pneumoniae* was observed in some but not all extracts (ZI = 12.83 + 7.10). Extracts were analyzed by GC/MS to explain the discrepant results and determine which constituent(s) could account for antimicrobial activity. The presence of a clindamycin-like constituent was noted in some samples and correlated well with Kirby Bauer analysis; this is the presumptive antimicrobial agent. Sucrose, and glycopyranosides were also present, as well as hexadecanoic, heptadecanoic, and octadecatrienoic acids. Our findings support the ethnobotanical use of mullein to treat earaches as it is effective against the common earache causing pathogen but not against those associated with other disorders.

09:30 THE NOVEL DROSOPHILA MELANOGASTER GENE, HUNCHBACK OF NOTRE DAME COLLEGE (HNDC/CG1436), PARTICIPATES IN EMBRYO PRODUCTION AND IS HIGHLY ASSOCIATED WITH STEM CELL DIFFERENTIATION REGULATORS BAM, PUM, AND AGO3. Marcia F. Leon (mleon11@students.ndc.edu), Brittany N. Stawicki (bstawicki11@students.ndc.edu), Lauren R. Sandrock (lsandrock12@students.ndc.edu), Matthew L. Johnson (mjohnson@ndc.edu), Notre Dame College, 4545 College Road, South Euclid, OH 44121.

Stem cells undergo symmetrical division producing

daughter cells with diametrically opposed fates. One cell self-renews into the future stem cell; the other differentiates into a new cell type. In the *Drosophila melanogaster* female germline, the fate of the daughter cell involves regulation by proteins *bag-of-marbles* (*bam*), *pumilio* (*pum*), and the non-coding RNA piRNA; however, the expression mechanisms are not fully understood. This study focuses on a recently isolated knockout mutant of Hunchback of Notre Dame College (HNDC/CG15436), which encodes a C2H2 zinc finger protein. Heterozygotes and homozygotes of HNDC null mutant produced only 66.7% (n=158) and 28.7% (n=68) of anticipated embryos, respectively, when compared to wild type. Furthermore, switching the temperature from 20°C to 30°C resulted in termination of embryo production within 48 hours in both heterozygotes and homozygotes. It was also found that fly ovaries in the homozygote HNDC knockouts were depleted of embryos that should be continuously generated. Recent analysis of ChIP-chip data shows that *hndc* is highly associated with the genes BAM, PUM and ARGONAUTE 3 (AGO3), a regulator of piRNAs. When compared to control levels, *hndc* had an increase association of 3.25 fold with BAM, 3.58 fold with PUM and a 3.42 as well as 3.82 fold increases at two different regions of the AGO3 gene. These data leads us to suggest that *hndc* plays an important role in regulation of the BAM, PUM, and AGO3 genes; thus, removal of HNDC from the genome results in disrupting the proper commitment of daughter cells following stem cell asymmetrical division.

09:45 TO ITCH OR NOT TO ITCH: ASSESSING EFFICACY OF SAPONINS IN JEWELWEED IN PREVENTING URUSHIOL INDUCED CONTACT DERMATITIS. Elizabeth Lendrum (e-lendrum@onu.edu), Alexander Kneubehl (a-kneubehl@onu.edu), Vicki A Motz (v-motz@onu.edu), Christopher P Bowers (c-bowers@onu.edu), Linda M Young (l-young@onu.edu), David H Kinder (d-kinder@onu.edu), Ohio Northern University, 402 West College Ave. Unit 2278, Ada OH 45810.

It has been shown that jewelweed, *Impatiens capensis* is effective in preventing or reducing rash development following contact with poison ivy (PI), *Toxicodendron radicans*. However, the active agent has not been identified. Soaps were also effective at preventing poison ivy rash. Saponins are a natural soapy constituent of many plants. To determine whether the saponins in jewelweed could prevent PI dermatitis, in this IRB approved study, PI was brushed onto forearms of 23 volunteers in 6 locations. PI exposed areas were treated as follows: untreated, treated with jewelweed mash, treated with saponin containing extracts of jewelweed at 1x and 2x the naturally occurring concentration, or treated with a commercially produced soap made with or without added jewelweed extracts. Rash development was tracked for 18 days and scored on a scale of 0-14. Thirty seven percent of participants developed a severe rash (>10 on a scale of 1-14), 47% developed a mild rash and 16% did not develop any rash. Compared to the untreated control, mash treated areas had an 18% reduction in rash severity, 1x extract: 26% reduction, 2x extract: 35% reduction and both soaps averaged a 52% rash reduction. The soaps and the 2x extract were all significantly reduced ($p < 0.05$ by Students' paired 1 tailed t-tests) and were not significantly different from each other. Saponin extracts of jewelweed were effective in reducing the severity of rash development indicating that the saponin component may be the active agent in preventing PI induced contact dermatitis.

10:00 RECOVERY AND HEALTH ASSESSMENT OF LITTLE BEAVER CREEK, OHIO FORTY YEARS FOLLOWING CLOSURE OF THE NEASE CHEMICAL COMPANY. Cameron C. Rudibaugh (rudibacc@mountunion.edu), 40209 Churchill Road Lisbon, OH 44432.

Little Beaver Creek (LBC) has a long history that's rooted in various anthropogenic activities. In 1961, the Nease Chemical Company opened in Salem, OH and began using the stream as a way to cost effectively remove waste

byproducts generated from the chemical commodities they produced. The key chemical component used to produce fire retardants and pesticides was mirex, a chlorinated hydrocarbon and a persistent bio-accumulative toxic chemical (PBT). The facility ceased operations in 1975 due to environmental damage concerns. Elevated concentrations of mirex were found throughout LBC in studies conducted from 1985-1986. Cleanup efforts began in the late 1980s and have continued into the present, culminating in the establishment of the Nease Chemical Superfund in 2011 and the drafting of a Watershed Management plan in 2012. As an important recreational site, it is crucial to gauge the success of cleanup efforts by studying the presence of aquatic biota, stream morphology, sediment chemistry, and chemical load in fish tissue. Three sites along the LBC are the primary focus of this study. At each site, stream habitat will be assessed using the Qualitative Habitat Evaluation Index. Macroinvertebrates collected via kick-net will be identified and counted to calculate Cumulative index value. Sediment sampled at each location will be processed and tested for remaining traces of mirex and photomirex via gas chromatography-mass spectrometry (GC-MS). It is predicted that trace levels of mirex still exists in the environment but the stream has mostly recovered.

10:15 ABDOMINAL MALFORMATIONS IN THE DROSOPHILA MELANOGASTER GENE HUNCHBACK OF NOTRE DAME COLLEGE (HNDC/CG15436) MAY BE LINKED TO THE NICOTINIC RECEPTORS ALPHA 6 AND ALPHA 7. Brittany N. Stawicki (bstawicki11@students.ndc.edu), Marcia F. Leon (mleon11@students.ndc.edu), Lauren R. Sandrock (lsandrock12@studnets.ndc.edu), Matthew L. Johnson (mjohnson@ndc.edu), Notre Dame College, 4545 College Road, South Euclid, OH 44121.

In the post-genomic era, understanding gene expression regulation is essential in interpreting the functional applications of sequence data. The largest protein family involved in transcriptional regulation is comprised of proteins with the C2H2 zinc finger motif. To better understand the role of C2H2 zinc fingers, a reverse genetic approach with *Drosophila melanogaster* was used to remove an uncharacterized C2H2 zinc finger protein, CG15436. Generation of CG15436 knockout mutants demonstrated a partially penetrant abnormal abdominal phenotype and was therefore named Hunchback of Notre Dame College (HNDC). Heterozygote and homozygote knockouts of HNDC have shown the phenotype, 15.5% and 30.2% respectively. The malformation of the abdomen is reportedly similar to deformities observed in *D. melanogaster* exposed to nicotine during development. Furthermore, genome wide ChIP-chip data was recently collected for *hndc*. Analysis of the data led to the conclusion that particular genes, that are known to be responsive to nicotine, are among the highest 1.5% of genome association with *hndc*. Chromatin for nicotinic acetylcholine receptors, alpha6 (Da6) and alpha7 (Da7) were respectively detected at a 3.01 and 3.05 fold level in association with *hndc*. Furthermore, Da6 and Da7 expression levels peak at the time of adult abdomen formation. Therefore, primary focus is on the transcript expression levels of Da6 and Da7 in HNDC homozygote knockouts. This study demonstrates that HNDC has a role in the regulation of Da6 and Da7, which are likely candidate genes for influencing the HNDC knockout induced malformations in the abdomen.

9:00 – 11:00 AM

**Session 05 - Environmental Science
The Barrette Business and Community
Center – Room 135**

09:00 THE DEVELOPMENT OF CALCITE ON THE SURFACE OF MARCELLUS SHALE SAMPLES EXPOSED TO GASEOUS

CARBON DIOXIDE, METHANE, AND WATER VAPOR AT HIGH TEMPERATURES AND PRESSURES. Kenneth A. LaSota (lasota@rmu.edu), Robert Morris University, Department of Natural Sciences, 6001 University Boulevard, Moon Township, PA 15108-1189 and Matthew F. Dieterich (mfdst6@mail.rmu.edu), University of Pittsburgh, Department of Geology and Planetary Sciences, 4170 O'Hara Street, Pittsburgh, PA 15260-3332.

As part of a larger study undertaken by the Department of Energy's National Energy Technology Laboratory (NETL) in Bruceton, PA, outcrop samples of the Marcellus Shale from near Petersburg, WV, and Canoga and Marcellus, NY and subsurface samples from near Houston, PA from depths of approximately 7,850 feet were treated with gaseous carbon dioxide, methane and water at 50°C and 100 atmospheres of confining pressure. Adsorption of the gases onto, and geochemical interaction of the gases with, the surface of the samples were analyzed with attenuated total reflectance - Fourier transform infrared spectroscopy (ATF-FTIR). Results showed no detectable adsorption of methane or water onto the samples' surfaces. Adsorption of carbon dioxide was noted on all samples, leading to the development of calcite on the surfaces of several of the samples. The study here has implications on the use of carbon dioxide as a carrier gas for hydraulic fracturing and secondary recovery protocols within the Marcellus Shale, as well as the use of the Marcellus Shale as a potential horizon for carbon dioxide sequestration.

09:15 TWO NEW GENERA OF FUNGI IN THE PLANT PATHOGENIC FAMILY GNOMONIACEAE (ASCOMYCOTA) FROM JAPAN. Brandy R. Lawrence (lawrenceb@findlay.edu), Donald M. Walker (walkerd@findlay.edu), The University of Findlay, Dept of Natural Sciences, Findlay OH 45840.

Species in the plant pathogenic fungal family Gnomoniaceae (Diaporthales) have been documented in deciduous forests from a worldwide distribution. Species in this family have endophytic, plant pathogenic, and saprobic life styles and are considered integral members in temperate ecosystems. Species of the Gnomoniaceae have been documented primarily from North America and Europe. Recent collection trips to biodiversity "hotspots" like Asia have resulted in the description of 23 new species in three genera of the Gnomoniaceae. Collection trips to Japan during the spring/summer of 2010 and 2013 (respectively) resulted in the collection of two new monotypic genera in the Gnomoniaceae. These species were isolated into pure culture, DNA extracted, amplified with PCR, and DNA sequenced. The genera are defined by phylogenetic analyses of DNA sequence data from three molecular markers including LSU, *rpb2*, and *tef-1a* using genealogical congruence phylogenetic species recognition. The micro- and macroscopic morphology of these fungi was also documented for the purpose of formal taxonomic description. The plant associations of these fungi represent two new host records on *Platycarya strobilacea* in the Juglandaceae and *Styrax obassia* in the Styracaceae. This increases the total number of species from Asia to 25 and genera in the Gnomoniaceae to 13.

09:30 SURVEY OF TREE SPECIES AND PREPARATION OF A FIELD GUIDE FOR THE CAPITAL UNIVERSITY PRIMER OUTDOOR LEARNING CENTER. Ian W. Cheesman (ian_cheesman@yahoo.com), Rebekah J. Will, Dr. Kerry L. Cheesman, Biological and Environmental Sciences Department, Capital University, 1 College and Main, Columbus, OH 43209.

In 2005 Capital University received a 75-acre parcel in southeastern Ohio (the Primer Outdoor Learning Center) that includes deciduous and coniferous forest stands, riparian zones, open prairie areas, and a large wetland. As plans developed for using the land as a living laboratory and environmental outreach site, the need for a tree guide that is accessible to both students and community members became apparent. National field guides are cumbersome,

expensive, and limited to single groups (eg: trees or wildflowers) so multiple books are required to identify the species within a single tract of land. Since most students come to the university without even moderate knowledge of plant identification, it was determined that a site-specific guide to the trees would be useful to students as well as to teachers and community members that use the land for self-study and recreation. An initial species inventory was conducted across the entire 75-acre property and has been periodically updated. A total of 37 tree species (22 families) have been identified on the property, of which 26 occur along the public access trails. Photographs of all species were acquired from the NRCS website for use in the field guide. Student researchers studied each species and wrote descriptions that would be useful in the field; in doing so much was learned about each species and its role in the ecosystem. To construct a useful educational resource, best practices and accurate scientific language appropriate to all audiences (students, science teachers, and the general public) are being employed.

09:45 MYCOREMEDIATION OF AGRICULTURAL FERTILIZERS USING THE EDIBLE GOURMET OYSTER MUSHROOM *PLEUROTUS OSTREATUS*. Emily M. Herr (here@findlay.edu), Anna Bitting (bittinga@findlay.edu), Katrina Hohenberger (hohenbergerk@findlay.edu), Catherine E. Dickey (dickey@findlay.edu), Donald M. Walker (walkerd@findlay.edu), The University of Findlay, Dept of Natural Sciences, Findlay OH 45840.

The use of gourmet edible mushrooms or the natural mycoflora of an ecosystem to remediate a waste site is termed mycoremediation. This is an effective and novel method utilizing fungi to clean up a waste-water source. Agricultural fertilizers in the form of nitrates and phosphates are commonly used to improve crop and ornamental plant growth. Fertilizers accumulate in surface water runoff and enter into adjacent aquatic ecosystems. Excess nutrients can cause harmful algal blooms which are unsightly and possibly toxic. The agricultural fields adjacent to a pond at The University of Findlay's Rieck Center offer a unique opportunity to test the effectiveness of a mycofiltration unit at remediating ammonia nitrogen and phosphate from nearby agricultural fields. To create the mycofilter, eleven burlap sacks full of autoclaved wood chips were inoculated with the oyster mushroom (*Pleurotus ostreatus*) and allowed to grow for four months at room temperature in the lab. During fall 2013 the mycofilter was installed bordering the inlet drain to a pond at the Rieck Center. Ammonia nitrogen and phosphate levels were measured (mg/L) in the pond weekly for one month (n=4) using the Hach surface water test kit. Ammonia nitrogen levels (0.20–0.40 mg/L) in the pond showed no significant reduction (T-test; p=0.29). Phosphate levels (0.14–0.25 mg/L) were consistently reduced over the four week time period (T-test; p=0.02). Although preliminary, these results indicate a mycofiltration unit is a viable and natural option at remediating phosphate runoff into natural ecosystems. Additional sampling over a greater time period is necessary to confirm these results and rule out other factors such as influences from seasonal changes.

10:00 METABOLIC CONSEQUENCES OF INCUBATION TEMPERATURE ON BOBWHITE QUAIL (*COLINUS VIRGINIANUS*) EMBRYOS. Spiro M. Mavroidis (mavrois@mountunion.edu), Cory D. Morris (morriscd@mountunion.edu), University of Mount Union, 1972 Clark Avenue, Alliance, OH 44601.

One of the most important developmental forces acting on bird embryos is incubation temperature. The range of temperatures for optimal growth and development is very narrow. Incubation temperatures can be influenced by several factors including setting characteristics of the parents and dramatic swings in environmental

temperatures. Slight variations of $\pm 1^\circ\text{C}$ from the optimal range during incubation can affect embryonic development and hatchability as well as viability post hatching. Our objective was to determine if temperature variations during incubation influenced embryonic metabolism and thus overall energy use during development. To assess the effect of incubation temperature on metabolic rate and overall energy expenditure of developing quail embryos, we conducted two incubation runs each with three temperature treatments. Incubation temperatures of the first run were 36.5°C , 37.5°C and 38.5°C while the second run temperatures were 35.5°C , 36.5°C and 37.5°C . At each temperature treatment, eggs (N=60 per treatment) were incubated in automatic egg turners placed in Hova-bator (GQF) forced air incubators. Temperatures were controlled using a proportional controller. Flow-through respirometry was used to measure O_2 consumption on three randomly chosen eggs from each treatment three days a week. The highest hatching rate (66.6%) occurred at 37.5°C and decreased above or below this temperature. For all treatments, metabolic rates increased progressively across the incubation period with the highest rates occurring during the middle third of development. Total energy expenditure, determined from the start of incubation to pipping, increased (0.54, 0.56, 0.67, 0.69 ml/ VO_2) with increasing temperatures (35.5°C , 36.5°C , 37.5°C , 38.5°C).

9:00 - 11:00 AM

Session 06 - Taking Science to Market: Entrepreneurship in Today's Economy - Room 136

Interested in how scientific ideas can turn into a business?

Doing science and getting science to market are two separate hurdles. Ohio is home to 100's of small scientific businesses that were started by intrepid individuals. However, for every successful business started there are countless that do not make it to market or do not survive when they arrive on the market. This session will give you the opportunity to learn from several entrepreneurs who have successfully made the jump from the scientific bench to the market.

This session will also introduce different techniques that scientists and entrepreneurs can use to protect their intellectual capital. We are fortunate to have Stephen Scanlon, a member of The Ohio Academy of Science and an Intellectual Property Lawyer, speaking on trademarks, patents, and other techniques to manage intellectual property. Mr. Scanlon will also be discussing recent changes to the law that affect intellectual property.

**1:30 – 3:00 PM
Career Symposium
The Barrette Business and Community
Center**

Join us at 1:30 in the Betzler Conference Room for a discussion of scientific careers. Professionals from diverse scientific fields will be available to discuss their education, background, experience that led to their current position, and where they see science careers moving in the future. This will be followed by an open forum for discussion and questions from attendees.

This symposium will be an opportunity for students to learn from the experience of those already in the scientific field as well as gain exposure to careers they might not have been aware of. Completing a scientific degree does not necessarily mean that students will be working in a laboratory following college, and the goal of this symposium is to introduce students to traditional and non-traditional career opportunities available in STEM fields.

All pre-college, college, and graduate students are encouraged to attend the Career Symposium.

**The Career Symposium is sponsored
by BioOhio**



BioOhio is a non-profit organization designed to build and accelerate bioscience industry, research, and education in Ohio. Visit their website at www.bioohio.com

**College and Professional Poster
Session
9:00 – 11:00 am
The Barrette Business and Community
Center**

Poster Board No. 001 EFFECTS OF ALCOHOL AND CAFFEINE CONSUMPTION ON THE BEHAVIOR OF MICE. Heather M. Lee (leehm@moununion.edu), Lin Wu (wuli@moununion.edu). University of Mount Union, 1972 Clark Ave. Alliance, OH 44601 (Mailbox #1082).

The combination of alcohol and caffeine in beverages is popular today, which has been demonstrated to be harmful to the human body. Many studies have been done to observe the effects of caffeine and alcohol individually on animal behavior, however there are limited studies conducted to examine the combined effects of these substances. The combined effects of caffeine and alcohol during adolescent development will be studied in this research to analyze mice anxiety with behavior. Anxiety in literature is defined as the few entries and less time spent in the light box in a light-dark box set up. In order to carry out this experiment, store-bought mice are bred first. After the mice are weaned, they are separated into four cages which contain approximately four of the same sex per cage. When adolescence is reached, which is 3 and 1/2 weeks, water in three cages will be replaced with alcohol in one cage, caffeine in another, and the last cage, the combination of the substances. Mice will be on the substance treatments for two weeks and will be tested for anxiety in a light-dark box set up. Experimental set up consists of a light box and a dark box separated by a removable slide. To begin a trial, one mouse will be placed into the dark box of the set up for 30 seconds. Then, the removable slide will be open to allow the mouse access to the light box. The total time spent in and the number of entries to be the light box will be recorded for 5 minutes. This study has been approved by the Institutional Review Board of the University of Mount Union.

Poster Board No. 002 PATTERNS OF ANTIBIOTIC RESISTANCE. Sarah Tegtmeier (tegtmeiers@findlay.edu), Chelsea Bering, Ashley Putman, and Bethany Henderson-Dean Ph.D. (henderson-dean@findlay.edu), The University of Findlay, 1000 N. Main St. Findlay, OH 45840.

Previous studies of two sites in the Blanchard River (Hancock County), pristine and septic leaching, demonstrated that microbial coliform diversity was greater at the leachate site. Isolated coliforms from this study were screened for antibiotic resistance patterns (aminopenicillin, macrolides, and aminoglycosides). These multi-drug resistant coliforms will be screened for their antibiotic resistance gene patterns. Total genomic DNA was isolated from resistant bacteria, and the presence of resistance genes will be determined through PCR analysis. Resistance patterns will be compared between the two sites (ANOVA) to determine if septic leachate leads to greater antibiotic resistance diversity (Pearson's r). Additionally, isolates will be screened to determine the elements that propagate horizontal gene transfer within these coliform populations, including integrons, transposons and plasmids, to determine if antibiotic resistance is transmitted through common microbial communities.

Poster Board No. 003 HAND SANITATION POSITIVELY CORRELATES WITH RISK OF INFECTIOUS DISEASES AMONG COLLEGE STUDENTS. Macey Brandeberry² (brandeberrym@findlay.edu), Melanie Lowers¹ (lowersm@findlay.edu), Dylan Long¹ (longd@findlay.edu), Daniel Weiland¹ (weilandd@findlay.edu), Xu Lu² (lu@findlay.edu), 11161 West Township Road 116, Fostoria, OH 44830. ¹University of Findlay College

of Pharmacy, Findlay, OH 45840 and ²The University of Findlay College of Sciences, Findlay, OH 45840.

It has been shown numerous times that proper hand hygiene can greatly reduce one's susceptibility to infectious diseases. However, such a potential correlation has never been identified on the University of Findlay campus among college students. The purpose of the experiment was to support the hypothesis that a similar correlation would be observed and designed an experiment to test this hypothesis. Student volunteers were recruited campus wide from the University of Findlay to participate in this research. The 166 volunteers were asked to fill out a survey on various questions including their genders, majors, living conditions, the number of times they were sick because of infectious diseases within the past winter season, the severity of their illnesses and whether they missed classes/jobs. A sample was then taken from each volunteer by pressing the fingers of his/her dominant hand on an agar plate and the process was repeated after the volunteer washed his/her hands. All plates were incubated at 37°C and bacterial colonies were counted 24 and 48 hours later. It was discovered that volunteers with infectious diseases during the winter contained significantly more bacterial cells on their hands, which was especially true for those who missed classes/jobs because of their illnesses. Specifically, 83 out of a total of 122 volunteers who did not get sick had uncountable numbers of bacterial cells on their hands. 36 out of a total of 44 who got sick had uncountable numbers of bacterial cells on their hands. And volunteers who missed at least 1 days of classes/jobs all had uncountable numbers of bacterial cells on their hands (22 out of 22).

Poster Board No. 004 EFFECTS OF CAFFEINE ON LEUKEMIA CELL GROWTH. Dylan Long¹ (longd@findlay.edu), Daniel Weiland¹ (weilandd@findlay.edu), Macey Brandeberry² (brandeberry@findlay.edu), Abigail Stone² (stonea@findlay.edu), Rebecca Culbert¹ (culbert@findlay.edu), Melanie Lowers¹ (lowersm@findlay.edu), Xu Lu² (lu@findlay.edu), 35562 Beachpark Dr., Eastlake, OH 44095. ¹University of Findlay College of Pharmacy, Findlay, OH 45840 and ²The University of Findlay College of Sciences, Findlay OH 45840.

It has long been known that caffeine can inhibit cancer cell growth. However, the underlying cellular mechanisms remain undetermined. In this study, we use a human acute T cell leukemia cell line, Jurkat E6-1, as a model to investigate this question. Our previous and current experiments show that in cell culture, Jurkat cell growth can indeed be inhibited by caffeine and the inhibitory effect is dependent on caffeine concentration. Because caffeine is a potent kinase inhibitor and because kinase activities are critical for cell division cycle control, we hypothesize that caffeine inhibits cell growth by blocking the cell cycle at a certain checkpoint. Molecularly, cell cycle is controlled by protein pairs, each of which contains a cyclin and a cyclin-dependent kinase (Cdk), including the pairs of cyclin D/Cdk4, cyclin D/Cdk6, cyclin E/Cdk2, and cyclin B/Cdk1. The inhibitory effect imposed by caffeine could result in alternations in expressions of cyclins and/or Cdk's and/or the enzymatic activities of the kinases and thus the phosphorylation states of their target proteins. Currently we focus our resource and efforts on elucidating the expression profiles of kinases and Cdk's and we hypothesize that there is an alternation in their expression. Quantitative real time PCR is being used to measure their expressions in the form of their mRNA's, in order to elucidate the underlying mechanisms.

Poster Board No. 005 DETECTION OF CALICIVIRUS IN FELINES. FROM SHELTERS IN NORTHWEST OHIO. Audrey Tucker (tuckera@findlay.edu), Cassandra DiCioccio (dicioccio@findlay.edu), Xu Lu (lu@findlay.edu), Linda Peck (peck@findlay.edu), and Jessica Wooten (wooten@findlay.edu), The University of Findlay Department of Natural Sciences 1000 N. Main St, Findlay OH 45840.

Caliciviridae are small, nonenveloped, RNA viruses. Calicivirus typically possess high-levels of genetic variability and have the ability to persist in infected individuals. Feline Calicivirus (FCV) is a naturally occurring pathogen in felines, and studies have shown that FCV is ubiquitous in feline populations worldwide. However, FCV has gone undetected in many populations, including in animal shelters, despite the fact that prevalence rates may be between 2% and 40%. The aim of this research was to investigate the prevalence of Calicivirus in felines in animal shelters in northwest Ohio. Swabs of the oral cavity of 24 felines were collected from two shelters, which accounted for 40% of the feline population in the shelters. Reverse transcriptase polymerase chain reaction (RT-PCR) was used to detect the presence while, real time PCR was used to quantify the relative viral loads of the tested felines. No detection of Calicivirus was revealed. The positive and negative controls were visible, so the findings are not an artifact of failed gel electrophoresis or polymerase chain reaction. Real time PCR corroborated the RT-PCR results. It is likely that because most felines at the shelters have been vaccinated against Calicivirus, along with other commonly found viruses for felines, that the prevalence of Calicivirus is zero in those tested.

Poster Board No. 006 CONDITIONS REQUIRED FOR THE BREEDING AND REARING OF PEPPERMINT SHRIMP (*LYSMATA WURDEMANNI*). Megan Kingrey (kingreym@findlay.edu), Katelyn Durbink (durbink@findlay.edu), and Jessica A. Wooten (wooten@findlay.edu), The University of Findlay Department of Natural Sciences 1000 N. Main St. Findlay, Ohio 45840.

Breeding conditions for *Lysemata wurdemanni*, Peppermint Shrimp, are not well-understood, which leads to over-collecting and harvesting in natural populations. Our aim is to determine the ideal conditions and procedures for raising *L. wurdemanni* larvae from hatch to settlement and to then to marketable size. Variables, including temperature, salinity, pH, water type / quality, and amount of feeding, will be altered, in turn, in an attempt to uncover the proper set of conditions that will promote breeding in *L. wurdemanni*. Two 7.5-liter tanks will be established: one control and one experimental. Each tank will have bare bottom that is stocked with three-kg of live rock and six adult peppermint shrimp in each. In order to maintain each tank, two sponge filters and an aquarium heater will be used to maintain the temperature between 24-29°C. Saltwater will be made in the lab from de-chlorinated water and Crystal Sea Bioassay Laboratory Formula salt mix adjusted to 33-35 ppt. Adult shrimp will be fed a mix of frozen brine shrimp and frozen mysis shrimp, supplemented with Cyclopeze twice per day. Breeding is associated with the molting of the shrimp's exoskeleton, which occurs about once per month, if water conditions are acceptable, especially temperature. The first goal of the experiment is to determine the most ideal water conditions to achieve the fastest rate of molting, which in turn will lead to a faster rate of breeding. Data will be collected on how many shrimp molt each day and how many are seen carrying eggs from each tank.

Poster Board No. 007 AN INVESTIGATION OF CRYPTOSPORIDIUM PARVUM AND GIARDIA LAMBLIA AND ENVIRONMENTAL STRESSORS IN BUCKET CALVES. S. M. Waibel*, F.D. McCarthy, and B. Henderson-Dean, The University of Findlay, Findlay, OH.

Cryptosporidium parvum and *Giardia lamblia* are protozoal parasites that can cause gastroenteritis in dairy calves and are zoonotic diseases causing intestinal enteritis in humans. The objective of this study was to determine if environmental stressors promote shedding of *C. parvum* oocysts or *G. lamblia* cysts in male dairy calves. The environmental stressors considered were arrival to the facility, transfer from isolation to the main barn, and processing (castration, dehorning, vaccination). Calves (n=17) were 3-5 d of age and were obtained from

local producers. Fecal samples were collected via rectum with an eSwab® or Para-Pak® vial. Fecal collections were taken within 24 h upon calf arrival, 24 h prior to the environmental stressor, and between 44 to 52 h after the environmental stressor. The feces were analyzed using rapid immunochromatographic assay. Results indicated that none of the calves were positive for either parasite upon arrival. The paired student t-test conducted before isolation removal (BIR) and after isolation removal (AIR) indicated no statistical significance for *C. parvum* ($p=0.2908$) and *G. lamblia* ($p=0.1671$). Samples collected before processing (BP) and after processing (AP) indicated no statistical significance for *C. parvum* ($p=0.1661$) and *G. lamblia* ($p=0.2481$). Data analysis found that 76% of the calves tested positive for *G. lamblia* and 35% tested positive for *C. parvum* at least once. In addition results detected *C. parvum* (18%) and *G. lamblia* (6%) in the calves prior to their removal from isolation suggesting that isolation may not be as effective as initially presumed.

Poster Board No. 008 POPULATION DYNAMICS OF REPTILES AT PRIMMER OUTDOOR LEARNING CENTER IN HOCKING HILLS REGION OF OHIO. Austin Clarridge (aclarrid@capital.edu) and Christine S. Anderson (canders2@capital.edu), 12055 St Rt 736 Marysville, OH 43040.

Capital University's Merl and Margaret Primmer Outdoor Learning Center is likely home to various different species of reptiles. This study was focused on collecting baseline data in order to better understand the species abundance and habitat preferences of snake, lizard, and turtle populations. It is hypothesized that snakes and lizards will be found predominately around lightly wooded areas that have been modified by human interaction. Visual surveys are the primary experimental technique being used. Investigators perform rock flipping and hikes through the open grass land habitats. Pieces of recycled metal siding were placed in areas most likely frequented by snakes and lizards to attract reptiles. Snakes and lizards were marked with a paint marker, measured for length, and the habitat type and location of capture were recorded. Individuals which were seen but not captured are still recorded and an estimation of length was made. Preliminary results showed that 4 different species of snakes have been found, including Northern Brown, Eastern Garter, Butler's Garter, and Black Rat snakes. Additional data collection on snakes and lizards is ongoing. The habitats where snakes have most often been captured have been brushy, lightly wooded areas, and low grassy fields. This study is currently in progress, and will be completed in May of 2014. In addition to being the first in-depth study of reptiles at the Center, these data will also allow for quantitative conclusions to be drawn as to the long term effect of the prairie restoration project that will occur Spring 2014 - Fall 2015.

Poster Board No. 009 ANNOTATION OF THE *DROSOPHILA BIARMIPES* CONTIG 51. Lauryn E. Zielinski (l-zielinski@onu.edu) and Jamie L. Sanford, PhD (j-sanford@onu.edu) (Advisor), 525 N. Main Street, Ada, OH 45810.

The Genomics Education Partnership (GEP) was started at Washington University and spread to incorporate undergraduate students at numerous other institutions with the purpose of using comparative analysis of several *Drosophila* species in order to examine the overall organization and regulation of genes on the highly heterochromatic fourth chromosome. The fourth chromosome, also known as the dot chromosome, uniquely expresses multiple genes from highly heterochromatic regions. The project hypothesizes these analyses will aid in revealing certain evolutionary changes, mechanisms of gene regulation, and differences between the heterochromatic and euchromatic regions of the chromosome. The current research focuses on annotation for the species *Drosophila biarmipes* contig 51. During the research procedure, NCBI Blast and the UCSC Genome Browser are used to compare the predicted protein sequence for a particular

gene in the contig to the known *D. Melanogaster* database in search of orthologs for already known genes that can be used as models in determining the location coordinates for the particular sequence. Through annotating, the exact locations of each exon are determined based on acceptor and donor sites in the sequence. All predicted exon sequences are confirmed through a gene checker to determine the possibility of any premature stop codons or faulty splice sites before submission. At the current time research is still being conducted however the current analysis shows an ortholog to gene eIF4G of *Drosophila Melanogaster* with three known isoforms, made up of fifteen exons. Annotation is underway for the rest of contig 51 and research will continue until the Ohio Academy of Sciences Conference.

Poster Board No. 010 ANNOTATION OF CONTIG 57 IN *DROSOPHILA BIARMIPES*. Natalia Buczkowski (n-buczkowski@onu.edu) and Jamie L. Sanford, Ph.D. (j-sanford@onu.edu) (Advisor), 525 N. Main Street, Ada, OH 45810.

The Genomics Education Partnership is a collaborative research project involving annotation of newly sequenced *Drosophila* genomes. The ultimate goal of this research is to compile this annotation data across species in order to gain insight into regulatory mechanisms responsible for transcription of genetic loci present on the highly heterochromatic 4th chromosome. The current work focuses on annotation of the *Drosophila biarmipes* species, specifically, contig 57. Annotation is conducted by first determining whether the contig contains any gene that has a known orthologue in the *D. melanogaster* reference sequence. This is done using *ab initio* gene finders, UCSC genome browser and FlyBase BLAST. The orthologue exonic sequence is then used in conjunction with the UCSC Genome Browser to annotate the exact coordinates of each exon in the gene being annotated on the *D. biarmipes* contig. The Gene Model Checker program is then used to verify the gene model that was annotated. Annotation of contig 57 is underway and analysis has shown that the contig contains orthologues to the following genes: PlexA, CamKII and ATP Synthase-B. Annotation of contig 57 will continue until the coordinates of each exon of all three genes and each of their isoforms has been mapped in *D. biarmipes*.

Poster Board No. 011 THE EFFECTS OF ENVIRONMENTAL TOXINS ON AMPHIBIAN EMBRYO DEVELOPMENT. Joshua E. Kwasnicka (kwasnije@mountunion.edu), Amy L. McElhinney (mcelhial@mountunion.edu), University of Mount Union, 1972 Clark Ave Alliance OH 44601.

Environmental pollution is a major problem in today's ecosystems. Chemicals such as coppersulfate, benzene, and toluene are being detected in our environment. These chemicals are left over from processes such as algal bloom control and horizontal hydraulic fracking. The goal of this experiment was to observe the effects of fracking toxin, benzene and toluene, and copper sulfate, used for algal bloom control, on embryonic development in amphibian species native to Northeastern Ohio. Fertilized eggs of *Lithobates clamitans* (green frog) and *Eurycea bislineata* (northern two-lined salamander) were field collected at the Huston-Brumbaugh Nature Center outside of Alliance, Ohio. Eggs were transported to the lab and exposed to various concentrations of benzene, toluene, and copper sulfate ranging from 0.0001-10.0 ppm. Daily observations were made to assess developmental abnormalities or death in treated cultures. Copper sulfate was the most lethal at concentrations >1.0 ppm, less than 1.0 ppm was not tested. Benzene exposure did not produce any abnormalities or result in death. Toluene treatment generated one heart abnormality at 10 ppm but did not result in death. Combining benzene and toluene at any concentration had no effect on development and limited effect on survivorship. It is possible that toluene exposure may induce heart defects as indicated in the literature but, further tests are

necessary. When combined, the lethality of benzene and toluene was amplified; supporting observations made in the literature. The lethality of copper sulfate may have resulted from low water hardness. Additional analyses are necessary utilizing earlier developmental stages and alternate amphibian species.

Poster Board No. 012 SOIL MICROBIAL METAGENOMIC ANALYSIS AND PHAGE HUNTING OF HUSTON-BRUMBAUGH NATURE CENTER NATIVE *Lindera benzoin* (SPICEBUSH). Angela M. Paridon (paridoam@mountunion.edu), 2772 Balton Dr. Akron, OH 44319.

This is the first soil microbial metagenomic and phage hunting research performed at the Huston-Brumbaugh Nature Center. Twenty-five different soil samples were taken from diverse areas throughout the research period, most centered around regions where *Lindera benzoin* was present to see if the plant had an impact on the bacteria and bacteriophage populations on the surface soil. This plant was selected because it is commonly found in very fertile soil, and can be found in many diverse areas of the Nature Center. Out of the 25 samples taken, including the controls, only two were positive for coliphage; sample 3 with a titer of 2×10^7 pfu/mL, and sample 6 with a titer of 2.5×10^7 pfu/mL. No samples were positive for mycobacteriophage when using plaque assay host specific technique. All but four samples showed positive results for the 16S rRNA gene when the genomic DNA was isolated using MoBio PowerSoil Kit and gel electrophoresis with a fluorescent dye. The results show, as expected, that there are microorganisms in the surface soil sampled. Further studies will be performed to classify these microbes.

Poster Board No. 013 MONITORING HEAT SHOCK PROTEIN 70 IN HERPES SIMPLEX VIRUS TYPE 1-INFECTED CELLS. Estelle Byelene (estellebyelene@walsh.edu), Katelin Smith (katelinsmith@walsh.edu), Adam Underwood (aunderwood@walsh.edu), Darlene Walro (dwalro@walsh.edu), Walsh University, Dept. of Biology, 2020 East Maple St. North Canton OH 44720.

Heat shock proteins (HSP) are chaperone proteins involved in the folding and unfolding of cellular proteins and are highly expressed when cells are exposed to stress such as virus infection. Herpes simplex virus is a DNA virus which replicates in a highly regulated and temporally-controlled fashion. The purpose of this study was to measure heat shock protein 70 (HSP70) in cells infected with herpes simplex virus type 1 strain GC and strain KOS 79. Vero cells were mock-infected or infected with virus at a multiplicity of 1 infectious virus particle per cell and harvested at hourly intervals up to 12 hours post-infection. Cells were lysed in RIPA buffer and protein was quantified using the Bradford assay. Four micrograms of protein were loaded into each lane and the proteins were separated electrophoretically and transferred to PVDF membrane. The amount of HSP70 was detected by Western immunoblot using monoclonal antibodies against HSP70 and the levels were normalized against the cellular tubulin protein. Densitometric analysis was performed with the BIO-RAD Gel Doc XR imager system using the *Quantity One* software program. HSP70 levels remained constant in mock-infected Vero cells over the course of the experiment. In virus-infected cells, the level of HSP70 was equivalent to that in mock-infected cells at one and two hour post-infection but increased at each sample point until eight hours post-infection strain KOS 79 or until nine hours post-infected for strain GC. The level of HSP70 at the peak time in virus-infected cells was four times the level of HSP70 in mock-infected cells, after which times the level of HSP70 decreased but still remained twice as high as HSP70 levels in mock-infected cells. These results suggest that cellular HSP70 may be utilized during HSV replication.

Poster Board No. 014 EFFECTS OF FUNGAL EXTRACTS ON

THE CELL CYCLE. Ailsa Hershaw (hershawa@findlay.edu), Graham Rossi (rossig@findlay.edu), Michael Edelbrock, PhD, The University of Findlay, Mail Stop 1051, 1000 North Main Street, Findlay OH 45840.

During the cell cycle, the DNA mismatch repair (MMR) pathway is activated that corrects mispaired DNA bases and detects damage. Upon DNA alteration, the cell cycle may be delayed to allow sufficient time to affect a repair response. This time delay should be detectable and may provide an indirect indication of DNA damage when compared to non-damaged cells. Data from a previous project investigating the effects of an environmental toxin (cadmium) indicated a delay in cell cycle progression of cadmium treated HCT-116 cells indicative of a DNA damage response. It is hypothesized that some fungal metabolites are cytotoxic and therefore may damage DNA and delay the cell cycle. A thymidine block was used to synchronize cells for cultures of human cancer cells. Addition of thymidine arrests cells in the G1/S boundary by preventing DNA synthesis. Cells were then released from the thymidine block and recovered periodically to approximate when G1, S, and G2/M occur. Duplicate cultures were treated with fungal extracts. Cells were then fixed in ethanol, stained with propidium iodide, and then analyzed by flow cytometry for DNA content, where DNA content can be used to determine the percentage of cells in the G1, S and G2/M phases.

Poster Board No. 015 CANCER CELL VIABILITY IN RESPONSE TO FUNGAL SECONDARY METABOLITES. Jeffrey A. Miller (millerj6@findlay.edu), Timothy Finlayson, Kara Bloom, Jocelynn Miller, Brandy Lawrence, Donald M. Walker, Ph.D., Michael A. Edelbrock, Ph.D., The University of Findlay, Department of Biology, 1000 N Main St, Findlay OH 45840.

Bioactive compounds isolated from fungi have been shown to elicit potent antioxidant, antimicrobial, and anticancer activities. The goal of this study is to screen extracts of fungal secondary metabolites for anticancer activities. Fungal specimens were collected and isolated into pure culture from surrounding areas in Ohio. The samples were morphotyped then grown in liquid culture for two weeks. Crude solvent extracts, of unknown composition and concentration, were prepared from samples of 30 morphologically distinct fungal isolates. Human colon cancer cells were seeded at uniform density, in triplicate, and treated with the crude extract. Colony viability was determined after seven days of incubation and compared to vehicle control. Of the 30 extracts, 19 were found to have significant activity against the colon cancer cells, as determined by a Student's t-test, $p < 0.01$. Additional work to characterize the fungal species, identify the active compounds, and determine the mechanism of anti-proliferative action is ongoing.

Poster Board No. 016 POPULATION DYNAMICS OF *PEROMYSCUS LEUCOPUS* AT CLEAR CREEK METRO PARK. Ashleigh M. Bope (abope@capital.edu), Christine S. Anderson (canders2@capital.edu), 145 Parklawn Blvd., Columbus, OH 43213.

The population dynamics of the rodent *Peromyscus leucopus*, commonly referred to as the white-footed mouse, is one of the best-studied rodents in North America. The purpose of this study was to examine the possible variations in two populations of white-footed mice at a new study site based on differences in habitat. It was hypothesized that there would be a difference in mice abundances based on the fact that there were different resources available to each population. In this study, a 4x4 grid of 16 Sherman live-traps was set in each of two different habitats at Clear Creek Metro Park in southeast Ohio. The habitat in which it was found, sex, weight, length, reproductive status, and pelage color were recorded for each capture. In addition, small tissue samples were taken to later confirm species identity. Traps were set on six different occasions during September – October 2013 in two secondary growth

deciduous forest habitats. One habitat contained deciduous trees ('deciduous habitat') while the other contained both deciduous and coniferous tree species ('conifer habitat'). For the six different trapping sessions, 192 total traps were set and checked. Separately, there were 85 total trap nights (96 minus 11 disturbed) for the deciduous habitat and 80 total trap nights (96 minus 16 disturbed) for the coniferous habitat. Half as many mice were captured in the deciduous habitat ($N = 6$) than in the conifer habitat ($N = 12$). When considering the habitats separately, and standardizing the trap nights, the deciduous habitat had 35.3 captures / 500 trap nights and the conifer habitat had 75.0 captures / 500 trap nights. Upon calculation of a chi-squared value, these capture values were statistically significant ($X^2 = 14.3$, $df=1$, $p=0.0002$). Results showed that the relative abundance was greater in the conifer habitat compared to the deciduous habitat. The sex ratios showed the same proportion of males to females present in both habitats and recapture rates, average weights, average lengths, and age (based on the proportion of juveniles with gray pelage) were not statistically different between habitats. The difference in abundance between the two habitats may be explained by the different food sources available to the populations, but more investigation is required. This study introduced a new study location and looked to identify trends in the data to better understand population characteristics of these very adaptive rodents in different environments.

Poster Board No. 017 TOOTH MORPHOLOGY PROVIDES EVIDENCE OF ANCESTRAL MEGALODON SHARK LINEAGE. S WINT¹ (wint.5@wright.edu), CN CIAMPAGLIO¹ (chuck.ciampaglio@wright.edu), SJ JACQUEMIN¹ (stephen.jacquemin@wright.edu), DJ CICIMURRI², ¹Wright State University - Lake Campus, Celina, Ohio 45822, ²South Carolina State Museum, Columbia, South Carolina 29201.

The evolutionary relationships within the mega-toothed shark lineage that culminates in *C. megalodon* are unclear. Previously noted patterns between several predominant taxa have elicited numerous hypotheses of evolutionary relatedness, however, few analytical approaches have been applied to test these relationships. The objective of the study was to utilize morphological data to build a phenetic tree that best describes the patterns of divergence along the mega-toothed shark line. Geometric morphometrics was used to describe overall tooth shape (upper anterior jaw) of the extinct mega-toothed sharks and resulting axes were combined in a cluster analysis to indicate phenetic relationships among taxa. In addition, counts of serrations and variability in serration spacing / height were included to describe taxa. The primary morphological gradients explained 77% of the total morphological variation along four primary axes. Shape axes included gradations between individuals based on root lobe and bourlette width as well as blade and cusplet width. Taxa classified as *C. appendiculata*, *O. obliquus*, *C. aksuaticus*, *C. auriculatus*, *C. sokolovi*, *C. angustidens*, *C. chubutensis*, and *C. megalodon* tended to exhibit increasingly wide blade and root widths with an increasingly reduced cusplet presence, respectively. This gradation among taxa was also typified by the appearance of and gradual reduction of serration counts (mean range of taxa 0 - 110) and variation in appearance (CV range of taxa 0 - 26). Inclusion of shape gradients and serration measurements in neighbor-joining cluster analysis indicated closest relationships (using bootstrapping procedures) between *C. chubutensis* and *C. megalodon* taxa (Boot N: 77%) and *C. appendiculata* and *O. obliquus* taxa (Boot N: 91%). Future research will repeat the above analysis using additional tooth datasets from lower anterior, upper lateral, and lower lateral tooth specimens to serve as additional evidence to build a phenetic evolutionary tree of the mega-toothed shark lineage.

Poster Board No. 018 ON THE SPECIALIZATION OF TOOTH MORPHOLOGY IN EARLY CLADODONT SHARKS. M JONES¹ (jones.948@wright.edu), SJ JACQUEMIN¹ (stephen.

jacquemin@wright.edu), CN CIAMPAGLIO¹ (chuck.ciampaglio@wright.edu), Z WHETSTONE¹, DJ CICIMURRI², ¹Wright State University - Lake Campus, Celina, Ohio 45822, ²South Carolina State Museum, Columbia, South Carolina 29201.

Differentiation of tooth shape with jaw position is a well-known pattern in modern piscivorous sharks. Differences in morphology of anterior, lateral, and posterior teeth have functional linkages in feeding performance and dietary diversity. However, whether specialization of tooth shape was present in early sharks or arose later due to selection is not known. The objective of this study was to describe tooth shape in early Devonian cladodont sharks, *Ctenacanthus* ($n=5$) and *Cladoselache* ($n=6$), and test for shape specialization with jaw position. The study prediction was that early sharks would not exhibit differentiation. Geometric morphometrics was used to describe tooth shape according to a series of 12 landmarks encompassing the margin of each tooth and resulting multivariate axes were regressed using linear regression analysis with jaw position to test for differentiation with position. The morphological analysis explained 69% of the total variation present in tooth shape along three primary axes. The morphometric analysis differentiated teeth on the basis of central and lateral cusp width and height as well as root thickness. Tooth shape did not significantly covary with jaw position in cladodont taxa (RWA1: $r = 0.03$, $p = 0.8$), however, significant morphometric differences between *Ctenacanthus* and *Cladoselache* were evident (RWA1: $t = -3.2$, $p < 0.001$). *Ctenacanthus* exhibited a more robust root structure, shorter central cusp, and wider lateral cusps compared with *Cladoselache* individuals. Inclusion of two modern taxa with similar niches as the Devonian age cladodont taxa yielded predictable differentiation of tooth shape with jaw position. The degree of overlap in shape ordination between *Ctenacanthus* and *Cladoselache* tooth morphologies may have additional ramifications for positive identification of loose teeth in other paleo work and warrants additional morphometric study.

Poster Board No. 019 EXPRESSION PROFILE OF DAMAGE SENSING PROTEINS IN CELLS TREATED WITH FUNGAL EXTRACTS. Corina Benjamin (benjamin.c@findlay.edu), Julia Edelbrock (edelbrock.j@findlay.edu), Michael A. Edelbrock Ph.D., The University of Findlay, 1000 North Main St, Findlay OH 45840.

The use of plants and fungi to derive medicines is well accepted. Specifically, fungi are an important organisms in generating novel metabolites and compounds. Some compounds are produced which are genotoxic to other eukaryotes and thus allow the fungi to survive in a niche environment. Our hypothesis is that the fungal metabolites can cause genotoxic stress. We have grown HCT116 cells in culture and treated them with varying amounts of a crude fungal extract of unknown composition. Cells respond in a dose-dependent manner with extract two extracts identified as "#590" and "#672". Further cells treated with these extracts show that caspase 3 is activated. We are measuring the relative expression of proteins related to damage sensing and apoptosis. Difference in protein expression observed in treated versus untreated cells may provide evidence that the fungal extracts are causing genotoxic stress which induces caspase activation.

Poster Board No. 020 THE GENOTOXIC EFFECTS OF CADMIUM AND TEMOZOLOMIDE ON HELA CELLS. Ying-Liang Liu (liuy1@findlay.edu), Michael Edelbrock (edelbrock@findlay.edu), The University of Findlay, 1000 North Main St, Findlay OH 45840.

Cadmium is a heavy metal that is carcinogenic to humans. Literature suggests that cadmium is not acting alone but rather is a co-carcinogen. This study investigated whether the combination of cadmium and temozolomide act in combination with one another in increasing cell genotoxic stress. Cadmium and temozolomide can cause apoptosis

if cells are exposed at high concentrations. Hela cells, a human cell line, were treated with those agents at sub-lethal concentrations. The genotoxic effects of these agents were evaluated using the Comet Assay. Concentrations of cadmium used were 0, 1 μM whereas the concentrations used for temozolomide were 0, 0.05, 0.2, 0.5, and 1 μM . Hela cells were exposed to those agents at the same time and was incubated for a day. Cells were then isolated and Comet Assay was performed. Micro slides with cells were stained with ethidium bromide so it can be observed under the fluorescent microscope. Tail moment was measured ($N=50$ for each treatment) as an indicator of DNA damage. Average tail moments were 0.959 for control, 2.046 for TMZ treated, and 1.939 for both cadmium and TMZ treated. A t-test was used to determine statistical difference ($P=0.05$). Although both agents exerted DNA damage when compared to control (0 μM Cd and 0 μM TMZ), no significant difference between cadmium and temozolomide treatment was measured.

Poster Board No. 021 COMPARISON OF PROTANDIM® AND TART CHERRY CONCENTRATE IN TERMS OF MUTAGENICITY AND ANTIOXIDANT ACTIVITY USING THE MICROTITRATION SOS-CHROMOTEST. Gretchen, C, Sandberg (gsandberg@hillsdale.edu), 854 Seaman Avenue, Baldwin, NY, 11510.

The Microtitration SOS-Chromotest is a mutagenicity assay that utilizes the bacterial SOS-response, fusing *lacZ* to the *SfiA* gene so that β -galactosidase is produced in response to mutagenic damage. In addition, the SOS-Chromotest can be used to show whether or not a substance acts as an ameliorative agent that reduces genotoxicity. It is expected that Protandim® acts as a promutagen to exacerbate the mutagenic affects of a known oxidative mutagen, while Tart Cherry Concentrate acts as an anti-oxidant to ameliorate the mutagenic effects. Tart Cherry Concentrate and the non-FDA approved supplement Protandim® were compared to a standard of cells grown without either substance of interest to determine whether or not the substances contributed to the amelioration or exacerbation of damage caused by a known oxidative mutagen. The Microtitration SOS-Chromotest mutagenicity assay was used in these investigations and modified to include a subculture step in which the bacterial tester strain is incubated with the test chemical, and then followed by an additional centrifugation/wash step. SOS-Inducing potency (SOSIP) values were calculated from the amount of β -galactosidase produced and the SOSIP values for each assay were compared to one another and to the standard. Protandim® and Tart Cherry Concentrate were compared using a one-way ANOVA and a Tukey test. The p-value 0.029 indicates significantly different SOSIP values, but neither was significantly different from the standard.

Poster Board No. 022 CORRELATION OF BIOACCUMULATED ENVIRONMENTAL CONTAMINANTS WITH CARAPACE DIMENSIONS IN THE COMMON SNAPPING TURTLE OF THE SOUTHEAST OHIO REGION. Michael A. MacKnight (s300648957@students.rio.edu), Whitney C. Smith (s300621532@students.rio.edu), Bradley M. Altier (s300606352@students.rio.edu), P.O.Box 803, New Haven, WV, 25265 (Advisor: Jacob White, University of Rio Grande).

Human consumption of the common snapping turtle, *Chelydra serpentina*, is prevalent throughout southeastern Ohio, as the meat is used in several local Appalachian recipes. In 2012, the Ohio Environmental Protection Agency (EPA) issued an advisory for the consumption of snapping turtles based on the findings of a 1997 study of turtles harvested from northern Ohio. While it has been demonstrated through various studies that bioaccumulation of contaminants generally increases with specimen size, the Ohio Department of Natural Resources recently changed the harvest regulations of this game species to establish a minimum carapace length of 13 inches, limiting consumption to only larger specimens. It is hypothesized that larger turtle carapace dimensions

correlate with increased levels of contamination, with the determination of such correlation being the primary objective of the study and the first within the sample area. Lead analysis will be performed at the University of Rio Grande using a multi-point standard additions calibration with a Perkin-Elmer AAnalyst 600 graphite furnace atomic absorption spectrophotometer. Mercury analysis will be performed at Mercury One Ltd. via EPA method 1631E, 245.7 Rev 2 (purge and trap, cold vapor atomic fluorescence spectrometry). Initial levels of lead and mercury in analyzed turtles with carapace lengths 27-40 centimeters have exceeded the World Health Organization's acceptable limit of <0.500 ppm in each of 9 specimens, but further research is required to determine whether a size to contamination correlation exists.

Poster Board No. 023 A METAGENOMICS APPROACH TO THE TOP-DOWN EFFECT; RED-BACKED SALAMANDER EFFECTS ON FUNGAL COMMUNITIES IN MIDWESTERN UPLAND DECIDUOUS FORESTS. Brandy R. Lawrence (lawrenceb@findlay.edu), Jessica A. Wooten (wooten@findlay.edu), Donald M. Walker (walkerd@findlay.edu), The University of Findlay, Dept of Natural Sciences, Findlay OH 45840.

Red-backed salamanders (*Plethodon cinereus*) are documented as top predators of the detritivore food chain in upland deciduous forests. *Plethodon cinereus* feed on invertebrate communities such as springtails (*Collembola* spp.) which are integral members in decomposer ecosystems. Invertebrate communities have herbivorous behavior on resident fungal communities involved in the detritivore food chain. This project evaluates the dynamics of the detritivore food chain with respect to the absence/presence of red-backed salamanders in upland deciduous forests. Eight-0.5 m² metal fleshing enclosures were erected in Litzenberg Memorial Woods in Findlay (OH) during the fall of 2013. This study site is characterized by several small tributaries from the Blanchard River and a mixed mesophytic deciduous forest dominated by *Acer saccharum*, *Quercus rubra*, *Quercus alba*, and *Fraxinus* sp. Each enclosure contained one salamander. After three weeks (day 21) four salamanders were evicted from each of four plots. Samples containing decaying organic material (fungal samples) were collected on day 1, 21, and 42 from all eight plots. Fungal samples from absence/presence plots were pooled ($n=6$) and homogenized from each of the three collection dates. Total genomic DNA was extracted from each of six samples and PCR used to amplify the fungal ITS "barcoding" marker. Shifts in fungal communities were evaluated using 454 pyrosequencing to determine if fungal community structure changes with respect to the absence/presence of red-backed salamanders. Comparison of fungi at the family rank at day 21 and day 42 (absence/presence) showed significant differences (day 21 - $n=8$, $p < 0.05$; day 42 - $n=5$, $p < 0.05$) in fungal community composition. These differences were documented in the families Ascobolaceae, Eremomycetaceae, Phaeosphaeriaceae, Plectosphaerellaceae, and Valsaceae. We hypothesize that the "top-down" effect can explain these differences. Upon salamander eviction, invertebrate communities are no longer under the pressures of salamander predation; this allows them to thrive, increasing mycoherbivory on fungal communities, thus altering fungal species composition in absence/presence plots.

Poster Board No. 024 FUNGAL-MEDIATED BIOTRANSFORMATION OF DHEA (DIDEHYDROEPIANDROSTERONE) BY PENICILLIUM COPROBIUM IS ASSOCIATED WITH INCREASED ANTIMICROBIAL ACTIVITY AGAINST BACTERIA AND FUNGI. Kara Bloom (bloomk@findlay.edu), Timothy J. Finlayson (finlaysont@findlay.edu), Rahul, Khupse (khupse@findlay.edu), Michael A. Edelbrock (edelbrock@findlay.edu), Donald M. Walker (walkerd@findlay.edu), The University of Findlay, Dept of Natural Sciences, Findlay OH 45840.

Fungi are important in the production of medicine accounting for more than 10-20% of the most profitable human drugs. These medicines are critical for the

maintenance of human health. Fungi are extraordinary metabolite and novel compound producers. They form chemically and structurally complex compounds many of which possess antimicrobial activity. Fungal-mediated biotransformation has the advantage of increased regio- and stereo-selectivities using environmentally friendly reaction conditions. During this experiment, the metabolic pathway of *Penicillium coprobium* was directed to biotransform DHEA (dehydroepiandrosterone), which is hormone manufactured naturally by the body's adrenal glands and is commonly available as over the counter dietary supplement. *Penicillium coprobium* was grown in two different types of liquid culture, potato dextrose broth (PDB) and PDB with a DHEA additive. A solid-liquid and solvent (ethyl acetate) partitioning protocol was used to extract the total organic compounds produced. The raw extracts (PDB and PDB+DHEA) were screened under standardized conditions using the Kirby-Bauer disc diffusion assay for antimicrobial activity against *Escherichia coli*, *Staphylococcus aureus*, and *Saccharomyces cerevisiae*. *Penicillium coprobium* showed a significant ($n=73-80$; $p<0.01$) increase in antimicrobial activity against all three microorganisms in the biotransformed PDB+DHEA extract when compared to the PDB extract. The PDB+DHEA extract also showed significantly ($n=54$; $p=0.00$) stronger inhibitory effects against *S. aureus* when compared to the broad spectrum antibiotic neomycin. Thin layer chromatography was used to confirm that *P. coprobium* metabolizes DHEA resulting in different metabolites. The biotransformed compounds produced in this experiment by *P. coprobium* can be potential leads for novel antimicrobial drugs.

Poster Board No. 025 COMPUTATIONAL BINDING ASSAYS AND SYNTHETIC ROUTES TO DERIVATIVES OF POTENTIAL ANTIBIOTICS. Kristopher Klesk, (s300628812@students.rio.edu), John Means, and Tim Hall, University of Rio Grande 324 Carmen Drive, Gallipolis Ohio, 45631.

In search for novel antibiotics, computational molecular docking has been an efficient and effective way for determining relative activity. The computational process produces a free energy of binding score for small ligands towards a larger biomacromolecule such as RNA. A previous study had developed a protocol that screened libraries of ligands and produced a free energy of binding score for each ligand. The target macromolecule of the study was a model of the T-box riboswitch, which plays a crucial role in transcriptional mechanisms in Gram-positive bacteria. This study had suggested the antimicrobial potential of three molecules, each of which were a part of the National Cancer Institute database. The purpose of this study is to develop synthetic modifications to these three ligands in an effort to improve each ligand's binding score. The derivatives that will be developed for the computational assay will be based on the structural properties of the ligand and of the receptor macromolecule. Binding scores of each derivative will be produced by the computational docking software AutoDock 4.2. The derivatives selected for synthesis will have lower binding scores than the initial ligands produced from the assay. The selected derivatives will then be synthesized and structurally characterized.

Poster Board No. 026 QUANTUM DOT REACTION KINETICS: DETERMINING THE COLOR OF THE DOT WITH REACTION TIME. Kristopher Kleski (s300628812@students.rio.edu) and Kimball Clark, University of Rio Grande 324 Carmen Drive, Gallipolis Ohio, 45631.

Quantum dots are semiconducting nanoparticles that exhibit electronic properties unique to that of individual atoms and bulk material. Quantum dots fluoresce when irradiated by an external UV source ($\lambda=405$ nm), and the fluoresced wavelength is dependent on the size of the nanoparticle, rather than the identity of the nanoparticle. The emitted wavelengths are within the visible region of the electromagnetic spectrum, which has led to many applications such as the tagging of tissue samples and

a variety of colored LED's. As an independent study designed to enhance student understanding, this project will focus on the UV spectral analysis of commercially available quantum dots and quantum dots synthesized on campus. The emitted wavelength of the standard samples will be plotted against their given radius. Then the synthesized quantum dots will be produced utilizing a colloidal synthesis technique. Aliquots of the quantum dot reaction mixture will be collected as reaction time proceeds, recording the reaction time the aliquot was taken. The aliquots taken during the synthesis will then be analyzed via UV fluorescence. The data collected from the synthesized quantum dots will be used to create a plot of emitted wavelength versus time. These analyses will provide data to create a plot of quantum dot radius versus reaction time, enabling the ability to create quantum dots of a specific radius with reaction time.

Poster Board No. 027 INVESTIGATING VARIOUS CANCER CELL LINES IN ORDER TO FURTHER UNDERSTAND THE EFFECTS OF COPPER IONS ON BIOLOGICAL CELLS: A COMPARISON STUDY Lucille E. Zappitelli (lucillezappitelli@walsh.edu), Joseph A. Lupica (jlupica@walsh.edu), Amy J. Heston (aheston@walsh.edu), Walsh University, 2020 East Maple Street, North Canton OH 44720.

Copper compounds are known for their toxicity toward bacteria and a limited number of viruses. This project investigated the effects of Copper (II) ions, Cu^{2+} , on MCF-7 (breast cancer) cells, and A375 (skin cancer) cells, and compared the results to HFF (noncancerous human foreskin fibroblasts) cells. All three cell lines are adherent epithelial cells. These metal ions may enter the cell through the Na^+/K^+ pump. Once inside, Cu^{2+} disturbs chemical processes and could lead to cell death by the release of Cytochrome C and its activation of the intrinsic apoptotic pathway and cellular death. Cells were treated with 1-150 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ and Sulforhodamine B (SRB) assays monitored overall cell death. Due to a lack of significant impact at these concentrations, an in depth study was conducted for 95 hours with concentration of 200, 250, 300, 350, 400, 450, and 500 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$. Results showed that A375 cells were the most sensitive exhibiting 69% growth inhibition at 200 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ and cell death was evidenced at 350 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$. Interestingly, no growth inhibition was found for HFF cells at 200 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$. Cell death for this cell line was apparent at 400 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$. MCF-7 cells exhibited 55% growth inhibition at 200 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ and cell death occurred at a slightly higher concentration than the other cell lines at 450 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$. Results indicated that 300 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ is the optimum concentration for achieving maximum antiproliferative effects on these cancer cells with minimal effects on the noncancerous cells.

Poster Board No. 028 EVALUATING THE ANTIPROLIFERATIVE EFFECTS OF THALLIUM AND COPPER ON GLIOBLASTOMA CELLS. Michelle L. Colopy (michellecolopy@walsh.edu), Joseph A. Lupica (jlupica@walsh.edu), Amy J. Heston (aheston@walsh.edu), Walsh University, 2020 East Maple Street, North Canton OH 44720.

This project investigated the effects of Thallium (I) ions (Tl^+) and Copper (II) ions (Cu^{2+}) on biological cells, GBM cells. GBM cells are brain cancer cells, also known as glioblastomas, and were chosen for this study in order to learn more about their mechanism of cell death. It is hypothesized that these ions can enter the cell through the Na^+/K^+ pump. Once the ions are present inside a cell, they can disrupt normal cellular pathways and potentially interfere with oxidative phosphorylation, and disruption of the mitochondrial membrane potential. This observation 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. The GBM cells were treated with various concentrations of TiNO_3 and $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ and Sulforhodamine B (SRB) assays monitored overall cell death. In a 48 hour study using 1-100 μM TiNO_3 , the assay demonstrated 8% growth inhibition at 2 μM TiNO_3 and 76% growth inhibition at 100 μM TiNO_3 . After increasing the treatment time to 72 hours, results showed 97% growth inhibition at 100 μM TiNO_3 . A separate experiment using 150-800 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ for 48 hours indicated 24% growth inhibition at 150 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ and cell death was apparent at 500 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$. These data support that Ti^+ and Cu^{2+} ions possess the ability to kill brain cancer cells.

Poster Board No. 029 BLADDER CANCER CELLS AND THEIR CELLULAR RESPONSE TO COPPER IONS. Alyssa M. Zimmer (alyssazimmer@walsh.edu), Joseph A. Lupica (jlupica@walsh.edu), Joseph A. Bauer (jbauer@bnoat.com), Amy J. Heston (aheston@walsh.edu), Walsh University, 2020 East Maple Street, North Canton, OH 44720.

In recent years, a number of studies have shown that copper compounds have successfully killed bacteria and some viruses. This project investigated the effects of copper compounds on HTB-1 and HTB-5 cells, bladder cancer cell lines. It is hypothesized that copper ions may enter the cell through the Na^+/K^+ pump. When a toxic cation, such as Cu^{2+} , enters the cell, it may bind to intracellular components, and therefore, disables their normal function. These events can lead to cell death by the release of Cytochrome C, initiation of the intrinsic apoptotic pathway, and lead to cellular apoptosis. The cells were treated with various concentration of $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$. The chosen concentrations were 150-800 μM . Sulforhodamine B (SRB) assays monitored overall cell death. In an experiment having a treatment time of 72 hours, this assay indicated cell death occurred at 150 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ for HTB-1 cells and 500 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ for HTB-5 cells. A further study was conducted with this compound at lower concentration in the range of 1-100 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ and the treatment time of 72 hours remained consistent. Results showed 15% growth inhibition for HTB-1 cells at 30 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ and declined to 91% growth inhibition at 100 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$. The HTB-5 cells exhibited 3% growth inhibition at 10 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ and only slowly declined to 10% growth inhibition at 100 μM $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$. The SRB assay proved that greater antiproliferative effects were found for HTB-1 cells as compared to HTB-5 cells in response to copper ions.

Poster Board No. 030 OPTIMIZING SOLID PHASE EXTRACTION OF NITROSYLCOBALAMIN FROM AQUEOUS AND BIOLOGICAL MATRICES. Chelsea Blank (chelseablank@walsh.edu), PO Box 399 Walsh University 2020 E. Maple St. N. Canton OH 44720, Michael J. Dunphy (mdunphy@walsh.edu) and Joseph A. Bauer (jbauer@uakron.edu), Bauer Research Foundation.

Nitrosylcobalamin (NO-Cbl), synthesized by a ligand exchange reaction between hydroxocobalamin and nitric oxide gas, has been shown to be a potent anti-tumor agent. NO-Cbl will soon enter FDA Phase I clinical trials and a reliable serum extraction method for NO-Cbl is needed for pharmacokinetic analysis. This study investigates conditions to accomplish solid phase extraction (SPE) of NO-Cbl from buffered aqueous media. Ten different SPE phases and eight different solvents (Acetone, Methanol, DMSO, THF, DMF, DEE, Ethyl Acetate, and 2-PrOH) were tested at pH 5, 6, 7 and 8 with 200 $\mu\text{g/mL}$ NO-Cbl in 0.10 M acetate, phosphate or TRIS buffer. The buffered NO-Cbl solutions (1 mL) were added to washed SPE columns, allowed to soak, eluted with an organic solvent to a fixed volume and analyzed spectrophotometrically at 450 nm. The absorbance of the eluent (A) was compared to a 200 $\mu\text{g/mL}$ standard in methanol (B) and % recovery calculated as $(A)/(B) \times 100$. All pure solvents had zero absorbance at 450

nm so methanol could serve as a universal blank. Current results indicate that eluting NO-Cbl with methanol on a C-8 or a C-18 phase at pH 7 with TRIS buffer produced an 85% recovery of spiked NO-Cbl. Other phases and solvent and pH variants were less effective (under 40%) with the conditions used. The results suggest the best conditions to use for plasma or serum extraction of NO-Cbl. Further studies are underway to evaluate the need for deproteinization prior to SPE and concentration linearity for extracted standards in buffer and plasma.

Poster Board No. 031 FLUORESCENT DERIVATIZATION OF NITROSYLCOBALAMIN WITH CARBAZOLE-9-CARBONYL CHLORIDE FOR HPLC. Taylor Sherrod (taylorsherrod@walsh.edu), Michael J. Dunphy (mdunphy@walsh.edu), Walsh University 2020 E. Maple St N. Canton OH 44720 and Joseph A. Bauer (jbauer@uakron.edu), Bauer Research Foundation, 411 Wolfe Ledges Parkway, Suite 105, Akron OH 44311.

Nitrosylcobalamin (NO-Cbl), a structural analogue of vitamin B12, is a potent anti-tumor agent with potential use in cancer therapy. Pharmacokinetic studies for NO-Cbl will require a method to detect and quantify NO-Cbl in the range of 50-2000 pg/mL in plasma. An HPLC procedure for NO-Cbl developed last year was able to reach a detection limit of 20 $\mu\text{g/mL}$. This study examines derivatizing NO-Cbl with Carbazole-9-Carbonyl Chloride (C9C) to form a fluorescent ester with a high quantum yield to lower the prior detection limit into the mid-pg/mL range. Preliminary data suggest that the C9C is likely to attach to the primary or secondary alcohol of the ribose component of the cobalamin structure with conditions mild enough to maintain the integrity of the labile Cobalt-NO bond. NMR and HPLC data with derivatized methanol, ethanol and phenol provide chemical shift and retention time evidence that the C9C forms an ester with the alcohols when mixed in acetonitrile and pyridine and heated under anhydrous conditions at 400°C. NO-Cbl, dissolved in acetonitrile and treated similarly, also exhibited fluorescence with a derivative peak separated from the underivatized C9C with a retention time expected for higher carbon content on the derivative. NMR and HPLC results obtained to date indicate that C9C is reacting with NO-Cbl to form a derivative which is amenable to HPLC analysis. Current work is focused on determining synthetic yield of the derivatization process, derivative structure and ultimately use of the derivatization for reliable quantitative analysis of NO-Cbl in biological fluids.

Poster Board No. 032 CHARACTERIZATION OF A POLYMER ELECTROLYTE MEMBRANE FUEL CELL USING A PLATINUM-BISMUTH ALLOY CATALYST. Michael Dempsey (michaeldempsey@walsh.edu), Jennifer Rampello (jenniferrampello@walsh.edu), Peter J. Tandler (ptandler@walsh.edu), Walsh University 2020 East Maple Street, North Canton, OH 44720.

Growing energy demands are straining the supply of fossil fuels. Research into hydrogen fuel cells, specifically Polymer Electrolyte Membrane Fuel Cells (PEMFCs), has grown exponentially to alleviate these problems. The PEMFCs are a very promising alternative energy source where the electrochemical energy stored in H_2 is harnessed. The PEMFC breaks down hydrogen into protons and electrons at the anode. The protons pass from the anode through the Polymer Electrolyte Membrane (PEM) to the cathode where oxygen is reduced to form water and heat. One issue with hydrogen fuel cells is they are inefficient at low temperatures. Because PEMs must be hydrated in order for hydrogen ions to cross them, the fuel cell temperature must stay below 1000°C. Consequently, the reactions at the anode and cathode must be catalyzed. The most commonly used catalyst is platinum which has unresolved issues with efficiency, longevity, and expense. An annealed platinum-bismuth catalyst has recently been shown to enhance the activity of the reaction at the hydrogen electrode compared with the platinum electrode

and a non-annealed Pt-Bi catalyst. The mechanism for enhancement is not well understood but presumed to be associated with the electronic effects due to bismuth. The Pt-Bi catalyst will be characterized using cyclic voltammetry and chronoamperometry. We hypothesize that the Pt-Bi catalyst lowers the onset potential of hydrogen oxidation and that the Pt-Bi catalyst will be less sensitive to carbon monoxide poisoning.

Poster Board No. 033 INVESTIGATION ON THE EVALUATION OF BIO-(GREEN) AND SYNTHETIC POLYMERS AS CALCIUM SULFATE DIHYDRATE (GYPSUM) SCALE INHIBITORS FOR INDUSTRIAL WATER SYSTEMS. Robert T. Landgraf (Robertlandgraf@walsh.edu), Jeremy Penn, and Z. Amjad, Division of Mathematics and Sciences, Walsh University, 2020 E. Maple Street, N. Canton, OH 44720.

In industrial water systems, untreated water poses serious operational challenges including scaling, corrosion, microbiological contamination, and suspended matter. Scaling is an adherent deposit of inorganic salts caused by precipitation of sparingly soluble salts on equipment surfaces. Common precipitants include sulfate, carbonate, fluoride, and hydroxide salts of alkaline earth metals. The most common approach to control scale formation involves addition of low concentration (few parts per million) of water soluble additives to the process water. In the present study, two types of polymers have been investigated as gypsum inhibitors by the spontaneous precipitation method. The polymers tested include: a) biopolymers such as lignosulfonate (LS); poly-aspartic acid (PAS); and carboxymethyl-inulin with different degrees of carboxylation (CMI), and b) synthetic polymers such as poly-acrylic acid (PAA); poly-methacrylic acid (PMAA); and poly-vinylpyrrolidone (PVP). Polymers containing carboxylic acid ($-\text{COOH}$) groups i.e., PAA, PAS, PMAA, CMI, etc., exhibit excellent performance in inhibiting gypsum scale formation. Under similar experimental conditions, polymers that are devoid of $-\text{COOH}$ groups i.e., LS, PVP exhibit poor performance as gypsum inhibitors. The data also show that performance of inhibitor increases with increasing inhibitor concentration. The effect of polymer addition on the crystals of gypsum morphology and structures were examined through scanning electron microscopy and X-ray diffraction studies. Scanning electron micrographs show that gypsum crystals formed in the presence of PAA, PMA, and CMI are highly modified compared to crystals formed in the absence of polymer. X-ray diffraction data confirms that only gypsum phase was formed in the absence and presence of polymers.

Poster Board No. 034 LONG TERM DECAY AND N DYNAMICS OF COARSE WOODY DEBRIS FROM RED PINE AND RED MAPLE. Charles McLaugherty (mcclauca@mountunion.edu) and Ian Laughlin, Dept. of Biology, Univ. of Mount Union, Alliance, OH 44601.

Decomposition of woody plant litter is closely related to nutrient cycling, playing a vital role in the storage and regeneration of nutrients. Freshly cut logs of Red Maple (*Acer rubrum*) ($n=80$) and Red Pine (*Pinus resinosa*) ($n=87$), each 1 m long and with diameters ranging from 20 to 50 cm were collected at the Harvard Forest, Petersham, MA. The logs were measured, weighed and subsamples collected to determine initial density and N concentration. The logs were incubated in September 1990 on the forest floor of adjacent forest stands dominated by the respective species. Collections were made during the intervening years with a final collection in October 2012. The residual wood was classified into two structural categories: firm and friable. Firm wood of both species retained much of its original strength and density but friable wood was fragmented and flexible. Initially, Red Maple contained 0.1 % N ($n=10$) and Red Pine 0.06 % N ($n=10$). After 22 years, N concentrations of hard Red Maple wood had increased significantly to 0.18 % N, almost 2 times initial values. After 22 years, N concentrations of friable Red Maple wood had significantly

increased to 0.50 % N, almost 5 times initial values. For Red Pine, the N concentration of hard residue after 22 years was not significantly different at 0.05 % N. However, friable Red Pine increased significantly to 0.34 % N, almost 6 times initial value. Means were compared with a t-test ($n=11$ for Red Pine and $n=10$ for Red Maple). These long-term results demonstrate the importance of coarse woody debris in retaining N and C in unharvested forest ecosystems.

Poster Board No. 035 SECONDARY SUCCESSION ON A FORMER GOLF COURSE AT ACACIA RESERVATION (MAYFIELD HEIGHTS, OH). Steven J. Shavel (sshavel11@students.ndc.edu) and Tracey Meilander (tmeilander@ndc.edu), Notre Dame College, 4545 College Road, South Euclid OH 44121.

Acacia Reservation, a former golf course and country club, is the most recent addition to the Cleveland Metroparks. The reservation includes 155 acres within the Euclid Creek watershed including a riparian stream dominated by beech and maple trees. Maintenance of the golf course greens was discontinued in spring 2013. The Cleveland Metroparks plans to restore a portion of Acacia Reservation to beech-maple forest. The purpose of this research project is to estimate the rate of secondary succession of beech and maple trees at the former golf course. The focus of the study is on hole number 4, a site that includes elevation changes and a nearby riparian stream. The number of saplings were counted within quadrants along three transects along the rough, one transect along the green, and one transect along the tee box. The distances of the saplings from the riparian edge were recorded. Saplings were identified to genus. Soil samples along each transect were obtained with a soil auger. Soil pH, phosphate concentration, and nitrogen concentration were estimated using a LaMotte soil testing kit (#5928). Some of the questions that will be studied in this project include – What types of sapling trees are identified? Do differences in soil nutrient concentration change the rate of succession in different zones of the golf course? The rate of succession will be measured by counting sapling trees at set dates. We hypothesize that succession will be more rapid on the rough and fairway and along regions with higher nutrient concentrations. The results of the project have the potential to inform rates of succession and their relationship with nutrient concentrations in restored ecosystems such as golf courses.

Poster Board No. 036 AMPHIBIANS INTRODUCTION INTO A RESTORED VERNAL POOL AT THE NATURE CENTER AT SHAKER LAKES – IS IT POSSIBLE? Matti Tygret¹, Justin Evans², Sarah Cech², and Tracey Meilander¹, ¹Department of Biological Sciences, Notre Dame College, South Euclid, OH ²The Nature Center at Shaker Lakes, Shaker Heights, OH.

Temporary filling in the springtime, vernal pools have an important role in the woodland ecosystem, specifically in the life cycle of amphibians by providing a window of opportunity for growth and reproduction to occur. Vernal pools can differ among their cycles, nutrients, and other characteristics; however the same basic factors influence their trends: temperature, pH, sunlight, hydrological cycle, dissolved oxygen, weather conditions, nutrients, vegetation and community structure. The Nature Center at Shaker Lakes (NCSL) in Shaker Heights, Ohio has a short-cycle vernal pool, degraded in 2003 and restored in late 2010. This pool is categorized as fall-filling, although the sources of snow melt, rain water, and run off, replenishing the water levels throughout the spring. The wet period for this pool should be long enough to allow the amphibians to complete their life cycle. The purpose of this research project is to investigate water quality parameters in the vernal pool to determine if spring conditions would support an amphibian introduction. Water quality parameters, abiotic factors, and biotic factors were observed and documented from January-May 2013. Phosphate, nitrate, and ammonia concentrations were estimated using a HACH water quality test kit. Dissolved oxygen levels

were determined using the Winkler method. An inverse relationship between phosphate and dissolved oxygen was observed: phosphate concentrations were above normal, as high as 5.0 mg/L during some weeks. The highest concentrations were associated with activity of Canada geese at the vernal pool. DO concentrations average 6.63 mg/L over the collection period. Periods of hypoxia with dissolved oxygen concentrations of 5.7 mg/L were observed. Based on the intermittent low dissolved oxygen concentrations, it is not currently advisable for NCSL to introduce amphibians or amphibian eggs into the vernal pool. Continued research is necessary to expand the study of factors impacting the water quality in the vernal pool.

Poster Board No. 037 USING CHLAMYDOMONAS TO INVESTIGATE CONCEPTS OF CELLULAR ASYMMETRY AND MOVEMENT. Magenta Tygret¹, Mark Thompson², Carol Dieckmann², ¹Department of Biological Sciences, Notre Dame College, South Euclid, OH, ²Department of Life Sciences, University of Arizona, Tucson, AZ.

Research of the eyespot organelle in *Chlamydomonas* green algae cells provides information about the asymmetric properties of the cytoskeleton, organelle biogenesis, and the movement response a cell has to light based on its structure. The direct relationship between asymmetry and movement is seen in *Chlamydomonas* by the influence the eyespot location has on determining which direction for the cell to move. An eyespot reforms after each cell division as the result of a group of proteins that cooperate together including photoreceptors along the plasma membrane and pigment granules in the chloroplast. *Chlamydomonas* cells have two photoreceptors, Channel rhodopsin 1 and 2 (ChR1 and ChR2), which are coded on the COP3 and COP4 genes, respectively. ChR1 and ChR2 are activated by light to aid the cell in phototaxis; however, other functions of the photoreceptors are unknown. Creating a double photoreceptor mutant, Δ COP3/ Δ COP4, will allow researchers to identify the role of the photoreceptors in formation and localization the eyespot. After screening approximately 5,000 transformants for a mutation in the COP4 gene in the Δ COP3 background for the hypothesized inability to phototax, five mutants were found unable to respond to light. Of those five mutants, one had an insertion in the DNA that disrupted proper formation of the eyespot. By sequencing the DNA around the insertion site of the mutant and comparing it to the *Chlamydomonas* genome, it was determined that the mutation was probably occurring in one or more genes on Chromosome 12. Further research is required to identify the role of the genes on Chromosome 12 and how the disruption of these genes impairs the formation and localization of the eyespot, due to the unidentified function of the genes. Identifying the properties of these new genes as well as the characteristics of the double photoreceptor mutant, which was not found in this screening, will give better understanding to the asymmetric properties of the cytoskeleton, organelle biogenesis and movement response in *Chlamydomonas* cells, which can be more generally applied to all eukaryote cells.

Poster Board No. 038 DEVELOPING A BASE-LINE DATA SET OF WESTERN CORN ROOTWORM POPULATIONS IN VARIED CORN PRODUCTION SYSTEMS IN OHIO. Curtis E. Young (young.2@osu.edu), Ohio State University Extension, Van Wert County, 1055 South Washington Street, Van Wert OH 45891.

Western corn rootworm (WCR), *Diabrotica virgifera virgifera*, is an important pest of corn (*Zea mays*) in the Corn Belt. Extensive research has gone into the management of this beetle including the development of soil insecticides and genetically modified (GM), rootworm-resistant corn hybrids. These GM corn hybrids were rapidly adopted, however resistance to one of these GM corn hybrids has already developed in Mid-western production fields. The goal of this project was to establish current base-line population levels of WCR in corn

production fields under various management practices before resistant populations of WCR develop in Ohio. On-farm production fields (N=40) were sampled for 6-8 weeks (9 Jul.-6 Sep. 2013). Corn production systems were described as: 1) first-year corn following soybeans planted with non-GM, rootworm-resistant corn hybrids; 2) first-year corn following soybeans planted with GM, rootworm-resistant corn hybrids; and 3) continuous corn planted with GM, rootworm-resistant corn hybrids. Six Scentry Multigard yellow sticky traps were deployed into to each field at a minimum of 60 feet from any field edge and 100 feet between each trap. Traps were replaced weekly and the numbers of WCR beetles were recorded for each trap. WCR was present in all corn production systems. Adult WCR were captured throughout the trapping period. The mean total numbers of WCR beetles captured per field during a common 6-week trapping period were 1,388 (range = 182-4,581) beetles, 266 (range = 47-584) beetles and 3,307 (range = 93-9,325) beetles respectively for the above systems. Resistance to GM, rootworm-resistant corn hybrids might already exist in Ohio.

Poster Board No. 039 HOMOLOGY MODELING AND ANALYSIS OF THE INTERACTION BETWEEN FTY-720P AND THE G PROTEIN-COUPLED RECEPTORS-S1PR'S. Jonathan Miller (jonathansmiller3@gmail.com), 700 25th St NW Canton OH 44709.

Fingolimod (FTY720) is an immunosuppressant derived from ISP-1 (myriocin), an immunosuppressive natural product isolated from *Isaria sinclairii*. FTY720 is in clinical trials for multiple sclerosis (MS). Sphingosine-1-phosphate (S1P), an immune system modulator, is involved in the body's response to cancer and MS. Clinical trials have shown that phosphorylated FTY720 (FTY720P) is an agonist on four of the five S1P receptors: S1PR1, S1PR3, S1PR4, and S1PR5. The method proposed involves relating computationally modeled binding affinities to drug potency. Since the crystal structures of the S1P receptors were not known, homology modeling was utilized to obtain 3D structures homologous to the receptors. Yet Another Scientific Artificial Reality Application (YASARA) was the computational application used for homology modeling. YASARA was used to dock FTY720P into the homologues. The binding affinities between the drug and receptors were then calculated. The computational results obtained indicate alignment with clinical studies showing potential benefit of the proposed method. The published results from the clinical trials indicate strong interactions between FTY720P and S1PR1, S1PR3, S1PR4, and S1PR5; our results indicate the same. Further research using YASARA is in progress to clarify and solidify the results. Software created by Schrödinger is being evaluated for use in providing additional research results.

Poster Board No. 040 CARBON DIOXIDE EFFLUX FROM SOILS: THE EFFECT OF N FERTILIZATION ON FIELD AND WOODLAND ALFISOLS. Eric A. Genshock (genshock@mountunion.edu), Dept. of Biology, Univ. of Mount Union, 1972 Clark Ave., Alliance, OH 44601.

Land management influences carbon dioxide efflux from soils. This study examined carbon dioxide efflux in adjacent forest and field communities on a Canfield silt loam (Alfisol) in Washington Township, Stark County, OH. Additionally, the response of carbon dioxide efflux to a moderate addition of ammonium nitrate was examined. Efflux was measured from June 7th until July 12th, 2013 in 20 circular plots, each with an area of 71.6 cm², in each community. Gas efflux was measured with a LiCOR 6400-09 IRGA. Initially field plots produced significantly more carbon dioxide than forest plots. On June 17th ammonium nitrate, in solution, was applied at a rate equivalent to 150 pounds per acre to half the plots in each community. After ammonium nitrate was added the amount of carbon dioxide efflux relative to control plots increased by 58% (t-test, n=10, p < 0.001) in the forest while the field increased by 56% (t-test, n=10,

$p < 0.001$). This increase was short lived for forest plots which decreased to normal levels within a few days, while field plots continued to release higher amounts of carbon dioxide than their controls. Field plots produced 7.9 kg hr⁻¹ ha⁻¹ while after the addition they produced 10 kg hr⁻¹ ha⁻¹. Considering the amount of agricultural land receiving ammonium nitrate fertilizers, large amounts of carbon dioxide could be transferred to the atmosphere from this practice. The forest had a lower overall carbon dioxide output, possibly due in part to a 1.9 C lower mean temperature (19.1 C vs. 17.2 C, $n > 2500$).

Poster Board No. 041 PHYLOGENY OF ZOANTHIDS (PHYLUM: CNIDARIA; ORDER ZOANTHARIA) GENERATED FROM NUCLEAR AND MITOCHONDRIAL SEQUENCES. Jessica Gordon (gordonj@findlay.edu), Courtney Timmons (timmonsc@findlay.edu), Cameron Koepp (koeppc@findlay.edu), and Jessica Wooten (wooten@findlay.edu), The University of Findlay Department of Natural Sciences 1000 N. Main St. Findlay, Ohio 45840.

Zoanthids are common corals known for their difficult taxonomy and variances in morphology. Thus, traditional biological analyses have been unreliable due to extensive morphological homoplasy. Zoanthids have a worldwide distribution and can be found in nearly all marine environments. Morphologically, they are soft polyp corals that form colonies at various depths in the ocean; these colonies are easily propagated and are important in the pet trade. However, this is of conservation concern because many groups of these corals are endangered and nearing extinction; overharvesting has afforded them conservation status and protection. The aim of this project is to examine the phylogenetic relationships of zoanthids that are commonly distributed by aquarium hobbyists. Live zoanthid colonies were obtained from aquarium stores and hobbyists. Individual polyps were dissected from the colonies, DNA was extracted, and 16S rRNA was amplified using polymerase chain reaction (PCR). The PCR products were sequenced and analyzed. A total of 93 individual polyps were sequenced and used in the alignment with approximately 900 base pairs for the 16S rRNA portion of the mitochondrial genome. Our findings supported the accepted hypothesis that the 16S rRNA gene portion is variable and useful for the delimitation of taxa to the species-level. Interspecific variation was uncovered across at least six zoanthid genera; however, some samples failed to group with any nominal taxa. Because zoanthids exhibit extensive morphological variation, the taxonomy is complicated and the delimitation of phylogenetic structure can be challenging. Thus, more data are needed to make any taxonomic conclusions.

Poster Board No. 042 MULTIPLE APPROACHES TO IDENTIFYING UNIQUE LINEAGE DISTRIBUTIONS IN THE OCMULGEE SLIMY SALAMANDER, PLETHODON OCMULGEE (CAUDATA: PLETHODONTIDAE). Ingrid Godfrey (godfreyi@findlay.edu), Kayla Huffman (huffmank@findlay.edu), Ameila Sikora (sikoraa@findlay.edu), Mollie Burwinkel (burwinkel@findlay.edu), Carlos D. Camp, Ph.D. (Piedmont College, Demorest, Georgia), and Jessica A. Wooten, Ph.D. (wooten@findlay.edu), The University of Findlay Department of Natural Sciences 1000 N. Main St. Findlay, Ohio 45840.

Plethodon ocmulgee (Ocmulgee Slimy Salamander) is a large slimy salamander in the Plethodontidae, which is the largest family of extant salamanders with over 350 described species. *Plethodon ocmulgee* was described in 1989 using allozyme data, and currently has a small distribution that extends from the upper coastal plain and adjacent piedmont physiographic provinces of central Georgia associated with the Ocmulgee River drainage. We combined phylogeography and ecological niche modeling (current and paleo) to examine unique cryptic lineages and to estimate the abiotic and biotic factors that may limit the geographic distribution of the *P. ocmulgee* throughout the known geographic range. Sequences totaling approximately 1800 base pairs for the cytochrome b, 12S valine transfer,

and NADH dehydrogenase 2 portions of the mitochondrial genome were analyzed to create a phylogenetic hypothesis to delimit evolutionary relationships within this group. Maximum likelihood and Bayesian methods were used to reconstruct the phylogeny. Preliminary analyses revealed three unique clades partitioned by geologic age; the clade with the shortest branch length includes individuals from regions of the youngest geologic age. These findings correspond to the varied geologic history of the coastal plain in Georgia. Ecological niche modeling, using presence-only data, showed that abiotic requirements of temperature and precipitation limit the geographic distribution of *P. ocmulgee*. Further sequencing may reveal additional unique evolutionary lineages within this group.

Poster Board No. 043 PHYLOGEOGRAPHY OF A SMALL-RANGED PLETHODONTID SALAMANDER SPECIES, WEBSTER'S SALAMANDER, PLETHODON WEBSTERI (CAUDATA: PLETHODONTIDAE). Tyler Fields (fieldst@findlay.edu), Claire Rolli (rollic@findlay.edu), Carlos D. Camp (Piedmont College, Demorest, Georgia), Sean Graham (graham@findlay.edu), and Jessica A. Wooten (wooten@findlay.edu), The University of Findlay Department of Natural Sciences 1000 N. Main St. Findlay, Ohio 45840.

Plethodon websteri is a small woodland salamander in the Plethodontidae. *Plethodon websteri* is endemic to the southeastern United States and has a disjunct distribution with populations scattered from eastern Louisiana, Mississippi, Alabama, Georgia, and western South Carolina. The objective of this study was to investigate the phylogeographic patterning among these isolated *P. websteri* populations across the southeastern United States. The cytochrome b portion of the mitochondrial genome was sequenced, and phylogenies were reconstructed using Bayesian and maximum likelihood methods. Branch support was assessed using maximum likelihood bootstrap values. Ecological niche models were constructed from presence data using Maxent. Unique climate and vegetation variables were extracted using DIVA-GIS to determine the suite of variables preferred by *P. websteri*. Preliminary analyses revealed a number of lineages that were weakly supported, but there was strong support for the separate lineages. Using only one mitochondrial gene portion may not be sufficient to accurately reflect the actual level of genetic diversity across these disjunct populations. Ecological niche modeling showed that abiotic requirements of temperature and precipitation limit the geographic distribution of *P. websteri*. The ecological niche model over predicted the geographic distribution of *P. websteri*, which implies that other factors may limit their distribution. To further this project, the addition of a nuclear gene, which is under neutral selection, will be used in an attempt to clarify the phylogeny and to gain an understanding of the factors that are influencing the distribution of genetic lineages in *P. websteri*.

Poster Board No. 044 CHARACTERIZATION OF THE HOXD-12 GENE REGION IN AMPHIBIANS AND REPTILES. Marie McKinnon (mckinnonm@findlay.edu), Elizabeth Sablotny (sablotnye@findlay.edu), and Jessica A. Wooten (wooten@findlay.edu), The University of Findlay Department of Natural Sciences 1000 N. Main St. Findlay, Ohio 45840.

Hox genes are major regulators in development and dimensional organization in tetrapods and other metazoans. Even though these genes possess highly conserved homeobox regions, high levels of diversity have been revealed in their number, organization, and expression patterns. Further, transcriptional products of Hox genes are important in limb and positional development in metazoans. Therefore, it is likely that there is a significant correlation between Hox expression and morphological evolution, particularly since limb development is directly associated with tetrapod evolution and the establishment and success of terrestrial life. These factors make exploring the evolution of Hox genes vital to the understanding of vertebrate evolution,

especially since new Hox gene clusters have been recently discovered. In amphibians, there are fifteen distinct posterior Hox genes and one retro-pseudogene described. The aim of this project is to characterize Hoxd-12 gene across several species of amphibians and reptiles, which vary in digit number, to determine if this gene is present or absent. Then, using methodologies of population genetics, sequence differences, mutation rates will be compared and evolutionary relationships inferred. Sequence analyses of the Hoxd-12 gene will reveal patterns of morphological evolution in amphibians and reptiles. It is predicted that the Hoxd-12 gene will be present in some species of interest, but not in others. If the Hoxd-12 gene is responsible for the development of the fifth digit, then species containing five digits will possess this gene, and Hoxd-12 gene will be absent or missing the key regulatory sequences in species lack limbs or fifth digits.

Poster Board No. 045 A COMPARISON OF CHEMICAL ENHANCEMENTS FOR THE DETECTION OF LATENT BLOOD USING EDTA-ANALOG. Marissa R. Bussard (mbussard001@defiance.edu) and Somnath Dutta, Ph.D. (sdutta@defiance.edu), Mailbox 489 701 N. Clinton Street, Defiance, OH 43512.

Blood is often found at crime scenes and collected in EDTA (ethylenediaminetetraacetic acid) vacuum tubes to prevent coagulation. EDTA coated blood does not impact the sensitivity of blood detection screening significantly. Latent blood can be detected by several enhancement methods, including the use of luminol, and commercially produced, stable fluorescein reagents, such as Bluestar[®] reagent, and the Hemascein[®] reagent. Diethylenetriaminepentaacetic acid (an EDTA-analog) has more polar groups to dissolve in blood and may impede blood screening. The enhanced solubility of blood by EDTA-analog should decrease sensitivity of enhancing agents and may render higher incidents of false negatives. This project compares the sensitivity and specificity of the three previously mentioned methods on synthetic blood that is treated with EDTA-analog and synthetic blood that is not treated, on several different surfaces (cotton fabric, jean material, rug, and foam flooring), and with several other substances that can cause false positive results in these methods (bleach, floor cleaner, canned tomato juice, potatoes, and turnips). False positive results are due to the presence of naturally occurring compounds that fluoresce under similar conditions. Serially diluted blood will be tested on the different surfaces (three samples for each surface) with the luminol, Bluestar[®] reagent, and Hemascein[®] reagent (three samples for each reagent). Known false positive substances (three samples for each substance) will also be tested with the three reagents.

Poster Board No. 046 MUTATION RATE ASSAY IN PRESENCE OF SECONDARY METABOLITES OF FUNGAL EXTRACTS. Dr. Michael Edebrock (Edelbrock@findlay.edu), Kaleigh Kenny (kennyk@findlay.edu), Dakota Bennett (bennettd@findlay.edu), The University of Findlay.

Fungi are important in the production of medicine, accounting for more than 10-20% of the most profitable human drugs. Some of the most well known drugs are the anti-cholesterol statins (*Phoma* sp.), the antibiotic penicillin (*Penicillium crysogenum*), and the immunosuppressant cyclosporine A (*Aspergillus terreus*). These medicines are critical for the maintenance of human health. Fungi are extraordinary metabolite and novel compound producers. They form unique complex molecules, many of which possess antimicrobial activity. Fungal bioprospecting is ideal for discovering new molecules useful in modern medicine. This remains an important topic in biotechnology and many cutting edge research laboratories. We started growing our specific cell lines through four passages before culturing in HAT media for four more passages. This removed existing *hprt* mutant cells. Cells were then treated with low concentrations of DMW 590 (administered of 1 μ L of 1:10, 1:100, and 1:1000 dilutions). Cells were then placed on media 6-thioguanine

(10 μ M). This selected for *hprt* mutants. Cell colonies were stained with crystal violet and counted. The number of colonies that survived indicated the frequency of mutation at the *hprt* locus. Fungal extracts appeared to produce the greatest number of mutant colonies at 1 μ L of the 1:1000 dilution. Preliminary results lead us to conclude that DMW-590 may have anti-cancer properties. Now our focus is testing this compound on HeLa cells, a tissue less prone to mutations than HCT116.

Poster Board No. 047 THE ROLE OF BUMETANIDE IN ACUTE KIDNEY INJURY (AKI) IN EXTREMELY LOW BIRTH WEIGHT (ELBW) INFANTS. Karen A. Kruzer (kak123@case.edu), rmerheb@metrohealth.org, mmhanna@metrohealth.org, 10900 Euclid Avenue, Cleveland, OH 44106.

Survival of extremely low birth weight (ELBW) infants continues to improve and is associated with prematurity and critical care related morbidities such as acute kidney injury (AKI), which affects 8% to 24% of all infants admitted to NICUs. The objective of this research was to determine the effect of Bumetanide (Btd) in AKI in ELBW infants. In a retrospective cohort study, all ELBW infants born at MetroHealth with AKI were enrolled (Jan 2000 – Jan 2013). Medical records were reviewed for infant characteristics, serum creatinine, blood pressure and anthropometric values in survivors. 797 ELBW infants were admitted to the NICU, of whom 12% (96/797) developed AKI. Among infants with AKI 34% (33/96) received Btd. Infants with AKI had a birth weight (BW) of 643.7 \pm 149.3 g, and a gestational age of 24.9 \pm 2.2 wks. Infants who received Btd had a lower BW and higher severity of illness scores than their controls [589.0 \pm 117.7 vs. 672.3 \pm 156.9; p=0.004 and 59.5 \pm 15.6 vs. 50.6 \pm 17.4; p=0.01 respectively]. At the day of onset of AKI, there were more infants with oligo-anuria in the Btd than in the control group [61% (20/33) vs. 17% (11/63); p<0.05]. During the first week following AKI onset, infants who received Btd became non-oliguric, and their daily urinary outputs became non-significantly different from their controls; however their serum creatinine became significantly higher than their controls (ANOVA; p<0.05). Findings demonstrated that in ELBW infants with AKI, Btd achieved a non-oliguric state at the expense of increasing serum creatinine during treatment. Btd did not have an effect on serum creatinine in AKI survivors at the time of NICU discharge.

Poster Board No. 048 THE EFFECT OF SOIL TEXTURE ON EXOTIC EARTHWORM DIVERSITY IN HANCOCK COUNTY, OHIO. Glynnis L. Prigge (prigge@findlay.edu) and Benjamin J. Dolan, Ph.D. (dolan@findlay.edu), The University of Findlay, 1000 N. Main St. Findlay, OH 45840.

Invasive earthworms can be damaging to forest ecosystems, because they alter soil structure, chemistry, and nutrient dynamics, and they harm vegetation by consuming roots and leaf litter, which may be necessary for maintaining soil moisture or for seed germination. The earthworm populations of the Great Lakes Region are non-native, because Wisconsinan-age glaciers eliminated soil dwelling organisms, and the natural spread of earthworm populations is too slow to have invaded much of the region. This project aims to examine the diversity of earthworms in northwest Ohio, and in particular, we propose to investigate community composition along a gradient of soil textures from clay to sandy-loam. Fine-textured soils drain slowly and become easily compacted, but the smaller clay minerals bind well with essential nutrients. Coarse-textured soils drain faster and are easier to cultivate, which could either improve success of earthworm colonization or increase dominance of a particular species. It is hypothesized that larger invasive species, such as *Lumbricus terrestris*, will dominate coarse-textured soil, and that diversity will increase along the gradient to finer-textured soils. To examine this, earthworms will be collected at five locations along three, 50 m transects using a mustard extraction technique. Each transect will

traverse a clay to sandy-loam texture gradient at three different forest locations in Hancock County, OH. Mature earthworms will be identified to species level, and changes in diversity will be tested using a regression analysis. Differences may assist in restoration programs that need to focus efforts in high-risk areas.

Poster Board No. 049 IDENTIFICATION AND QUANTIFICATION OF RELAXIN RECEPTOR (RXFP-1) SPLICE VARIANTS EXPRESSED IN RAT ADVENTITIAL FIBROBLASTS. Veronica Ringel (veronicaringel@walsh.edu), Jacqueline Novak (jnovak@walsh.edu), Adam Underwood (aunderwood@walsh.edu), Walsh University, 2020 East Maple St., North Canton OH 44720.

Relaxin is a peptide hormone whose activity is mediated predominantly through the full length relaxin family peptide (RXFP) receptor 1. In addition to full length RXFP-1, a truncated nonfunctional splice variant has been identified that can bind relaxin. Relaxin is secreted into circulation from the corpus luteum of the ovary and its binding to full length RXFP-1 has been linked to modifications to placental, renal and systemic blood flow due to vasodilatation. These effects are believed to contribute to reduced risk of cardiovascular disease in premenopausal women. However, after menopause circulating levels relaxin drop and cardiovascular disease surpasses that of equally aged men. Thus administration of relaxin may be a means to curb cardiovascular disease in these individuals. However, there is a need to determine if RXFP-1 and/or the truncated variant is expressed in postmenopausal cardiovascular tissues. To address this question tissue explants of aortic fibroblasts derived from an animal model of human menopause, Long Evans rats with ovaries removed and pair-fed for 12-14 weeks will be generated. Explants will also be generated from the control animals, which are subjected to a sham surgery yet retain ovaries. From these aortic fibroblast explants (N=3 aorta, each assayed in triplicate) total RNA will be extracted and cDNA synthesized using Life Technologies High Capacity cDNA Synthesis Kit. From this cDNA the relative expression ($\Delta\Delta CT$) of full length and truncated RXFP-1 transcripts will be examined using real-time PCR with 18S as an endogenous control. Final values will be expressed as the ratio of RXFP-1 to 18S.

Poster Board No. 050 MEASUREMENT OF COLLAGEN TYPE 1 DEPOSITION FROM ADVENTITIAL FIBROBLAST EXPLANTS DERIVED FROM OVARECTOMIZED LONG EVANS RATS. Hillary Henderson¹ (hillaryhenderson@walsh.edu), Denise Boyd¹ (deniseboyd@walsh.edu), Jacqueline Novak¹ (jnovak@walsh.edu), Rolando JJ Ramirez² (rjr@uakron.edu), Adam Underwood¹ (aunderwood@walsh.edu), ¹Walsh University, 2020 East Maple St., North Canton OH, 44720 and ²The University of Akron, Dept. of Biology, 302 E Buchtel Ave, Akron OH, 44325.

The prevalence of high blood pressure and cardiovascular disease is lower in premenopausal women when compared to equally aged men. However, this cardiovascular condition reverses after menopause. Physiologic changes in these individuals include increased vascular tone and vessel rigidity. Vascular rigidity can be linked to elevated collagen deposition in the extracellular matrix. The goal of this project was to optimize conditions and assay deposition of collagen type 1 from aortic adventitial fibroblasts derived from an animal model of human menopause; ovariectomized (ovex) Long Evans (LE) rats pair-fed for 12-14 week. Fibroblast explants where established from 0.5-1 mm sections of thoracic aorta (from three LE Ovex animals, N=3) incubated seven days in Dulbecco's Modified Eagles Medium (DMEM) supplemented with 15% FBS in TPP® 24 well plates. Cells were then transferred to TPP® T-25 flasks in DMEM containing 10% FBS for three days. Cell identity was verified using immunoblots against the protein desmin and immunocytochemically against the protein vimentin. Cells (5×10^4) where transferred to 93 wells of a 96 well plate. The remaining three wells were

coated with 10 μ g of rat collagen type 1 positive control protein and standard (Chondrex, Inc). After 24 hours, DMEM clear was applied to the cells and incubated 72 hours. Fibroblasts were then subjected to an ELISA which detected the deposition of collagen type 1. The conditions established from this work are now being used to measure differential collagen deposition in fibroblasts derived from rat models of menopause and in the presence of gender specific hormones.

Poster Board No. 051 CEREBRAL ARTERY TONE IS INCREASED IN PREGNANT RATS WITH CHRONIC REDUCTIONS IN UTERINE PERFUSION PRESSURE. Spencer Dennis¹ (darryldennis@walsh.edu), Brittany Balser² (bab159@zips.uakron.edu), Jacqueline Novak¹ (jnovak@walsh.edu), and Rolando JJ Ramirez² (rjr@uakron.edu), ¹Walsh University 2020 East Maple St. North Canton OH 44720, ²University of Akron.

Preeclampsia is a hypertensive disorder of pregnancy. Under-perfusion of the placenta is recognized as a hallmark sign of the disease. Alterations in the maternal circulation have been well documented in preeclampsia mothers. However, animal models of the disease allow a closer examination of the impact uterine underperfusion on vascular behavior. For this reason, chose to investigate the effects of RUPP on isolated posterior cerebral arteries (PCA) harvested from control pregnant and pregnant rats with reduced uterine perfusion pressure. Normal pregnant and pregnant rats with chronic reductions in uterine perfusion pressure (RUPP) were employed for these studies. RUPP dams underwent surgery on day 14 of gestation in which sliver clips are placed on the abdominal aorta and utero-ovarian arteries resulting in utero-placental perfusion reductions similar to that of preeclampsia. At the end of gestation, the maternal PCAs were isolated from each of the groups and studied in a pressurized arteriograph. The inner diameter of each artery was measured in HEPES buffered saline solution with and without calcium at intraluminal pressures ranging from 25-200 mmHg. The percent tone was calculated for each artery at each pressure step. The tone of the PCAs isolated from the control pregnant animals was lower than the tone exhibited by the PCAs isolated from RUPP rats. For example at 125 mmHg the percent tone was $8.7 \pm 1.9\%$ in the control pregnant rats compared to $14.6 \pm 6.1\%$ in RUPP rats. From this data we conclude that placental underperfusion leads to increased vascular tone in maternal posterior cerebral arteries.

Poster Board No. 052 L-ARGININE DECREASES MYOGENIC REACTIVITY IN RENAL INTERLOBAR ARTERIES ISOLATED FROM MICE. Lawrence Woodward¹ (lawrencewoodward@walsh.edu), Margaret Rusnak² (mer47@zips.uakron.edu), Rolando JJ Ramirez² (rjr@uakron.edu), and Jacqueline Novak¹ (jnovak@walsh.edu), ¹Walsh University 2020 East Maple St. North Canton OH 44720, ²University of Akron.

Small arteries (150-200 μ m) respond to changes in intraluminal pressure to regulate flow and pressure. This phenomenon is called the myogenic response. The response occurs both in vivo and in vitro. Typically, increases in pressure cause a decrease in lumen diameter (vasoconstriction). This type of vascular behavior has been studied in resistance-sized arteries isolated from a wide variety of rat models of disease. Over the last two decades, genetically altered mice have been generated that open up new avenues of investigation. More recently, conditional knockouts have further advanced the research potential. Therefore, it is important to characterize the myogenic responses in mouse arteries. The purpose of the current study is to examine the myogenic response in resistance-sized renal arteries isolated from mice and identify the role that nitric oxide plays in these responses. For these studies, resistance-sized arteries are isolated from mouse kidneys and mounted in an isobaric arteriograph in which pressure and temperature are monitored and maintained. The arteries are incubated with L-arginine to stimulate

nitric oxide synthase or D-arginine as a control. Arterial lumen diameters were measured at 60 and 80 mmHg and myogenic responses were determined by calculating the percent change in diameter. The average arterial diameter at 60 mmHg was $142.6 \pm 23.8 \mu\text{m}$. Myogenic reactivity was decreased in mouse arteries treated with L-arginine ($5.8 \pm 0.9\%$) compared to those treated with D-arginine ($0.8 \pm 0.75\%$).

Poster Board No. 053 THE ROLE OF NITRIC OXIDE IN THE VASCULAR REACTIVITY OF CORONARY ARTERIES ISOLATED FROM POST-MENOPAUSAL RATS. Zach Thomas (zthomas.wu@gmail.com), 247 King St Ravenna OH 44266. Joseph McCarthy, Rolando JJ Ramirez and Jackie Novak – Walsh University.

Women have a decreased risk of cardiovascular disease compared to men until after menopause, when the risk is similar between men and women. The mechanism for cardioprotective effect is unclear. Nitric oxide is a potent vasodilator and is a potential mediator of the cardioprotective effects in women. However, in order to study the physiological changes, which occur in the cardiovascular system of women after menopause, it is necessary to identify animal models. One model of post-menopausal physiology is surgically removing the ovaries (ovariectomy/ovex group) and pair-feeding female Long Evans (LE) rats for 12-14 weeks. The control animals underwent a sham surgery in which the ovaries are left intact. The purpose of the current study is to determine if nitric oxide system is still active in coronary arteries isolated from 'post-menopausal' rats. Septal coronary arteries were isolated from ovariectomized and sham-ovariectomized animals and studied in pressure arteriograph system. After equilibration, diameters were measured in the presence and absence of the nitric oxide synthesis inhibitor, L-NMA over a range of pressures ranging from 20 to 100 mmHg. The pressure steps will be repeated after equilibration in calcium-free passive buffer. Percent tone was calculated $(1 - (D_{active} - D_{passive}) / D_{passive}) \times 100\%$ at each pressure step. For example, tone at 60 mmHg was $19.4 \pm 4.2\%$ in the ovex animals compared to $49.6 \pm 5.7\%$ in L-NMA treated coronary arteries ($p = 0.01$ via unpaired t-test). Treatment with L-NMA increased tone in the ovariectomized animals indicating that nitric oxide still plays a role in mediating the tone of the coronary arteries isolated from 'post-menopausal' rats.

Poster Board No. 054 CRYPTOSPORIDIUM SPP. ISOLATION AND TRANSMISSION. Jeffrey Foley (foleyj@findlay.edu), Allison James, Rachel Kalas, and Bethany Henderson-Dean, Ph.D. (Henderson-dean@findlay.edu), The University of Findlay, 100 N. Main St. Findlay OH 45840.

The identification of *Cryptosporidium* spp. from environmental samples through direct staining and morphometric differences is difficult and often unreliable. Antigenic identification of *Cryptosporidium* through immunological means is plausible but is limited to genus identification only. In the study, molecular mechanisms will be employed to identify and determine the presence and persistence of *Cryptosporidium* in bovine populations. Fecal samples were collected from 18 dairy calves, once weekly for seven consecutive weeks; the samples were then processed for total DNA extraction of all microbes. PCR will be used to screen the samples for the presence of *Cryptosporidium* spp. The samples will be sequenced and analyzed to identify isolated to the species level and to determine if there is a common source of infection within the population.

Poster Board No. 055 EFFECTS OF JOINT ADMINISTRATION OF BACTERIOPHAGE AND ANTIBIOTICS ON GROWTH IN GRAM-NEGATIVE BACTERIA. Danielle J. Davis (Daniellejoyd@gmail.com), 227 North Manning Street Hillsdale, Michigan 49242.

As the frequency of antibiotic resistant bacteria increases, so to does the need for a new method for treating bacterial

infections. It was hypothesized that the combination of bacteriophage and antibiotics would yield a growth inhibition greater than either one separately. The purpose of this study was to test the interactions between bacteriophage and antibiotics on bacterial growth. This interaction was studied using *Escherichia coli* B, *Pseudomonas aeruginosa* K, *Pseudomonas aeruginosa* O1, and the corresponding unknown isolated bacteriophage. Phage were isolated from raw sewage using the specific bacterial strains as hosts to select for the appropriate phage. Six different antibiotics (Amoxicillin, Ampicillin, Chloramphenicol, Ciprofloxacin, Streptomycin, Tetracycline) were used and the minimum inhibitory concentration (M.I.C.) for each antibiotic was determined for all bacterial strains used. Antibiotics, at concentrations below the M.I.C., were added to top agar containing bacteria and poured onto agar plates. Paper disks were placed on solidified top agar and varying dilutions of bacteriophage were added. As a control, phage were placed on plates containing only bacteria. Zones of inhibition were determined by measuring the inhibition of lysed bacteria around the paper disks. Data analysis, using a two-way ANOVA, revealed that the results were not synonymous between bacterial strains. In *E. coli* B, there was a linear relationship between the concentration of phage and the zone of inhibition. As the concentration of phage decreased, the zone of inhibition proportionately decreased as well. The *Pseudomonas* strains, however, showed consistent diameters in zone of inhibition regardless of phage concentration. As the concentration of phage decreased, the zone of inhibition only slightly decreased, if at all, and usually maintained a consistent zone of inhibition.

Poster Board No. 056 INHIBITING AROMATASE WITH NATURALLY OCCURRING AND READILY AVAILABLE DIETARY POLYPHENOLS. Jacob L Dotson and John Means (s300626235@students.rio.edu), 3683 Centerpoint Road, Oak Hill Ohio, 45656.

According to the Center for Disease Control and the World Health Organization, breast cancer is one of the leading causes of death in females the world over. Some breast cancers are hormone dependent and spread more quickly in response to the presence of estrogens. In the treatment of these cancers, it is important to inhibit the enzyme aromatase, thus depriving the cancer cells of the estrogens needed to grow. This enzyme completes the aromaticity of the A ring in the steroid core structure in the androgen precursors and completes the biosynthesis of the estrogens, estradiol and estrone. The focus of this study is inhibiting aromatase with naturally occurring dietary polyphenols. A selection of these polyphenols will be screened with the main consideration being practical access to the foods that contain them, namely fruits and berries. Inhibition of aromatase will be characterized by observing the enzyme's behavior in a fluorescent plate reader with a kit specialized for the observation of inhibition of aromatase. The results will also be quantified in the computational program AutoDock 4.2. In the program, the selected polyphenols will be docked to a model of aromatase to obtain binding scores, where the lower values represent better docking. The in vitro results will be compared to the in silico findings to determine the most effective inhibitors and to validate the computational docking assay as a virtual screening tool for this receptor system.

Poster Board No. 057 THE EFFECTS OF VITAMIN E ON THE DEGREE OF LIPID PEROXIDATION IN THE MEMBRANE SYSTEM. Regina M. Friedl (ReginaFriedl@walsh.edu) and Nisreen A. Nusair (nnusair@walsh.edu), Walsh University, 2020 E. Maple St. mailbox # 398, North Canton OH 44720.

Membranes are vital part of all forms of life. Lipid peroxidation in membranes is of great importance because it modifies the structural and dynamic properties of the membranes, which in turn, influences the membranes' function. Lipid peroxidation in membranes plays a central role in many pathologic processes, including cancer,

Alzheimer's disease, atherosclerosis, and type II diabetes. Vitamin E is an important lipid-soluble vitamin that acts as antioxidant and protects against lipid peroxidation in membranes. In this study, different amounts of vitamin E (0 mol%, 2.5 mol%, 5 mol%, and 10 mol%) are incorporated into the model membrane system to examine how vitamin E affects the degree of lipid peroxidation in the membrane using UV-VIS Spectroscopic technique. The data show that as the amount of vitamin E increases in the model membrane system, the absorbance decreases. Henceforth, the degree of lipid peroxidation decreases. One remarkable feature of all biological membranes is their dynamic properties or fluidity. Therefore, this work is also focused on studying how the incorporation of different amounts of vitamin E into the membrane system affects the fluidity of the membrane utilizing Fluorescence Polarization (FP) Spectroscopic technique. The results indicate that as the amount of vitamin E increases in the membrane, the FP value increases. An increase in the FP value implies a decrease in the fluidity of the membrane. The attained results indicate that vitamin E serves as a structural antioxidant. Vitamin E is highly effective at preventing lipid peroxidation because its structure decreases the availability of oxygen, as well as, creates a steric hindrance to the radical chain reactions.

Poster Board No. 058 SIX WEEK CONSUMPTION OF POMEGRANATE SUPPLEMENTS DEPRESSES SERUM GLUCOSE AND LIPID LEVELS IN YOUNG FEMALE RATS. James A. Wanamaker¹ (jawanama@buffalo.edu), Emily A. Wanamaker² (eaw10@geneseo.edu), Beth B. Pritts³ (prittsb@lemoyne.edu), ¹SUNY Buffalo School of Dental Medicine, Buffalo NY 14214, ²SUNY Geneseo, Geneseo NY 14454, and ³Le Moyne College, Syracuse NY 13214.

Pomegranates have been used therapeutically since Biblical times. Manufacturers today claim pomegranate products may prevent cancer and cardiovascular disease, and lower blood glucose levels. This study evaluated the effects of pomegranate supplements on mammalian physiology in an attempt to ascertain the validity of suggested health benefits. All protocols were approved by the College's Animal Care and Use Committee. Sixty-four 21-day-old CD-IGS albino female rats (Charles River Labs) had free access to food and deionized water. Controls (con) ate a standard rat diet (Harlan Teklad Diet 8604), while experimentals (pom) consumed the same diet containing pomegranate extract (POM_xTM, PomWonderful LLC) in an amount proportional to the recommended human dosage (100 mg/kg rat diet). Animals were divided into short-term (3 weeks—3W con/swim, 3W con/nonswim, 3W pom/swim, 3W pom/nonswim) and long-term (6 weeks—6W con/swim, 6W con/nonswim, 6W pom/swim, 6W pom/nonswim) treatment groups (n=6-8 rats/group). Swimmers participated in Morris water maze trials to assess learning and memory (not reported here). Rats were anesthetized with isoflurane and terminated. Trunk blood was collected, centrifuged, and stored (-20°C) until colorimetric assays were performed. Pomegranate consumption depressed, but not significantly, (1) total cholesterol in all 6W pom rats compared to their respective controls, and (2) triglycerides in all 3W and 6W pom animals compared to their respective controls. Serum glucose levels were significantly depressed (t-test, p<0.05) in 6W pom/non-swim compared to 6W con/nonswim; these data suggested longer-term consumption of pomegranate supplements may have beneficial effects for patients with diabetes. (Supported by Le Moyne College Student Research Committee)

Poster Board No. 059 ULTRASONIC VOCALIZATION MODIFICATION IN YOUNG RATS BY POLYCHLORINATED BIPHENYL (PCB); IS THERE A DEVELOPMENTAL "WINDOW"? Hannah Duffy (hduffy@bgsu.edu), H. Casey Cromwell, and Lee A. Meserve, Bowling Green State University, Biology and Psychology Departments, Bowling Green, OH 43403.

Commercial manufacturing and widespread use of polychlorinated biphenyl (PCB) in the United States has

left lasting negative effects on the environment. These persistent contaminants continue to bioaccumulate in the food web because of their stable structure resulting in long half-life, and high lipophilicity. Adding PCB into the diet of Sprague-Dawley rats during pregnancy and lactation alters the thyroid status of offspring, as well as behavior of the dams and the pups. To examine the hypothesis that there is a critical period or "window" of development with the greatest impact of PCB exposure of females on offspring fitness, female Sprague-Dawley rats were mated and fed PCB diet (25 ppm PCB 47 and PCB 77 congeners combined in standard rat chow) during either one of five, two week "development windows", or one of three, one week "developmental windows." Ultrasonic vocalizations (USVs) were recorded on pup postnatal day (PND) 3, 7, 14, 21, and 22. Grooming (PND 14), open field (PND 21), and play behaviors (PND 22) were also observed in pups. Blood serum was also collected on PND 3, 7, 14, 21, and 22 for thyroid hormone analysis. Preliminary data show that there is a significant difference in the number of USVs emitted from pups among the window groups ($F(5,23) = 4.203$, $p < 0.01$) and also between developmental days PND 3 and 7 ($F(1,23) = 14.461$, $p < 0.001$). It is anticipated that those pups from dams given PCB diet from the start of gestation to early lactation will emit a significantly greater rate of isolation USVs, as well as altered grooming, open field, and play behavior. Further behavioral testing as well as analysis of thyroid hormone status will likely demonstrate that PCB exposure during a particular "window" of development has the greatest impact on pup behavior.

Poster Board No. 060 HYBRIDIZATION AND POPULATION STRUCTURE IN PLETHODON WEBSTERI (CADUATA: PLETHODONTIDAE) USING MICROSATELLITES. Matthew Grisnik (grisnikm@findlay.edu), Coyne Hopey (hopeyc@findlay.edu), Stacey Sponsler (sponslers@findlay.edu), Tyler Cross (crosst1@findlay.edu), Carlos D. Camp (Piedmont College, Demorest, Georgia), Sean Graham (graham@findlay.edu) and Jessica A. Wooten (wooten@findlay.edu), The University of Findlay Department of Natural Sciences 1000 N. Main St. Findlay, Ohio 45840.

Plethodon websteri (Webster's Salamander) is a small woodland salamander in the Plethodontidae, which is the largest family of extant salamanders with over 350 described species. *Plethodon websteri* is endemic to the southeastern United States and has a disjunct distribution with populations scattered from eastern Louisiana, Mississippi, Alabama, Georgia, and western South Carolina. *Plethodon websteri* is listed as an endangered species in South Carolina and as a species of special concern in Louisiana. The aim of this study was to compare and contrast microsatellite findings with maternally inherited mitochondrial DNA. Later our lab will investigate gene flow, hybridization, impacts of land use and habitat change, and population structure among isolated *P. websteri* populations in eastern Louisiana, Mississippi, Alabama, Georgia, and western South Carolina. Microsatellite primers for *Plethodon albagula* (Western Slimy Salamander) were used for the generation of microsatellite data for *P. websteri*. Samples from *P. websteri* were collected by clipping 0.5 cm of tail tissue from salamanders. Samples were stored in spectrophotometry-grade ethanol until DNA was extracted using a DNeasy DNA extraction kit. Polymerase chain reaction (PCR) was completed using the *P. albagula* primers with a modified PCR protocol. Each amplified microsatellite locus was sequenced to ensure proper motif. To date, four microsatellite loci have been amplified and sequenced, and the goal is to add at least four more. After microsatellite data generation, these data will be analyzed and compared to the mitochondrial and nuclear gene sequences generated in a related project concerning the phylogeography and population genetics of *P. websteri*.

Poster Board No. 061 PLANTING SEEDS OF SCIENCE:

ROOTS LEAVES AND STEM IN AFTER SCHOOL ENRICHMENT PROGRAMS. Colleen Baker (c-baker@onu.edu), Keaton Morris (K-morris@onu.edu), Vicki A. Motz (v-motz@onu.edu), and Linda M. Young (l-young@onu.edu), Department of Biological Sciences Ohio Northern University, Nichole Stitt (n-stitt@onu.edu), Department of Education Ohio Northern University] 402 W. College Ave Unit 0990 Ada, Ohio 45810.

To determine whether after school enrichment programs can be an effective tool in engaging middle school students in STEM learning; a series of exercises were developed to present botanical and horticultural concepts on a weekly basis throughout the academic year to students in the Bunsold After School Enrichment (BASE) program. Students participate in this BASEic Botany curriculum on a voluntary basis and the number of students returning each week is used to gauge interest in STEM. Preliminary data over the first four months of the program indicated that students enthusiastically participated in activities and that the program has been growing by word of mouth testimony. The mean total population participating in the after school program is 31.3 \pm 4.4 and of those 6-28 choose to participate in BASEic Botany activities depending on what else is offered that day. The innovation in this project is in using multi-level mentoring to convert after-school/summer programs from glorified babysitting into legitimate inquiry-based botanical learning opportunities. Content retention is assessed by students receiving points for answering review questions; point accumulation is also a good motivational tool, encouraging students to participate and return each week. We hypothesize that after school educational opportunities can be an effective tool in fostering interest in STEM. In light of the increased demand for STEM educated employees, after school exposure to STEM fields may cultivate scientific mindsets thus meeting the need. Following our final assessment our activities will be assembled into a "book" and be made available on the American Society of Plant Biologists and Union County Master Gardener websites for adoption by any interested after school program. This project was supported by a grant from the American Society of Plant Biologists.

Poster Board No. 062 WATER QUALITY IN NINE MILE CREEK (SOUTH EUCLID, OH). Meaghan B Wierzbic, Jesse Bartle, Patrick Fisher, and Tracey Meilander, Department of Biological Sciences, Notre Dame College, 4545 College Road, South Euclid OH 44121.

Nine Mile Creek is adjacent to the Euclid Creek Watershed in South Euclid, OH. The study site is a restored step pool design wetland area that replaced a channelized basin located within this area. In spring and fall 2013, Nine Mile Creek was monitored for water quality metrics including dissolved oxygen, chloride, phosphate, nitrate, and ammonia. A comparison was made between water quality measures in upstream, midstream, and downstream sections. Dissolved oxygen was determined using the Winkler Method. Chloride was estimated using an ion-selective electrode. Nutrient estimates were made using a HACH water quality test kit. Water quality testing revealed that phosphate levels were high, with an average of 0.6 mg/L above federal standards declaring values under 0.1 mg/L as an indicator of ecosystem health. Chloride levels averaged 199.1 mg/L, meaning each visit's levels were either near or exceeded the federal chronic limit of 230 mg/L. Other nutrient levels and dissolved oxygen were within normal ranges on average. A decreasing gradient from upstream to downstream was observed in ammonia, dissolved oxygen, nitrogen, phosphate, and chloride concentrations at least once and a decreasing gradient was seen in at least one nutrient on five of the six site visits that have been done thus far, however, the significance of this trend has yet to be verified. Monitoring of Nine Mile Creek will continue through Spring 2014 to determine if high levels of phosphate and chloride are seasonal or persistent. Continued water quality and additional biotic factor monitoring will assist in determining the health status of the stream.

Poster Board No. 063 A POPULATION ESTIMATION OF WHITE-TAILED DEER (ODOCOILEUS VIRGINIANUS) AT THE WILDS USING THE SIGHT DISTANCE METHOD. Ryan L. Burke (rburke@muskingum.edu), Danny Ingold (ingold@muskingum.edu), Dan Beetem (dbeetem@thewilds.org), and Curt Coleman (ccoleman@thewilds.org), Muskingum University, 163 Stormont St, New Concord OH 43762.

Over-population of white-tailed deer (*Odocoileus virginianus*) is a significant problem in the United States. The increase in deer populations has been linked to their flexibility in habitat and foraging preferences and the fact that they have relatively few natural predators. White-tailed deer are now cited as examples of ecological engineers, a species that can heavily impact and alter its immediate environment. The Wilds has been monitoring deer numbers for eight years with the aim of better understanding likely impacts on forest and grassland habitats. The Wilds is also looking at the possibility that with rising deer populations, diseases carried by deer could be transmitted to some of the exotic hoof stock species housed at the Wilds. These introduced animals are not adapted to resisting many of the diseases carried by white-tailed deer. Population census counts, aimed at ultimately providing an estimate of the deer population on the Wilds is being continued this year with the additional goal of estimating the number of fawns that were born in the spring of 2013 and have survived thus far. Data were gathered using established field protocol along five transects on the Wilds. Distance to deer were obtained using a range finder. The mean number of bucks per week ($n = 9$) along all transects ($n = 5$), was 7 while the mean number of does and fawns was 35 and 2 respectively. A linear regression analysis revealed a noticeable but not significant association in the number of bucks with the progression of time ($F = 4.50$, $df = 1, 8$; $P = 0.07$; $r^2 = 0.39$) and the number of does with the progression of time ($F = 3.84$, $df = 1, 8$; $P = 0.09$; $r^2 = 0.35$). Once data collection is completed, program *Distance* (Thomas et al. 2010) will be used to develop an array of local and property-wide population size estimates.

Poster Board No. 064 EFFECTS OF METEOROLOGICAL CONDITIONS ON THE AVIAN PARATYMPANIC ORGAN: AN ETHOLOGICAL ANALYSIS. Zoe P. Buccella (zb805212@ohio.edu), 147 Pine Lane, Barnesville OH 43713.

The paratympanic organ, discovered by Giovanni Vitali in 1911, is a sensory structure located in the avian middle ear. Vitali hypothesized that the paratympanic organ (PTO) allows avians to detect barometric pressure fluctuation, and analysis of the organ's morphology has supported this theory (von Bartheld 1994). Although the PTO is known to respond to barometric pressure, how avians utilize the organ remains unknown. This study investigated the PTO through an analysis of barometric pressure and other meteorological conditions on avian feeding patterns. The hypothesis was that low barometric pressure, an indicator of future inclement weather, would yield higher feeding rates, pointing to the possibility that the PTO plays a role in adaptive avian feeding behavior. Experimentation consisted of ($N=81$) fifteen-minute observation sessions. During observation sessions, the number of avian visits was recorded. A visit was recorded when an avian attempted to feed from a feeding device. After data was collected, summary statistics, single-factor ANOVA tests, and two-sample t-tests were utilized. Eight of the eleven species studied supported the hypothesis, displaying higher mean visitation ($x = 38.8\%$) during low barometric pressure (100,440.33 pa—101,253.06 pa). In dark-eyed slate-colored juncos (*Junco hyemalis*), northern cardinals (*Cardinalis cardinalis*), and European starlings (*Sturnus vulgaris*) this preference was statistically significant ($p < 0.05$). This study presents further support for the hypothesis that the PTO detects fluctuations in barometric pressure. In addition, this research opens the possibility that the organ, as an adaptive mechanism, is responding to low barometric

pressure and driving increased feeding behavior prior to inclement weather.

Pre-College Poster Session 12:45 – 3:00 PM The Barrette Business and Community Center

Poster Board No. 001 SIZE VARIATION WITH ALTITUDE IN THE RUFOUS-COLLARED SPARROW. Kyle M. Davis (kdavis302@embarqmail.com), 12885 Centerburg Rd., Sunbury, Ohio 43074.

Heat is generated by the body volume and lost across its surface. Therefore larger homeotherms with their proportionately larger volume and smaller surface will withstand cold better than small homeotherms. Bergmann's Rule, which states that as temperature decreases body size increases, is a common expression of this relationship. Bergmann's Rule also relates body size to latitude. Environmental temperature also decreases with altitude. I tested the possible relationship between body size and altitude in Rufous-collared Sparrows (*Zonotrichia capensis*), which are abundant; range through the tropics and from sea level to the snow line in the Andes. Due to the range of temperatures, we expect a similar change in body size with altitude as described for latitude by Bergmann's Rule. To estimate the change in size, I measured the tarsometatarsus of 198 specimens from the Peruvian Andes in the collections of Louisiana State University, The University of Michigan, and Cornell University. The change is slight, but if the specimens are grouped into elevational increments of 700 m from sea level to 4,000+ m, there is a gradual increase in size of the tarsometatarsus specimens from sea level to the snow line. Based on the coefficient correlation, the average tibiotarsal length increases in size. This change was minimal (.3) but suggests there is change in size with altitude following Bergmann's Rule which states as environmental temperature decreases, body size increases.

Poster Board No. 002 COMPARISONS OF HORSE SHOE WEAR ON DIRT AND SYNTHETIC RACETRACK SURFACES. Lauren D Jenkins (ljenkins97@icloud.com), Susan Stover (smstover@ucdavis.edu), University of California Davis School of Veterinary Medicine, Dept. of Anatomy, Physiology & Cell biology, V2309 VET MED 3A Davis, CA 95616.

Between 2003 and 2006, California racetracks experienced a 40% increase in racing fatalities. Fatal musculoskeletal injuries to racehorses have a direct and detrimental impact on the racing industry, through both public perception and major economic loss. In 2006, Kentucky Turfway racetrack reported an 85% decrease in racing fatalities because they removed their dirt racetrack surface and replaced it with a synthetic racetrack surface. This study evaluates selected racehorse shoe characteristics produced by the wear patterns caused by dirt and synthetic racetrack surfaces. The hypothesis is that a synthetic racetrack surface causes less wear on the horseshoes of Thoroughbred racehorses than a dirt racetrack surface. Data of the shoe wear patterns showed that the synthetic racetrack surface produced a shallower longer wear on the toe-front whereas the dirt racetrack surface produced a deeper longer wear pattern on the toe-end. Studies have shown that placing the greater weight on the toe-front of the hoof results in decreased leg injury of a Thoroughbred race horse. Measurements of the length of horseshoe wear at the toe-end of the horses that raced on synthetic track showed much more uniformity than horses that raced on dirt track. The results supports my hypothesis by showing that the horses that raced on dirt surfaces had greater

wear patterns in their shoes compared to horses that raced on synthetic surfaces.

Poster Board No. 003 SELF-HEALING CONCRETE. Rajat Bhageria (rajat1996@gmail.com), 11890 Shenandoah Trace, Loveland OH 45140. (Sycamore High School)

Traditional concrete cracks quite easily and calls for expensive repairs (currently ~ \$2.2 trillion in US). Self-healing concrete repairs itself by releasing bonding-agents when salty run-off water seeps through cracks. The main question asked was whether self-healing concrete can be made; and if it can, do the bonding-agents added to repair the concrete reduce its overall strength? This was determined by comparing traditionally repaired concrete to concrete that was self-healed by a variety of bonding-agents in two major durability experiments (N=3 trials each). In the first experiment, concrete was cracked and then the bonding agents were used to repair it (as traditionally done). In the second part, the bonding-agents were added before the concrete solidifies; this ensured that the bonding agents do not negatively affect the overall strength of the sample. There were five bonding-agents: 1—calcium carbonate, 2—sodium silicate, 3—glue (modeling a polymer), 4—a mixture of soil and lactate (modeling *bacillus pasteurii* and lactate), and 5—concrete mortar (control). It was observed that the sodium silicate sample sustained more weight (17.69 kg—Part1 and 6.80 kg—Part2) than any other agent including control (4.88 kg in Part 1&2); however, sodium silicate is impractical because of high costs (\$4.00/100g). As a result, calcite was the best *overall* bonding agent; it adequately repaired the cracked concrete in Part 1, did not significantly reduce the overall strength of the sample in Part 2 (held 3.33 kg), and was cost-effective (\$0.11/100 g). Ultimately, self-healing concrete made of calcite has the economical and engineering potential to save trillions.

Poster Board No. 004 ENZYME ACTIVITY IN LIVER. Rohan S. Joshi (ARJRON@GMAIL.COM), 660 Scott Drive Mansfield, Ohio 44906.

Enzymes need to be in certain conditions to work best. Different enzymes are located in different tissues in the body. An enzyme should be able to function in the tissue that it is in. But some conditions damage enzymes. This experiment tested which conditions affected the activity of the enzymes in the blended liver the greatest. The seven treatments were: untreated, heated in a microwave on high for 20 seconds, frozen in a freezer for one hour, acidic, basic, salted, and without hydrogen peroxide. The hypothesis was that the liver that is untreated will have the greatest amount of enzyme activity. This project involved learning about hydrogen peroxide, catalase, and the liver. Important control variables included the same batch of chicken liver, kitchen utensils, and hydrogen peroxide. The dependent variable was the amount of enzyme activity in the liver. The independent variable was the treatment of the liver. The result of this experiment supported the hypothesis, showing that the untreated liver had the greatest amount of enzyme activity. These results could be used to show how the tissues should be stored or biopsied in clinics. To study the enzyme activity in depth would require infrared spectroscopy, which is expensive. This shows that when the liver is untreated, enzymes catalyze most efficiently. A future experiment might include altering the amount of hydrogen peroxide used or the liver of a different animal.

Poster Board No. 005 WATER PURIFICATION USING ALUMINUM SULFATE. Aditya Jog (ajog14@gmail.com), 7592 Hunt Club Drive, Mason OH 45040. (Mason High School)

Inexpensive methods for water purification have the potential to provide access to clean water to the approximately one billion people worldwide who lack access to it. The effectiveness of aluminum sulfate (alum, $Al_2(SO_4)_3$) to accelerate sedimentation in contaminated water for purification was investigated. It was

hypothesized that (1) aluminum sulfate would increase sedimentation in dirty water, but after an optimum concentration its effectiveness would plateau, and (2) sedimentation rate would increase in acidic solutions. The changes in turbidity of dirty water samples were measured with varying alum concentration. A turbidity meter was constructed using a laser pointer, photoresistor, potentiometer, and 9-V battery. With decreasing turbidity, more light passed through the sample which decreased the electrical resistance of the photoresistor. This increased the voltage drop across the potentiometer which was measured by a multimeter. Eleven dirty-water samples with alum concentrations from 0.004 mL/L to 4 mL/L were tested. Turbidity change was measured for two hours for each sample. To study the effect of pH, seven samples from pH 3 to 11 were tested with a fixed alum concentration of 0.4 mL/L. Alum effectively promoted sedimentation with a final voltage of 8.5 V for 0.04 mL vs. 3.96 V for only water. Its effectiveness increased with concentration but had no noticeable change at concentrations above 0.04 mL/L. The solution with pH 6 was the most effective (8.72 V) with similar results for other acidic solutions. Alum was less effective in basic solutions (7.4 V). These data support both hypotheses, showing that a very small quantity of alum substantially accelerates sedimentation in contaminated water.

Poster Board No. 006 ANTIBIOTIC RESISTANT BACTERIA IN SURFACE WATERS. Susan R. Johnson (SusanRJohnson@wcnet.org) 1000 Gustin Ave. Bowling Green OH 43402.

When bacteria become antibiotic resistant they can render antibiotics useless against them. The experiment sought to answer the question: how does the presence of antibacterial chemicals in waste water affects antibiotic resistance? Specifically, does the amount of resistant bacteria in treated waste water differ from pond water, well water, agricultural runoff water, and other surface waters? The hypothesis was treated waste water has a higher prevalence of antibiotic resistant bacteria than other surface waters. Water samples were collected and plated on Standard Methods Agar. Plates were then replica plated in five variations: (1) Standard Methods Agar as a control and (2) Standard Methods Agar with treatments of vancomycin, (3) tetracycline, (4) sulfadiazine, and (5) triclosan. The average number of bacteria found on each plate with antibiotic divided by the average number of bacteria grown on the Standard Methods Agar plate gave the percentage of resistant bacteria to each particular antibiotic. The experiment was repeated three times. Water samples were taken from eight different locations and tested. Each water sample was replicated three times for a total of nine samples tested for each water source. Standard deviation was the statistical test used. All water samples had statistically the same amount of antibiotic resistance to each respective antibiotic. The conclusion was antibiotic resistance is not significantly different down gradient or up gradient of the waste water treatment plant or in any of the surface waters tested. This research is important because if pathogenic bacteria acquire antibiotic resistance, they render antibiotics ineffective.

Poster Board No. 007 DR. E. LUCY BRAUN RECONSIDERED: AN EXAMINATION OF THE ADVENT OF PROMONTORY PRAIRIE POINTS IN ADAMS COUNTY, OHIO. Elijah B. Bedell (birdboy21@hughes.net), 19 Abner Hollow Road, Lynx, Ohio 45650. (West Union High School)

Dr. E. Lucy Braun reported that prairies on dolomite rock promontories in Adams County, Ohio were primary plant communities that originated before the Illinoian glaciation in Ohio. This study examines the possibility for a more recent timeframe for the origin of these prairies. By aging cliff-grown eastern red cedar (*Juniperus virginiana*) on promontory prairies to obtain germination dates, to compare with Adams County settlement dates, and by measuring soil depth in open prairie vs. encroaching forest, this study examines the origins and the possibility for long-

term persistence of open prairie on these promontories. Thirty-six tree samples (cores and cross sections) and sixty-two soil depth readings were taken at six promontory points within the Edge of Appalachia Preserve System in Adams County, Ohio. Cedar ages were found to be 40 to 174 years old and mean soil depth in prairies was 8.2 cm as compared to 20.3 cm in the bordering forest. Positive soil depth linear correlation coefficients (0.107-0.869+) support that prairies on these points only exist in shallow rocky soil (<10 cm) and that accumulating organic matter from the advancing forest edge does not support long-term prairie persistence. The lack of pre-settlement-aged cedars and the earliest germination date of 1838 for any of the trees coincides with early settlement (early 1800's) and the subsequent deforestation of this region, supporting the possibility that these prairies and associated red cedars are secondary communities and anthropogenic in origin from post settlement times.

Poster Board No. 008 THE SCIENCE OF GUESSING: DOES THE ABILITY TO GUESS CHANGE WITH AGE? Mary K. Conway (londonandparis97@yahoo.com), 24434 Emmons Road Columbia Station Ohio 44028. (Columbia High School)

Does the ability to guess change with age? Guessing is defined as predicting without sufficient information and is a common occurrence. Multiple choice tests are tests that many people guess on; people commit themselves to an answer without having sufficient evidence to support their answer. Therefore, it is possible to use multiple choice tests to determine if age affects a person's ability to guess. A multiple choice test was administered to ninety-nine people divided into three groups: younger group ages 9-15, middle group ages 16-25 and the older group ages 26+. The hypothesis was that if a person belongs to the older group, then they will have a greater ability to guess on the multiple choice test. The test consists of fifteen questions, each with five choices on a variety of topics. There was also a line next to each question that asked each person to rate on a scale of one to ten how sure they were of their answer. Each group's tests were analyzed to find the mean test score for each group. The older group had the highest test score, followed by the middle group and then the younger group. There was not a large difference between test scores; the difference was only in the tenths of the test score. However, the older group thought they were wrong more often and the younger group thought they were right more often. The results supported the hypothesis, the older group did guess better than the other groups, but the younger group had more self confidence regarding their answers.

Poster Board No. 009 LEFT VERSUS RIGHT HEMISPHERE DOMINANCE IN HIGH SCHOOL SOPHOMORES. Zachary S. Samples (zsamples9@yahoo.com), 91 Township Road 1026 South Point, OH 45680.

The educational techniques by which high school students are taught both impact their understanding of the material and can help them determine which occupational path to take in the future. Determining the ways high school students prefer to process thoughts will define the areas they are strongest and thus learn the most efficiently as well as where they may need help to be a well-rounded thinker. To determine these data, 24 high school sophomores – 12 males and 12 females – were interviewed via an online quiz by The Art Institute™ that determines one's abilities in various patterns of thinking. Results include the following left hemisphere thought processes: linear, sequential, symbolic, logical, verbal, and reality-based; and the following right hemisphere thought processes: holistic, random, concrete, intuitive, nonverbal, and fantasy-oriented. When comparing male and female results, differences exist for the following skills: sequential thinking, where females average 33.2% and males average 27.3%; holistic thinking, where females average 27.0% and males average 20.5%; intuitive thinking, where females average 34.2% and males average 28.7%; and nonverbal

thinking, where females average 27.8% and males average 19.2%. Overall, 71% of individuals are “right-brainers,” and females are slightly more well-rounded thinkers than males are since the mean for 9 of the 12 skills are higher for females than for males. The fact that the interquartile data extends from low to high skill for most thinking patterns concludes that there is great variation among thinking patterns on an individual basis. Therefore, each student is unique and his/her data may be far different from that of his/her peers.

Poster Board No. 010 POTENTIATING THE KILLING OF PSEUDOMONAS AERUGINOSA (PAO1) PERSISTERS BY GENTAMICIN USING ALTERNATE CARBON-SOURCES. MARTA L. Baker (mbaker15@hb.edu), ARNE Rietsch (arne.rietsch@cwru.edu), 6990 Norvale Circle West, Gates Mills OH 44040 (Hathaway Brown School) Department of Molecular Biology and Microbiology, Case Western Reserve University.

Pseudomonas aeruginosa is an important bacterial pathogen causing both acute and chronic infections. *P. aeruginosa* displays a high intrinsic resistance to antibiotics, which, particularly in chronic infections, is exacerbated by the occurrence of quasi-dormant persister cells. Previous work done in the Collins lab with *E. coli* and *Staphylococcus aureus* showed carbon-sources were able to sensitize persister cells to antibiotics. The intent was to sensitize *P. aeruginosa* persister bacteria to aminoglycoside antibiotics by adding a variety of sugars to growth medium. It was hypothesized that the addition of carbon-sources to *P. aeruginosa* would sensitize persisters grown in both overnight cultures and biofilms to gentamicin. The methods used involved assaying killing of persister cells by comparing cell-death in the presence of gentamicin alone as a control (ciprofloxacin was used to kill the non-persister cells) to bacteria incubated with gentamicin and an additional carbon source for one to two hours. Of the results obtained for 13 carbon-sources tested on overnight cultures, Malic Acid had the lowest percent survival compared to the no carbon source addition with a 15.00% survival rate out of 3 trials. However in biofilm cultures, sodium acetate only reduced survival to 47.2% compared to the gentamicin control (a survival rate of 13.85%), while Malic Acid had a survival of 518.6% compared to the gentamicin control. Thus the conclusion is that while this approach was successful in sensitizing persister bacteria in overnight cultures of *P. aeruginosa*, the approach failed to yield substantial killing of persisters when treating *P. aeruginosa* biofilms.

Poster Board No. 011 ANTI-VIRULENCE AGENTS INCREASE SURVIVAL IN MRSA INFECTED INSECT LARVAE. Anisha V. Sehgal (asehgal15@hb.edu), Menachem Shoham (mxs10@case.edu), David Kuo (dxk415@case.edu), Guanping Yu (gxy40@case.edu), Wyatt Hoch (wbh15@case.edu), Lucy Bollinger (lucy.bollinger@gmail.com), Case Western Reserve University School of Medicine 2123 Adelbert Rd Cleveland, OH 44106-4935.

Methicillin Resistant *Staphylococcus aureus* (MRSA) is a growing public health problem due to a proven increase in antibiotic resistance. There is an urgent need for alternative treatments. It was hypothesized that anti-virulence therapy is an effective alternative strategy that would target disease-causing toxins of the pathogen, disarming the pathogen of harmful effects. Anti-virulence compounds against MRSA strain USA300 were identified by virtually screening small-molecule compounds against the response regulator protein AgrA to block phosphorylation of Asp 59, which is required for the expression of toxins such as a-hemolysin. This toxin forms pores in host cell membranes. *In vitro* efficacy was then measured by a hemolysis inhibition assay using rabbit erythrocytes. The most effective compounds identified through this assay were further evaluated in vivo through testing the ability of the compounds to increase the survival of infected wax moth larvae, *Galleria mellonella*. Infections were

established in the last proleg of the wax moth larvae by inoculation with 2×10^7 colony-forming units of MRSA strain USA300. The study included control groups to test impact of physical trauma from needle penetration and hemolymph dilution, an infected group that did not receive any treatment, and three infected groups treated with: (i) compounds only, (ii) Nafcillin only, (iii) compounds and Nafcillin, together. Nafcillin is a beta-lactam antibiotic to which MRSA is resistant. For every compound, each test group included 10 larvae. Each trial was repeated 10 times. Larvae were inspected every six hours for five days and were considered dead if they did not respond to touch. From the *in vivo* studies, it was discovered that two compounds, when tested alone, extended the survival of infected larvae by a time factor of three. Combination treatments revealed a synergism between anti-virulence compounds and nafcillin. This opens up the possibility of a renaissance of “old” antibiotics to treat MRSA infections.

Poster Board No. 012 THE EFFICACY OF BONE GRAFTING IN THE ALVEOLAR REGION. Alyzah Quereshey (aquereshey15@hb.edu), 33492 Hanover Woods Trail, Solon, OH 44139 Dr. Manish Valiathan, MDS, DDS, MSD (manish.valiathan@case.edu), Case Western Reserve University, Tarek El-Shebiny (tme18@case.edu), Case Western Reserve University.

This research project was conducted in the School of Dental Medicine at Case Western Reserve University, with the goal of measuring the bone density (after the alveolar bone graft procedure) in two different craniofacial anatomical landmarks, known as the piriform and the alveolar crest on the left and right side of the face, for patients between the ages of 8 and 17 years old with a cleft lip or cleft palate. Twenty-two patients were studied in this project. The purpose was to determine a common pattern in the bone density levels, post bone graft, as time progressed. It was hypothesized that there will be a consistent pattern of increasing bone density changes in the patients. This data would be used to further develop the knowledge of the surgeons involved. This project was solely based upon cone-beam computed tomography (CBCT) images, a three dimensional scan, which would allow for a completely accurate visual of the affected patient. Over 264 CBCT images were viewed, analyzed, and oriented using the program Dolphin Imaging. Once a CBCT image was imported into the Dolphin Imaging program, the scan was oriented using the horizontal and axial planes. After orientation, the scan was marked at either the piriform or the alveolar crest, cropped around the point, and then the density for that small point was determined. The data collected, however, did not show a consistent pattern of an increasing bone density value, but rather fluctuating values over time. In conclusion, this information is still valuable to surgeons and post operative medical professionals as they will be able to exploit new grafting regions and use other, more effective techniques. Further work will be conducted using the same procedure, however, using different craniofacial anatomical landmarks.

Poster Board No. 013 NON-PROTEIN CODING RNA, BORG, AND THE HUMAN GENOME. Sarah Moghari (sarah.moghari@gmail.com), Saba Valadkhan (saba.valadkhan@case.edu), Andrew Curtright (andrew.curtright@gmail.com), Lalith Gunawardane (lsg48@case.edu), 3586 Meadowbrook Blvd. University Heights, Oh 44118. (Hathaway Brown), The Center of RNA Molecular Biology, Case Western Reserve University.

The goal of this research is to mutate BORG (a long, non-protein coding RNA found in the brain that helps cells with stress response). The ultimate was to help pancreas cells overcome stress. There are two types of diabetes: Type 1 and Type 2. Type 1 diabetes is diagnosed in children and young adults. In Type 1 diabetes, the body does not produce insulin (a hormone that is needed to allow the uptake of sugars from blood into tissues). Type 2 diabetes occurs when the body does not use insulin correctly (insulin resistance). First, the pancreas makes extra insulin to make up for it. Then, it is not able to keep up and cannot

make enough insulin to keep the blood glucose at normal levels. Pancreas cells work so hard they die of over-work stress. BORG was over-expressed in a human muscle tissue cell and the cell then transformed into a brain neuron. Knowing this, the lab hypothesized that they could use mutant forms of BORG to help cope with stress on the pancreas cells preventing them from over-exerting themselves. In order to do this, restriction enzymes were used to cut a plasmid. Then, the plasmid that contained BORG was restricted. The plasmid with BORG underwent digestion and was gel purified (using 4 agarose gels) and the stickons were placed together. PCR was run three times to multiply the plasmids. The BORG was then linearized by using restriction enzymes. The conclusion at this point based on all data is that we successfully linearized the BORG plasmid. Future work will include finding areas to mutate BORG and helping expand the growth of the mutated BORG (by transferring the plasmid to 293 cells). Then, viruses will be cultured to find a way of inserting the mutated BORG plasmids into the pancreas cells

Poster Board No. 014 TOLL-LIKE RECEPTOR 3 AND GEOGRAPHIC ATROPHY IN NEOVASCULAR AGE-RELATED MACULAR DEGENERATION. Alison A. Martin (amartin15@hb.edu), 19600 North Park Blvd, Shaker Heights, OH 44122. (Hathaway Brown School)

Neovascular Age-related Macular Degeneration (wet AMD) is the leading cause of legal blindness in the United States. Treatment with ranibizumab or bevacizumab can prevent vision loss in wet AMD, but the development of geographic atrophy (GA), a localized area of cell death in the macula, may occur during treatment and reduce visual outcome. A previous study reported that a single nucleotide polymorphism (SNP) in the *TLR3* gene protects against the development of GA in the early stage of AMD (dry). It is hypothesized that this SNP (rs3775291) might also protect against GA in eyes receiving treatment for the later stage of AMD (wet). The methodology of this study employed DNA that was isolated from blood collected in patients receiving treatment in a clinical trial for wet AMD. Using TaqMan SNP genotyping assays, 770 patients were genotyped for SNP rs3775291 in the *TLR3* gene. The development of GA had previously been assessed at a Fundus Photo Reading Center from retinal photographs taken after 2 years of treatment. Genotypic frequencies were compared to the development of GA. The data from this study showed that 8 (11.0%) of 73 patients homozygous (TT) for the protective allele at rs3775291 developed GA versus 57 (17.8%) of 321 patients heterozygous (TC) and 73 (19.4%) of 376 patients homozygous (CC) for no protective alleles (linear trend $P=0.13$). In conclusion, although not statistically significant, the trend and magnitude of the protective effect of the T allele at rs3775291 was similar to that previously reported in dry AMD. Larger studies involving more than 2,000 patients would be required to show statistical significance, assuming that the prevalence of the protective allele remained unchanged.

Poster Board No. 015 ENERGY EXPENDITURE IS RELATED TO BODY COMPOSITION AND FUNCTIONAL CONSEQUENCES IN CHILDREN: A PROSPECTIVE STUDY. Dhweeja Dasarathy (ddasarathy@gmail.com), 391 East St Andrews Drive, Highland Heights, OH 44143. (Hawken School)

Childhood obesity is a major epidemic and contributes to a number of chronic diseases not only in childhood but also to adult disorders like diabetes mellitus, hypertension, fatty liver, sleep disorders and disorders of lipid metabolism. Excessive caloric intake and decreased energy utilization are believed to contribute to the development of childhood obesity. One of the consequences of obesity is a reduction in skeletal muscle mass relative to the fat mass and this may contribute to the reduced utilization of calories contributing to further accumulation of fat mass. The role of the skeletal muscle mass and energy utilization in children has not been evaluated. A prospective study

was performed to examine the relation between muscle mass, muscle strength and energy expenditure. It was *hypothesized* that children with lower muscle mass will have lower energy expenditure and consequently are at risk of obesity. After obtaining an informed consent form consecutive children aged 8-15 as well as their parents, energy expenditure (EE) and oxygen utilization (VO_2) were measured using a MedGem® hand held indirect calorimeter. Pulse oximetry and heart rate were determined by a Nymex® pulse oximeter. Peak energy expenditure and VO_2 were studied after maximum voluntary aerobic activity by running on the school steps. Anthropometry and bioelectrical impedance analyses (BIA) were done to measure body composition. A modified pediatric sleep questionnaire was used as a screening instrument for disordered sleep. All analyses were performed using the SPSSv20 and R statistical programs. 36 subjects (10M;26F) with mean age 11.0 ± 1.7 y were evaluated. Mean resting VO_2 was 199.5 ± 22.1 ml/min and peak VO_2 was $418.91.7 \pm 91.7$ ml/min. Resting EE was 973 ± 137.7 Kcal/d while peak EE was 2041.1 ± 447.6 Kcal/d. Resting and peak EE were significantly inversely correlated ($r=-0.73$; $p<0.001$) and positively correlated ($r=0.74$; $p<0.001$) with whole body fat and muscle mass respectively. Predicted REE was significantly higher than the measured REE. Lower muscle mass and grip strength were significantly lower and fat mass higher ($p<0.01$) in subjects with sleep disorders compared to those without. Rate of recovery from peak pulse at 1 min was significantly correlated ($p<0.01$) with muscle mass. Lower muscle mass was accompanied by metabolic and cardiovascular abnormalities and had functional consequences. These studies form the basis to propose targeting strategies to increase skeletal muscle mass and function as a therapeutic intervention to reverse the metabolic and disease consequences of obesity.

Poster Board No. 016 THE EFFECT OF USING DIFFERENT TRANSPORT METHODS ON THE FORCE OF FRICTION. Catherine M. Horvath (Sabercat12@gmail.com), 173 Waldorf Drive, Akron, Ohio, 44313.

The Egyptians used gigantic quarried stones weighing 400 tons to build The Great Pyramids. Debate remains on how they could move stones that would take 16,000 workers to lift and carry. The goal of this experiment was to discover the best way the Egyptians might have moved their colossal stones from quarries to their pyramids. The hypothesis was: "If a wooden path was built under the stones with sand sprinkled onto the path, then the amount of friction created while moving the stone would be at its lowest, hence the amount of force needed to move the stone would also be at its lowest." An Ametec (5 lb, 0.05 lb/division) force meter was used to measure the force needed to push a masonry brick weighing 5.4 pounds across sand. Materials such as popsicle sticks, wooden dowels, and wooden spools were used to mimic the Egyptian's available building resources. Each transport method was tested 3 times, and the force readings were averaged. Transport methods included: brick on sand (43% reduction), a wooden path with grain perpendicular to the directional force (39% reduction), a wooden path with parallel grain (42% reduction), a wooden path with parallel grain and sprinkling of sand (62% reduction), a wooden path with parallel grain and dowels (85% reduction), and a wooden path with parallel grain and wheels/axils, which demonstrated the greatest reduction of necessary force; a 96% reduction when compared to carrying the stones. My test using wheels and axils outperformed the hypothesized solution.

Poster Board No. 017 MICORBIAL FUEL CELLS: E. COLI VERSUS TOTAL COLIFORM BACTERIA. YENNMAI. K. Chia (14ychia@beaumontschool.org), 832 Hardwood Court, Mayfield Village, 44040 OH.

Waste contaminated with total coliform allows for fuel cells to harness the natural process of the bacteria digestion to be conducted into electricity. Microbial fuel cells use the

excreted electrons of bacterium to transfer between the electrodes of a fuel cell. This study hypothesized *E.coli* bacteria would produce higher voltages in comparison to other total coliform bacteria, while tested in microbial fuel cells. Fuel cells were constructed using pc tubing, plastic containers, carbon cloth, wire, and nickel epoxy. Two cells were used to test *E. coli* bacteria, two for total coliform bacteria, and one for the control containing only the bacteria-free growth broth. Both bacteria types peaked around 0.6-0.9 volts while the control also produced 0.1-0.4 volts. *E. coli*, however, reached slightly higher voltages in four of the six trials. A trial was also done to justify the bacteria as the cause of the increased voltage. Three milliliters of bacteria broth was added to a control cell after collecting two days of voltage data. After 17 hours the voltage increased exponentially and peaked at 0.7 volts. A trial was also completed to show the bacteria growth. Samples were taken every 24 hours. At the 48th hour the bacteria had gone from 400 per mL to 381,000 per mL, showing that the bacteria was not the limiting factor of the voltage produced, as their rate of reproduction continued to rise while the voltage plateaued, concluding that the lack of surface area of the electrode inhibited the additional transfer of electrons.

Poster Board No. 018 MESENCHYMAL STEM CELLS: NEW DIRECTIONS IN ANTIMICROBIAL THERAPY. MORGAN T. Sutton (msutton15@hb.edu), DAVID Fletcher, CHRISTIAAN Van Heckeeren, ARNOLD Caplan, TRACEY L. Bonfield (tracey.bonfield@case.edu), 13154 Woodcrest Lane; Chesterland Ohio 44026. Department of Pediatrics, Case Western Reserve University, Cleveland Ohio 44106.

Mesenchymal stem cells secrete products (MSCsups) that are anti-inflammatory and antimicrobial. Cystic Fibrosis (CF) is a genetic disease that results in lung infection with *Pseudomonas aeruginosa* (PA). MSCs decrease inflammation and infection in the in vivo murine model of CF, focusing studies on MSCsups to treat infections. We hypothesize that MSCsups can directly impact PA growth, potentially improving antibiotic effectiveness. The specific aims are: 1.) Determine whether MSCsups change PA survival; 2.) Determine whether MSCsups change PA growth kinetics; 3.) Determine if MSCsups improve antibiotic effectiveness. MSCsups (n=4) were derived from adult bone marrow aspirates with IRB approval. PA growth was measured by colony forming units (CFUs) and kinetics, measured by bacterial ATP production, with or without antibiotic geneticin (50µg/mL sub-optimal). Statistics were performed using standard t-test and GraphPad Prism. MSCsups decreased PA growth from 41±3 CFU (mean±SEM, n=4) to 21±2 CFU (p=0.0004). Geneticin decreased PA growth to 30±4 CFU, while when combined with MSCsups PA growth decreased to 15±1 (p<0.009). ATP growth kinetics of PA versus time up to 24 hours was linear with a slope of 36±6 (mean±SEM). Geneticin treatment decreased PA growth kinetics to a slope of 26±6, while MSCsups alone decreased the slope to -51±10 (p<0.001). Geneticin and MSCsups combined decreased the PA growth kinetics to a slope of -68±11 (Optimal antibiotic concentration is being pursued). These studies show: 1.) MSCsups significantly decrease PA growth by 48.8%; 2.) MSCsups decrease PA growth kinetics by 191.6%, and excitingly 3.) MSCsups may enhance antibiotic effectiveness. MSCsups are antimicrobial, slow PA growth and potentially enhance antibiotic effectiveness. MSCs have the potential to become an innovative therapeutic to treat infections in CF.

Poster Board No. 019 HYDROPOWER: THE EFFECT OF WATER FLOW RATE ON POWER GENERATION AND ENERGY. Suyash Dixit (ssdixit@gmail.com), 2220 Alum Village Dr., Lewis Center, OH 43035.

In a waterwheel, water falls on a wheel spinning it to generate power. The objective of this project was to determine the relationship between water flow rate and the power generated by the waterwheel. A radial waterwheel

was assembled with rectangular blades, and 20 tests were run by placing the waterwheel at 2.5" and 10" under the kitchen-sink faucet. The tap opening was changed to get different flow rates. A stopwatch was used to measure the time taken to fill a gallon jug before placing the waterwheel under the water stream. Slow motion replay of the video recording was used to measure the average rotations of the waterwheel for a 1 minute interval. At 2.5" head, the RPM (Rotations per Minute) increased from 130 RPM to 232 RPM as the flow rate was increased from 22.8 Gallons per minute to 94.7 Gallons per minute in step increments. At 10" head, the RPM increased from 198 RPM to 372 RPM as flow rate was increased from 17.1 Gallons per minute to 90 Gallons per minute in step increments. Since power generated by the waterwheel is directly proportional to the RPM of the wheel, the experiment conducted proved the hypothesis that the power generated by the waterwheel increases as the flow rate increases. The results of this experiment can be applied to vary the water flow rate in a hydropower plant based on power demand or to maximize total energy generated using fixed amount of water.

Poster Board No. 020 THE SCARY TRUTH ABOUT EATING OUT. Megan I. Cordell (mic41700@gmail.com), 7622 Marelis Ave NE, Canton OH, 44721. (Oakwood Middle School)

Going out to dinner is expected to be a celebration or night without cooking, but danger could be lurking where a person least expects. After doing research and finding that the average menu contains 185,00 bacteria, it was hypothesized that if bacteria are grown from twenty different restaurant menus, then it can be determined which one has the most bacteria and what type of bacteria is present. Samples including one control to make sure the swabs and agar were not contaminated and nineteen menus were taken by going to restaurants, using the cotton swab to rub across the menu in a two inch by two inch section, and rubbing across the agar. After twenty-four, forty-eight, seventy-two, and ninety-six hours the dishes were observed for bacterial growth and the colonies were counted. The results showed that the restaurants that had the most bacteria used plastic menus and the restaurants that had the least bacteria used paper menus. The conclusion can be made that paper menus are cleaner than plastic menus because most plastic menus are not cleaned between customers. Plastic surfaces such as menus harbor bacteria unless cleaned and paper menus are used once and then thrown away. This project is important because it could create a positive public health outcome by making restaurants aware of the need to clean plastic menus.

Poster Board No. 021 THE UTILITY OF THE SUN'S ULTRAVIOLET (UV) TO CLEAN WATER. Arjun Ramachandran (arjunramachandran99@gmail.com), Solon High School, Inwood Road, Solon, Ohio 44139.

Many under-developed regions such as India and Africa have little to no access to clean water. However, being close to the equator, they get a steady amount of UV (~32 Watts/year) from the abundant sunlight. It has been previously demonstrated that UV effectively kills bacteria and has been used in water purification. Drawing on this, this paper aims to prove the hypothesis that UV from sunlight is effective in killing bacteria and could be used to develop an electricity-free source to clean water. The study was performed in two parts. The first part was in a controlled lab setting where UV generators emitting 2 wavelengths of UV (302 nm/312 nm; UVA/UVB spectrum of sunlight reaching the earth) and cultures of *E. Coli* bacteria (example of common disease bacteria) were used. Petri dishes of the bacterial cultures were exposed to varying times (15 s, 30 s, 60 s, 300 s) of both wavelengths, except for the control petri dish, which was not exposed to any UV. The colonies were grown overnight, and counted the following day. The trials were repeated 6 times. The second part of the study was to repeat the first experiment but using UV from sunlight. First, the amount of level of UV in ambient sunlight was measured

(through the month of April in Cleveland, OH) with an UV meter (General® ModelUV513AB). It was found that the level of UV was 10-15 mW/cm² slight lower than the output of the Lab UV machine, which was at 17 mW/cm². Again, petri dishes of bacterial cultures were exposed to various times (5, 10, 15, 20 minutes). An exposure of 15 minutes resulted in eliminating all the bacteria. The experiment was also repeated using a Fresnel lens to focus the sunlight, which resulted in much higher UV levels at 40 mW/cm². However, no measurements could be made consistently because of fluctuating levels of sunlight and also because of safety concerns of focused sunlight causing burns and fire. The bacterial colonies reduced with increasing UV exposure times both in the controlled lab setting and in ambient sunlight, proving the hypothesis that the sun's UV is effective. In ambient sunlight, it took much longer (15 min vs. 1 min) to destroy the bacteria. The results demonstrate that the UV from the sun can kill bacteria, supporting the hypothesis. The next step is to design a cheap and effective practical implementation of this concept to solve this global water problem by using an effective optical system to focus sunlight and test it in actual water samples.

Poster Board No. 022 ORIGAMI FOR OIL SPILL CLEANUP: AN EXPERIMENTAL STUDY. Athulya Murali (electronicmailtoam@gmail.com), 9945 Zig Zag Rd. Cincinnati OH 45242. (Sycamore High School)

The massive release of liquid petroleum hydrocarbon (aka oil spills) into oceans causes health, economic, and environmental hazards and therefore, is undesirable. Better oil spill cleanup methods are needed because current methods and response systems are inadequate. The hypothesis of this study is that cleaning up oil spills in the ocean will be more effective if origami based designs are used. To test the hypothesis, oil spills were simulated by including 60 grams of petroleum distillates in 40 liters of water in a bathtub. A fan was used to simulate "ocean wind". In this study, the oil-spill cleanup by polypropylene sheets was compared to that of an origami based spherical design. The initial experiments, conducted by varying "one-factor-at-a-time," showed that the flat sheet absorbed about 60% more oil than the spherical design in static conditions, whereas the spherical design absorbed 116% more oil in dynamic tests. Further investigations were performed using a 24 full factorial experimental design to understand the impact and interactions among the four experimental variables videlicet, temperature, salinity, motion, and geometry of the designs used. This study revealed that in ocean-like conditions (salt water and wind), the spherical design could be more useful because it: (1) transports itself to shore without manual labor while collecting a large amount of oil, (2) is comparatively less time-consuming, and (3) can also be compressed into a space saving design. Further, it is concluded that designs with more surface area performed better oil absorption than those with lesser surface area.

Poster Board No. 023 EXPRESSION OF DOUBLE-STRAND BREAK REPAIR GENES IN DEINOCOCCUS RADIODURANS. David M. Johanson (johansons@windstream.net), 5708 Nicholson Dr. Hudson OH 44236.

Deinococcus radiodurans is an extremophilic bacterium capable of surviving high radiation doses. Isolated from an irradiated can of meat, *D. radiodurans* is found everywhere from gut flora to surgical instruments. This experiment tested the relationship between transcription levels of genes responsible for DNA repair and regulation, being *recA* and *ddrB*, and exposure to common sources of oxidative stress. The DNA repair and regulations, along with the housekeeping gene, GAP, were assayed with Real-Time PCR to determine mRNA transcription levels in mid-recovery phase. The *D. radiodurans* cells were treated with hydrogen peroxide and UVA radiation as analogues to externally and internally produced oxidative stress. The expectation was for an increase in transcription levels for

the *recA* and *ddrB* genes after exposure to the H₂O₂ sample and UVA source at 8 watts and 365 nm. When calculated with the Delta-Delta-Ct method, adjusted for GAP curve threshold, Fold change after H₂O₂ was 1.96 for *recA* and 1.36 for *ddrB*. Fold change after UVA exposure was 0.174 for *recA* and 0.236 for *ddrB*. When GAP was calculated from control, fold changes of 4.85 after H₂O₂ and 0.17 after UVA show either a procedural error or sample irregularity. The No Template and No Reverse-Transcriptase Controls all tested negative for contamination or error, so it is possible that GAP experiences transcription level changes after exposure to oxidative stress. The RT-PCR assay showed that both *ddrB* and *recA* are positively regulated when *D. radiodurans* cells experiences oxidative stress, indicating that *ddrB* has a role in oxidative stress response.

Poster Board No. 024 SCENT AND SALES II: THE EFFECT OF SCENT ON CONSUMERS' PRODUCT PERCEPTIONS. Gillian M. Baker. (gillianbaker97@gmail.com), 1318 Wheeling Road Lancaster, OH 43130.

The purpose of this experiment was to identify the relationship between scent and consumer behavior. It was hypothesized that scent would influence people's perceptions of a product's characteristics, and it was separately hypothesized that scent would affect the perception of the product's value. Three different conditions were arranged with a between-subjects design, with each subject being asked to evaluate the product on a questionnaire. Condition one featured a white t-shirt scented with PINK "Sunny and Happy"; condition two featured a white t-shirt scented with Axe "Phoenix"; and condition three featured an unscented white t-shirt as a control. The data was entered into SPSS (Statistical Package for the Social Sciences) and initially analyzed via an ANOVA. There was no significant difference between the two separate scented conditions when they were compared and therefore the conditions were collapsed. The sampling of men and women was unequal with 46 women and 21 men participating, and the relationship between gender and scent preference or perception was not analyzed due to a low n value. However, when responses to both the scented conditions were combined and compared to the control condition in an independent sample T-test, several differences appeared. There was evidence of scent influencing people's willingness to wear, buy, or give a product leading to the conclusion that scented clothing is more valued than unscented clothing, as predicted in hypothesis two.

Poster Board No. 025 DETERMINING THE SMELLING AND HEARING DEPENDENCY OF THE RED FOX. Samantha J. Keum (skeum15@hb.edu), Harvey Webster (hwebster@cmnh.org), Michelle Leighty (mleighty@cmnh.org), 10680 Mount Royal Drive, Concord Township OH 44077. (Hathaway Brown School), Wildlife Resource Center, Cleveland Museum of Natural History, Perkins Wildlife Center, Cleveland Museum of Natural History.

Primarily located in the northern hemisphere and belonging to the Canidae family, the red fox is considered as a highly adaptive and cunning omnivore. This mammal does not solely rely upon sight to hunt because of the species' ability to detect prey with its acute hearing and exceptional smelling capabilities. The objective of this project is to calculate which of these senses has the faster response time in order to determine the more efficient one used in locating unexposed specimens. It is hypothesized that the red fox will rely more on smelling than hearing. To test this, the response times of each of the two categories was recorded three times and averaged. Each of the six tests had a five minute time limit. All tests were randomly conducted once a day to prevent the subject from anticipating the trials. During hearing tests, a repeating 7000Hz tone was emitted from a cellular device in a plastic container. For smelling tests, crumbled newspaper drenched in strong fish liquid was prepared. First, the fox was placed in its enclosed kennel to prevent it from discovering the

hidden object's locations before the tests started, while the objects were buried. In the fox's outdoor habitat at Perkins Wildlife Center, objects were buried in different locations each time. A timer started once the fox was released, stopped when it successfully uncovered the stimulant, and the subject received a food reward afterwards. It was found after three trials of each test that the mathematical average for hearing was 74 seconds, and the range of these three trials was between 36 seconds and 99 seconds. The smelling tests had a mathematical average time of 43 seconds and a range between 26 seconds and 62 seconds over the course of three trials. The results support the conclusion that smelling is a more efficient hunting tactic of the red fox than hearing.

Poster Board No. 026 THE POWER OF SUGGESTION: MEMORY MANIPULATION. Caitlyn A. Miller (millerbdhc@aol.com), 13684 Janell Drive, Columbia Station, OH, 44028. (Columbia High School)

The hypothesis was if the power of suggestion is used in an experiment, then participants' responses can be altered by the person conducting the study. The hypothesis was supported by the data. Background research indicates the power of suggestion can be influential to people and, therefore, is used in many aspects of daily life. It can be seen in slogans and commercials to influence buying decisions. Suggestion is used to give directions to the subconscious mind. Test subjects were shown a poster with twelve images for thirty seconds and asked to remember as much as possible. Participants were given twenty-five seconds to make a list of all of the images they could remember. Test subjects were then asked fifteen questions. Three questions were predetermined to ask participants "Are you sure?" as a suggestion to change their answers. 12.5% of the participants changed their answers all three times when prompted. The remaining participants changed their answers 29% of the time for at least one of the prompted suggestions. The participants were also asked a question about a non-existent image and its location. The results showed that 54% of participants stated that there was really nothing underneath the image, which is correct. However, 46% of the participants actually offered an answer regarding an image that was not there. Whenever a researcher influences the test subjects and data, the study is negatively impacted and overall results are rendered invalid.

Poster Board No. 027 TANNING IN TEENAGERS: PERCEPTION AND INFLUENCES. Nour G. Yacoub (yacoubn@alterhs.org), 441 Timberlea Trail, Kettering OH 45429. (Alter High School)

There is an alarming increase in the incidence of deadly skin cancer. The most recognized risk factor for skin cancer is exposure to the sun and skin tanning. Understanding the epidemiology of tanning, its incidence, and distribution, is instrumental in establishing a basis of intervention for behavior modification and monitoring. A survey about tanning was given to 80 teenagers and 64 adults. The data collected show a significant incidence of teen tanning: 100% of teenagers surveyed tan, and 78% of adults did. Not all tanners admitted to tanning behavior: 36% of teenagers and 34% of adults denied tanning, but showed tanning behavior, such as outside activities and sports. This group was designated as "unintentional tanners". The majority of the subjects in the unintentional tanners group were teen males (20% of teens) and adult females (23% of adults). There is an opposite perception of tanning between teenagers and adults. 98% of teenage subjects perceive tanning as beneficial, only 16% of adults shared this view. This contrasted with the reported use of sunscreen, which is more prevalent in teenagers (84%) than in adults (35%). Lastly, there is a higher incidence of reported tanning behavior in family and friends of teenagers who admit to tanning (90%). These findings identify two major groups who would benefit from immediate intervention: the unintentional tanners and especially the female teenagers who admit to tanning. It is

crucial to intervene by educating these groups on tanning behavior modification, and maybe it is time to introduce legislation for commercial tanning ban for teenagers.

Poster Board No. 028 CONSERVED GLYCINE IN THE SEQUENCE SPECIFIC HMG BOX REDEFINES A CRUCIAL DNA BINDING MOTIF. Danielle Immerman, Joseph Racca, Yen-Shan Chen, Nelson Phillips and Michael Weiss Department of Biochemistry Case Western Reserve University, Cleveland OH 44106.

Classification of newly discovered genes into a protein family relies on sequence similarity to known proteins. Some protein families are very large, named superfamilies, like proteins in the HMG box superfamily. The HMG box is a DNA binding domain that is conserved from plants to humans; there are two subfamilies, sequence specific versus non-sequence specific. In order to differentiate between the two subfamilies, better understanding of key structural motifs can be exploited. The human SRY (sex determining region of the Y chromosome) is used as a model to study sequence-specific HMG boxes. Of particular interest to this study is a key 4-residue motif, "the hydrophobic wedge", crucial for proper DNA binding. The hypothesis is a conserved glycine amino acid, G40, should be included as a fifth member of the wedge motif. This position is the site of two clinical mutations associated with human sex reversal. To this end, all 20 amino acid substitutions were studied at this position through the use of a yeast one hybrid system. Combined with further characterization of selected variants, the data demonstrates that G40 is the only amino acid viable for proper function in the model HMG box. Furthermore, G40 is 100% conserved in the sequence specific subfamily of the HMG box. No other variant has been observed in this subfamily. Together, these results support the hypothesis that redefining this wedge motif to include G40 creates a better and more stringent parameter for the annotation of HMG box containing proteins.

Poster Board No. 029 THE EFFECT OF SODIUM CHLORIDE AND BETAINE HYDROCHLORIDE ON THE EFFICACY OF IMIPENEM AGAINST E. COLI AND KLEBSIELLA PNEUMONIAE. Alex C. Carrico (acarrico009@gmail.com), 1229 Bickel Church RD NW, Baltimore OH, 43105. (Liberty Union High School)

This study investigates the possibility of using NaCl and betaine hydrochloride (BHCL) as additives to increase the effectiveness of Imipenem against *Klebsiella pneumoniae* 700603 and *E.coli* 25922. Mueller Hinton agar was prepared containing mixtures of BHCL and NaCl for 1 plate per trial for six trials. Plates were inoculated with a 0.5 McFarland turbidity standard using Kirby Bauer assay and 10 µg Imipenem disks. The control zone for the *E.coli* was 27.55 mm and 25 mm for the *Klebsiella*. The increase of effectiveness for (Trial 1) *E.coli* NaCl plates was: +16.36% (0.1 M), +12.72% (0.2 M), +23.74% (0.4 M), and +23.75% (0.6 M). For (Trial 2) *E.coli* BHCL plates, the zone sizes resulted in a loss of effectiveness: -19.56% (200 µM), -5.45% (175 µM), -9.09% (150 µM), and -3.36% (100 µM). The Trial 3 NaCl *Klebsiella* plates increased Imipenem effectiveness on *E.coli*: +12.00% (0.1 M), +10.00% (.2 M), +28.00% (0.4 M), and 40.00% (0.6 M). BHCL (Trial 4) resulted in loss of effectiveness: -24.00% (200 µM), -12.00% (175 µM), -20.00% (150 µM), and -18.00% (100 µM). The following mixed trials (Trials 5 and 6) resulted in significant loss of effectiveness for both *E.coli*, and *Klebsiella pneumoniae*: 0.1 M NaCl and 200 µM BHCL, 0.2 M NaCl and 175 µM BHCL, 0.4 M NaCl and 150 µM BHCL, and 0.6 M NaCl and 100 µM BHCL. The BHCL caused decreased resistance in every trial. Based on these results, NaCl may be used as an additive to increase effectiveness of topical antibiotics.

Poster Board No. 030 ENZYME KINETICS: THE APPLICATION OF CALCIUM AS AN ACTIVATOR OF BOVINE CATALASE. Kirstin N. Boni (kirstin.boni@yahoo.com), 13635 Braeburn Lane, Novelty OH 44072. (West Geauga High School)

The enzyme catalase regulates hydrogen peroxide, which induces signalers of insulin. Deficiencies of catalase have been linked to type-two diabetes. Calcium, a possible activator of catalase, could be used to improve this condition. The goal of this research was to study how the application of calcium to bovine liver affected catalase's decomposition of the substrate hydrogen peroxide. The hypothesis was that if calcium is an activator of bovine catalase, then the product of the catalase's breakdown of hydrogen peroxide and rate of increase will raise when calcium is applied. Five milliliters of 3% hydrogen peroxide solution was added to five milliliters of liquid bovine liver at 100% protein concentration with and without 50 mg of calcium citrate with vitamin D for absorption. The volume of the products of the reaction was measured at five, ten, fifteen, and twenty-second time intervals. After forty trials, the hypothesis was confirmed. All volume measurements had a standard deviation less than five. Bovine liver with calcium had an average product volume of 60.23 milliliters, versus the control, which was 1.4 milliliters less, at 58.83 milliliters. In addition, the liver with calcium had an average product volume increase of 8.22 milliliters or 19.2% between five and ten-seconds, versus the control, which was 6.89 milliliters or 16.1% in this time interval. The data shows that calcium increases the initial reaction speed of catalase. The result provides an in vitro basis for future studies on calcium as a catalase activator in humans.

Poster Board No. 031 FROM GRASS TO GAS. Srinath V. Ses-hadri (sscavsfan99@gmail.com), 7104 Timberview Dr. Dublin, OH 43017.

Ethanol is an ideal alternative to the non-renewable fuel shortage that the world is currently facing. Presently, the leading feedstock for ethanol production in the United States is corn. However, since corn is a major food source, scientists are searching for other alternative candidates. An ideal looking candidate for ethanol production is *Miscanthus sinensis*. The objective of the experiment was to compare the ethanol yields of *M. sinensis* and corn. The hypothesis was that *M. sinensis* would yield more ethanol than corn. A quarter pound of *M. sinensis* was pretreated with 70% sulfuric acid and then neutralized using potassium hydroxide, while the corn was heated and blended into liquid mixtures. Both mixtures were fermented and distilled twice. Then, both distillates were tested under specific conditions for the presence of ethanol via index of refraction and Iodoform reaction. A calibration curve of ethanol/water solutions for specific refractive indices was made to estimate the amount of ethanol in each distillate. The *M. sinensis* distillate had an ethanol concentration of 8%, while the corn distillate had an ethanol concentration close to 20%. However, the corn mixture only produced 5 mL of final distillate; therefore only producing 1 mL of ethanol. The *M. sinensis* hydrolyzate produced 15 mL of distillate, and yielded an 8% ethanol concentration, resulting in 1.2 mL of ethanol. In conclusion, *M. sinensis* produced 0.2 mL more ethanol than corn.

Poster Board No. 032 AFFECT OF NITROGEN CONCENTRATION ON THE MICROBIAL COMMUNITY OF A PURE WATER SOURCE. Ann E. McBeath (amcbeath15@hb.edu), 10213 Russell Avenue Garfield Heights, OH 44125 (Hathaway Brown School), Dr. Brad Goodner, Department of Biology Hiram College.

Aquatic ecosystems are susceptible to excessive levels of nitrogen, which may lead to algal blooms, acidification, and species modification. The objective of this experiment was to see if microbial communities in freshwater would be affected by increased nitrogen concentration. It was hypothesized that if the nitrogen concentration increased then the microbial community would be modified. To test this, a 50 ml water sample with 0 ppm nitrogen was added to five Windogradsky columns, a variable amount of nitrogen, 0, .1, 1, 10, and 100 ppm was added to each tube, and they were placed in front of a light source. On day 100

a metagenomic DNA sample was isolated from each tube using the Qiagen DNeasy isolation protocol. PCR, specific bacterial primers and gel electrophoresis were utilized to determine the microbial groups present in the tube. Six gels were run per tube for a total of 30 gels and in 25 gels (83%) the presence of the specific base pair primer band and its intensity led to the conclusion that as nitrogen concentration increased Archaea, Cyanobacteria, Sulfate reducers, Bacterial ammonia oxidizers and Archaea ammonia oxidizers all increase in concentration. 5 gels (17%) showed a primer band for Chlorobi only at the highest nitrogen concentration indicating that available nitrogen is a limiting factor to the its growth. Thus the conclusion is that increased nitrogen concentration will modify the microbial community in freshwater.

Poster Board No. 033 HYBRID INFERTILITY IN DROSOPHILA. Sanjana D. Roy (saroy15@hb.edu), 38780 French Creek Road, Avon, OH 44011; Claudia Mizutani, Hyun Lee, Case Western Reserve University Department of Biology. (Hathaway Brown School)

Infertility barriers prevent gene flow among separate organismal populations causing the emergence and evolution of new species. Biodiversity is one of the most fundamental benefits in life. This project aims to identify genes involved in the infertility of hybrids between two species of *Drosophila*: *Drosophila melanogaster* and *Drosophila simulans*. When mated, their hybrid progeny are infertile. However, a special strain of *D. simulans*, C167.4, generates fertile hybrids when crossed to *D. melanogaster*. The hypothesis is that the C167.4 strain contains a mutated gene, creating compatible hybrid genomes that rescue hybrid infertility. This experiment was designed to determine the presence or absence of major genetic mutations in the C167.4 strain. The genome-wide study identified genes that are most dissimilar between the species and are expressed in germline cells, leading to the isolation of 8 candidate genes. The method was to use PCR amplified DNA products for these candidate genes from *D. simulans* wildtype and C167.4 strains and employ restriction enzyme mapping and gel electrophoresis to test for mutations in the 8 candidate genes in C167.4. The predictions of the restriction profiles were made using ApE software and the data led to the conclusion that the PCR products and restriction profiles are identical to the wildtype and are 100% in agreement, which is what was hypothesized. After completing this analysis, no mutation was detected. The conclusion is that these 8 candidate genes are not involved in hybrid infertility. Future work includes different, more detailed analysis of the 8 candidate genes to detect, if any, point mutations. These could play a role in hybrid infertility.

Poster Board No. 034 HOW THE BISON ROAM: THE EFFECTS OF ENVIRONMENTAL CONDITIONS ON THE BEHAVIOR OF AMERICAN BISON. Michaela M. Dean (mdean43015@gmail.com), 282 North Washington Street, Delaware, Ohio 43015.

The experiment's purpose was to determine if different environments affect the behavior of American Bison. It was hypothesized that if the behavior of bison at the Wilds and other herds were observed and compared, then the behaviors of the bison would be the different. This was tested by comparing the frequency of different behaviors of the bison at the two locations. The results showed that the animals at the Wilds had 14 different behaviors, the Zoo's 12, and Darby Creek 11. The animals at the Wilds ran five times more than those at the Zoo and Darby Creek. The animals at Darby Creek stood twice as often as those at the Zoo and 6 times more than those at the Wilds; additionally they laid 3 and a half times, and grazed nine times more often than those at the Wilds and the Zoo. It is concluded that the hypothesis was correct because there was an obvious difference between the behaviors of the animals at the three sites. These results are supported by background research which showed that

bison in larger herds and/or enclosures act differently than those in smaller herds and/or enclosures. Possible errors include the amount of time each animal was observed, and the time of day and year each observation took place. Uncontrolled variables include calves in the Wilds' herd, the Zoo's male being castrated, and Darby's all female herd. Bison have a matriarchal society and herds may be without males during some seasons; additionally, there are very few males within a herd anyway, maybe one or two in a herd of over a hundred, because of this it is still a viable comparison. Ways this experiment could be improved include having more observing time at the Wilds and observing the animals over an extended period of time. These results raise questions regarding where the bison act more naturally.

Poster Board No. 035 GRADIENT GENERATION CHARACTERIZATION OF A BIOREACTOR FOR A 3-DIMENSIONAL OSTEOCHONDRAL TISSUE ENGINEERING. Kaitlyn L. Glasener (kl.glasener@gmail.com), 7302 Winchester Drive Solon, Ohio 44139 (Hathaway Brown School). Harihara Baskaran (hxb35@case.edu), Department of Chemical Engineering. Alexander L. Rivera (alr36@case.edu), Department of Biomedical Engineering, Case Western Reserve University.

Osteoarthritis is a debilitating condition characterized by the wearing of articular cartilage along joints. Tissue engineering using stem cells to form composite tissues of bone and cartilage offers a promising solution. A gradient generating bioreactor has been developed to create such composite tissues by exposing a scaffold containing stem cells to opposing bone and cartilage inducing flow generated molecular gradients. The objective of this study was to characterize gradient formation within this bioreactor and also across the depth of Polyethylene Glycol Diacrylate (PEGDA) hydrogels, which simulate cellular constructs, using two molecules: FD&C Red 40 dye and Texas Red labeled Dextran. It was hypothesized that these molecules would form a 2-dimensional gradient across the flow channel width, which would be maintained throughout the depth of the hydrogels. Four bioreactor fluid flow rates were tested. For each flow rate, one reactor containing 8 hydrogels was tested with FD & C Red to determine the depth at which the dye gradient diffused throughout the gel and one reactor with Dextran, which allowed for fluorescent gradients to be measured across the flow channel width. Overall 32 hydrogels were tested for each molecule and all hydrogels showed molecular diffusion across the hydrogel depth and a molecular gradient was produced across the channel width. Further, image analysis indicated that lower flow rates led to an increased diffusion across the channel width resulting in a more gradual gradient compared to higher flow rates. In conclusion, this reactor can create stable gradients that can be modified via flow rate across a 3-dimensional construct, establishing it as a device that can be used to study the effects of molecular gradients on tissue regeneration.

Poster Board No. 036 A NANOMEDICINE APPROACH FOR THROMBUS-TARGETED DELIVERY AND CONTROLLED RELEASE OF THROMBOLYTIC AGENT. Kavya Ravichandran¹, (ravichandran.kavya@gmail.com), Clarissa M. Kos² (cmk155@case.edu), Christa L. Modery-Pawlowski² (clm38@case.edu), Anirban Sen Gupta² (axs262@case.edu), ¹19600 North Park Boulevard, Shaker Heights Ohio, 44122 (Hathaway Brown School), ²Department of Biomedical Engineering, Case Western Reserve University.

In occlusive vascular disease, rapid thrombolysis is necessary for restoring blood flow to critical organs. To accomplish this, it is advantageous to localize the delivery and action of the thrombolytic drugs specifically at the occluded (clot) site to minimize the risks of systemic coagulopathy and hemorrhage from indiscriminate drug action. To this end, it is hypothesized that site-specific thrombolytic delivery could be achieved by targeting the thrombus with nanoparticles that can specifically bind

thrombus-associated active platelets and allow controlled drug release via thrombus-relevant enzyme action. Targeted binding of liposomal vehicles to integrin GPIIb-IIIa and P-selectin on active platelets has been previously demonstrated in the Sen Gupta laboratory. Building on this work, the goal of the current study was to determine the encapsulation of a model payload within the liposomal vehicle and characterize the payload's release triggered by a thrombus-relevant enzyme action. For this, a model payload carboxyfluorescein (CF) was encapsulated in the aqueous core of liposome samples and the encapsulation efficiency (EE) was measured by fluorescence spectrometry to be 74.70%±0.97. Subsequently the CF-loaded liposomes were subjected to incubation with the thrombus-relevant enzyme phospholipase A2 (PLA₂) at a physiologically-relevant concentration of 2.5 ng/mL, and resultant CF release at pH 7.4 in 5 mM Tris-HCl buffer at 37°C was monitored over time for 5 hours by measuring CF fluorescence. These studies showed a twofold increase in CF release from liposomes triggered by PLA₂ as compared to the absence of PLA₂. The results demonstrate the potential of platelet-targeted enzyme-triggerable liposomes as a novel nanomedicine technology for site-specific thrombolysis. The technology will be tested in clot models in vitro and in vivo in the future phases of the research.

Poster Board No. 037 SOIL TEMPERATURES EFFECT ON SOYBEAN GROWTH. Steven J. Speck (sjspeck@ymail.com), 20381 Mercer Rd., Bowling Green OH 43402. (Bowling Green High School)

The eagerness of farmers to provide their soybeans the full advantage of the growing season has caused them to plant earlier in the spring, thus exposing their crop to potential damaging soil temperature. To test the effect soil temperature had on soybean seedling growth three temperature ranges were used 10.00-11.11°C(A), 12.22-13.89°C(B), 14.44-16.11°C(C), seventy two soybean seedlings were exposed to each temperature range. The effects could be seen in the first three days of root growth where temperature range C produced the longest root growth with an average of 0.39 cm and a standard deviation of 0.30 cm. The temperature range A produced the least root growth (average of 0.02 cm and a standard deviation of 0.08 cm). Soil temperature also influenced shoot growth; plants growing in soil of 14.44-16.11°C exhibited the greatest increase in height (mean 5.29 cm and standard deviation of 3.32 cm). Seedlings growing in the coldest soil did not increase in height. It can be seen that there was a correlation between warmer soil temperature and faster, larger growing soybeans.

Poster Board No. 038 CAN NO-TILL FARMING WITH BIOCHAR INCREASE THE GROWTH OF SOYBEAN PLANTS? Bethany G. Cox (coxbe45@alliancecityschools.org), 300 W. Bayton Street, Alliance, OH, 44601. (Alliance High School)

There is a global interest in reducing atmospheric carbon. A connected interest is the use of biofuels instead of fossil fuels. Soil conservationists and farmers are seeking economical ways to prevent soil erosion in croplands. Biochar can sequester carbon in the soil, lessen erosion while enhancing plant growth. Biochar is created from plant and animal waste through pyrolysis. It is tilled into the ground once as an organic fertilizer. No-Till with the use of biochar can sequester carbon in the soil while promoting the accelerated growth of soybean plants. Forty plant pots were labeled and placed in trays. All pots contained one germinated soybean seed. Ten pots contained plants and biochar from 2012 to show no-till. Ten pots contained plants from 2012 and no biochar. Ten pots contained plants and new biochar. The control group of ten pots contained plants and soil. Plants received 80 mL of water daily. Measurements were recorded. The control group's growth was 625.75 cm stem height, 74 leaves, 50.6 cm total leaf width and 54.5 cm total leaf length. The new biochar group recorded 778 cm stem height, 92 leaves, 47.2 cm total leaf width and 56.1 cm total leaf length. The 2012

with no biochar group's growth was 716.25 cm stem height, 80 leaves, 54.25 cm total leaf width and 50.95 cm total leaf length. The 2012 group with biochar had 875.25 cm stem height, 102 leaves, 56.7 cm total leaf width and 54.85 cm total leaf length. Results confirm that biochar with No-Till farming produces the accelerated growth in soybean plants.

Poster Board No. 039 THE ROLE OF HYPOXIA IN NOTCH-MEDIATED TIP ENDOTHELIAL CELL FORMATION. Emily Amjad (emilyamjad@gmail.com), 19600 North Park Blvd. Shaker Heights OH 44122, Hathaway Brown; Anna Henry, Alexander Calderon, Diana L. Ramirez-Bergeron, Case Western Reserve University.

Angiogenesis, the process by which endothelial cells form mature vessels, is imperative to meet nutrient and oxygen needs in pathologies where damaged tissues are in a hypoxic state (low O_2). Sprouting angiogenesis involves the proper balance of specialized tip-endothelial cells (ECs) towards a gradient of vascular endothelial growth factor (VEGF) whose signaling engages the activation of its receptor, VEGFR-2 (Flk-1), and cross talks with the Notch cell-signaling pathway causing the upregulation of Notch ligand Delta-like 4 (Dll-4) and its the downstream target Hrt-2. Hypoxia is known to induce the expression of *Vegf*, *Dll-4* and *Hrt-2*. The hypothesis of this project is that hypoxia plays a critical role on Notch-mediated tip EC formation. To test this, chemical (DAPT) and genetic (dominant negative mastermind, DNMM) Notch inhibition approaches were used to measure molecular and biological responses of MS1 ECs to either 21% or 2% O_2 , ambient or hypoxic oxygen levels, respectively. Quantitative-PCR analysis of three separate experiments, each performed with triplicate samples, reveals that 2% O_2 alters the expression of genes involved in tip cell formation with decreasing *Dll4* and *Flk-1* and increasing *Hrt-2* RNA transcript levels. Chemical or genetic inhibition of Notch results in the downregulation of all these genes in 21% O_2 , but only DNMM further alters their expression in response to 2% O_2 . To further test the hypothesis, a biological readout for endothelial cell sprouting was employed. MS1 EC aggregates exposed to hypoxia, DAPT, or DNMM all showed decreased numbers of sprouts and branch points relative to controls (N=5). In conclusion, these experiments support the hypothesis that hypoxia has a significant role in sprouting angiogenesis, in part by affecting the Notch pathway.

Poster Board No. 040 GRÄTZEL CELLS: THE FUTURE OF ENERGY. Jesse R. Rines (jesse.rines@gmail.com), 7304 Seraphim Court Galena, OH 43021. (Big Walnut High School)

The world is in desperate need of renewable, sustainable energy. Solar panels have long been discussed as a solution to the problem, but are often simply too expensive for the consumer to purchase. Grätzel cells solve that problem by providing a much cheaper alternative. They work by allowing sunlight to hit titanium dioxide (TiO_2), thereby displacing electrons and generating a flow of electricity. This experiment determined the mathematical relationship between the concentration of TiO_2 in the cell and the potential voltage it can produce; in addition, it optimized the concentration from the perspective of a company trying to create an effective product while keeping production costs low. That concentration, at about 4.3 M TiO_2 , was determined after finding that the relationship is logarithmic, and therefore, as the concentration increases, there exists a horizontal asymptote at which greater concentration has no effect. Producing a product with a higher concentration would be inefficient, as it would be spending money while not actually increasing the quality of the product. Optimizing Grätzel cells is essential to delivering them to consumer markets effectively—these results are significant as both a model for other photovoltaics and as a direct application to Grätzel cell manufacturing.

Poster Board No. 041 A SPECTROPHOTOMETRIC

DETERMINATION OF ANTIOXIDANT BEHAVIOR IN TEA EXTRACTS: RADICAL QUENCHING OF 1-DIPHENYL-2-PICRYLHYDRAZYL. Marija J. Rowane (14mrowane@beaumontschool.org), 2937 Legend Lane, Willoughby Hills OH 44092. (Beaumont School)

Antioxidants, biochemical repair substances that inhibit oxidation through the inactivation of free radicals, are found in various foods, skincare products, and supplements. The objective of this scientific research involved the analysis of antioxidant levels in multifarious tea extracts, including herbal, black, white, green, and oolong teas, to determine the most nutritive variety of tea. The hypothesis was that the tea type and brand impacts the antioxidant levels present in the tea extracts. An Ultraviolet-Visible (UV-Vis) Spectrophotometric method, involving radical quenching of the free radical 1-Diphenyl-2-picrylhydrazyl (DPPH), was conducted for the analysis of the tea extracts. The DPPH assay involved a visible colorimetric change from purple to yellow in the presence of antioxidants. UV-Vis spectrophotometric measurements demonstrated the range of antioxidant concentrations through assessing the inhibition of 50% of the DPPH, IC_{50} , by analyzing the difference in absorbance of a methanol control and a given concentration of the DPPH solution. The moles of free radicals inhibited per cup of tea were calculated from the obtained absorbance. The three trials conducted per brand of tea demonstrated the differences between tea types in their antioxidant capacity, supporting the hypothesis. The highest antioxidant levels from black, white, herbal, and green teas were 1.5×10^{-3} , 8×10^{-4} , 3.3×10^{-4} , and 2.3×10^{-3} moles (mol) of radicals (R) inhibited by antioxidants per cup of tea. Choice Organic Teas® Oolong Tea was most potent, with 2.7×10^{-3} mol*R/ cup of tea. This study indicates the antioxidant presence in all of the analyzed tea extracts to support the nutritional benefits of tea drinking.

Poster Board No. 042 IS YOUR WEEK OLD ORANGE JUICE AS HEALTHY AS YOU THINK? Shawn A Tahajod (techno35@ohio.net), 1002 Smokerise Dr., Medina OH 44256. (St. Francis Xavier School)

The objective was to determine the effects of temperature on the levels of vitamin C in orange juice over time. A standard solution of the ascorbic acid using vitamin C tablets was prepared. The vitamin C of the standard solution was measured by titration using 1% iodine solution and starch indicator, in order to develop a procedure for measuring vitamin C in orange juice. Three cartons of store-bought orange juice were purchased. One container was opened at 0 days and the vitamin C of the orange juice measured via titration. All measurements were done in triplicate. One container of orange juice was kept at 40.6°F, and another container was kept at 67.8 °F. After 24 hours, 72 hours, and 168 hours, the vitamin C of each sample was measured. The cap of each container was left open for 5 minutes during each use to simulate consumer habits. All the titration results were recorded and analyzed. Vitamin C in the orange juice samples was reduced over time. The amount of vitamin C in the juice before any tests were done was 48.0 mg. The amount of vitamin C in the orange juice during refrigeration depleted slowly throughout the storage period from 52.5 mg at 24 hours to 48.8 mg at 168 hours (about 8%). The vitamin C in the sample held at room temperature depleted significantly faster, from 48 mg to 34.4 mg at 168 hours (about 28%). Refrigeration slowed the rate of depletion. In order to maximize vitamin C intake, consumers should drink orange juice in a short time.

Poster Board No. 043 BRIDGES: WHICH ONE IS OUR STRONGEST CONNECTION? José Pablo Fernández García (jp2208@cinci.rr.com), 4174 Oak Tree Ct; Loveland, OH 45140.

There are many bridges in today's world. There are six basic types. These basic types are the beam, truss, arch, suspension, cable stayed, and cantilevered. However,

which bridge is truly able to carry the heaviest load and be the most efficient? The hypothesis was that the arch bridge would sustain the heaviest load and be the most efficient. 2 bridges of each type were used. (12 total) For the load, sand weights were used. Attaching the load to the bridge was a weighing mechanism that connected a bucket to the bridge with S hooks, chain, washers, and a nut and bolt with a hook. The mass held was recorded, and the efficiency score was calculated by dividing the mass held by the bridge's mass. There was a pause of 20 seconds before increasing the load. The beam bridge did not break while the load reached an unsafe level. The beam bridge carried the heaviest load (21 kg; possibly more), and the cable-stayed bridge carried the lightest load (4.25 kg). The beam bridge had the highest efficiency score (677; possibly more), and the cable-stayed bridge had the lowest efficiency score (218). These are the results (mass held/efficiency score): Beam: 21 kg/677, Truss: 7.25 kg/372, Arch: 5.25 kg/438, Suspension: 7.5 kg/375, Cantilever: 7.25 kg/330, Cable-stayed: 4.25 kg/218. In the end, the hypothesis was proven wrong, with the beam, not the arch, being the most efficient and be able to carry the weight.

Poster Board No. 044 THE EFFECT OF A DIMPLED SURFACE ON MODEL ROCKET ALTITUDE. Ian DD Mail (imail@neo.rr.com), 513 Earl Ave., Kent OH 44240. (Stanton Middle School)

Introduction: This project was conducted to determine whether golf ball-like dimples on a rocket's surface, compared to a smooth surface, as hypothesized, would reduce drag and increase altitude. **Methods/Materials:** Six identical model rockets were tested. The researcher applied clay (3 mm in thickness) to each of the rocket surfaces and dimpled three rockets with a hand tool. Rockets were launched three times each; altitude data were collected and averaged. One rocket was non-retrievable during launches. A second launch, 6 months later, using same procedures and dimpled and smooth rockets was conducted to replicate original results. The only differences between the October and April launches were the wind speed and direction. Wind tunnel testing was conducted on each rocket (6 trials each) and averaged. The wind tunnel velocity was 70 feet per second as opposed to the Estes® estimated 100 feet per second for the rockets. **Results/Conclusion:** The dimpled-surface rockets peaked at an average of 89 meters during the first launch, while the smooth-surfaced rockets peaked at 74 meters. The dimpled-surface rockets reached an average altitude 15 meters, or 20% higher, than the smooth rockets. Average rocket altitudes were higher during the second launch; however, average gain in altitude of the dimpled rockets remained 20% higher than the smooth ones. Replication of results was achieved and hypothesis supported. Wind tunnel data indicated opposite results than both launches. Due to lower velocity in the wind tunnel, the Reynolds Number may not have fallen in the transition zone to trip the flow from laminar to turbulent to reduce wake and drag.

Poster Board No. 045 LIFESAVER: A PROTOTYPE CRIB ALARM TO PREVENT INFANT DEATH. Selena M. Turner (Selena.Turner@yahoo.com), 1208 Winter Fern Avenue, Springfield Township OH 44312. (National Inventors Hall of Fame Science, Technology, Engineering and Mathematics High School. Akron OH)

The purpose of this project was to design a device to prevent infants from suffocating when they get trapped in their cribs. It would save lives because an alarm would sound to summon help. There is nothing on the market to solve this problem. This design is very inexpensive. The problem is to design a device that will sound an alarm upon contact with 2.27 kg; the minimum weight a baby must be to come home from the hospital. The technological design of a crib alarm is invented to sound when an infant is trapped in the crib, then the baby will not suffocate and die because it will

alert the parents they need help. A crib and mattress were designed to test and fit the device. Aluminum foil, wax paper, a 9V battery and connector, battery clip, wire, tape, and buzzer were used to make the alarm. It was placed around the mattress bottom where the baby should never be, but is in danger if they are. A switch series circuit using the foil as the conductor was the end result. When tested, using a doll the size and weight of a newborn, the baby triggered the alarm 100% of the time, no matter where it was trapped. The alarm was heard as far away as a different floor. The objective was met after much trial and error. Several devices were made first that did not work as the baby didn't weigh enough to trigger the switches tried. Nor, did it fall far enough to obtain the force needed. This contributes to both the medical and engineering fields. The main goal is it will keep babies alive. Filing for a patent is in the process.

Poster Board No. 046 SYNTHESIS AND CHARACTERIZATION OF GOLD NANOPARTICLES IN METHACRYLATE POLYMERS. Rebecca E. Weinberger¹(rweinberger97@gmail.com), Mohan R. Sankaran², Stuart Rowan², Stephen R. Diegelmann², Souvik Ghosh², ¹Hathaway Brown School, 19600 North Park Boulevard, Shaker Heights, Ohio 44122, ²Case Western Reserve University Department of Engineering.

Composites of metal nanoparticles and polymers have potential electronic, biomedical, and optical applications. Typically, nanoparticles are preformed and combined with the polymer, resulting in undesirable phase separation of the materials. This lack of dispersity was addressed by forming metal nanoparticles directly within the polymer matrix. Poly(butyl methacrylate) (PBMA) (T_g=20°C) and poly(methyl methacrylate) (PMMA) (T_g=114°C) were the polymers used. The objective was to examine various methods of nanoparticle synthesis and the overall properties of the nanocomposites. The hypothesis was that the properties of a polymer including their glass transition temperature could be used to control particle nucleation, growth, and agglomeration. Two methods were used to reduce the metal ions suspended in the polymers: ultraviolet (UV) light combined with heat, and a microscale plasma discharge. The formation of gold nanoparticles was monitored by UV-visible absorption spectroscopy and TEM imaging. After 30 minutes at room temperature, the UV-visible absorption spectrometer indicated a maximum absorption level of 0.0412 in the PBMA. The PMMA attained this same absorption level only after 90 minutes at 75°C. Therefore, the nanoparticles formed more readily. There are many bridges in today's world. There are six basic types. These basic types are the beam, truss, arch, suspension, cable stayed, and cantilevered. However, which bridge is truly able to carry the heaviest load and be the most efficient? The hypothesis was that the arch at room temperature in PBMA than in PMMA, correlating with PBMA's lower T_g. The microscale plasma discharge also reduced the ions, but needed to be controlled in order to avoid polymer degradation. In conclusion, both the importance of the polymer's T_g in situ synthesis of metal nanoparticles, as well as the feasibility of controlled nanoparticle synthesis by limited application of the reducing agent, were shown.

Poster Board No. 047 THERMAL ENERGY FROM WOOD BURNING FIRES: HARDWOOD VS. SOFTWOOD. Faith C. Myers (myersfc@embarqmail.com), 4251 N County Line Rd., Sunbury, OH 43074. (Big Walnut Middle School)

The purpose of this experiment was to determine if hardwood (oak) or softwood (poplar and pine) produce the most thermal energy when burned. Research shows that hardwoods contain more thermal (chemical) energy than softwoods on a volume basis. The hypothesis was hardwood (oak) will produce the highest amount of thermal energy. The hypothesis was tested by evaluating the maximum water temperature generated, volume of water evaporated, and fire duration. Eight pieces of wood (each 0.6 cm long

and 3.2 cm in diameter) were placed onto shredded paper (25 g) in a fireplace. The wood pieces were dipped into kerosene and placed on the paper. Kerosene (5 ml) was poured onto the wood and the paper was ignited with a match. A beaker of water (250 ml at 20°C) containing a thermometer was placed on a grate above the fire after one minute. Water temperature was recorded every minute, as well as the final burn time (minutes). The volume of water (ml) evaporated was recorded. Ten trials were performed for each wood type (total of 30 trials). The highest mean water temperature was 80.5°C for oak, 75.1°C for poplar, and 72.2°C for pine. The largest mean water volume evaporated was 8.2 ml for oak, 5.6 ml for poplar, and 4.5 ml for pine. The total mean burn time was 12.0 minutes for oak, 8.0 minutes for poplar, and 7.1 minutes for pine. Hardwood (oak) produced more thermal energy than softwood (poplar and pine) by all three measures tested, supporting the hypothesis.

Poster Board No. 048 SUSTAINABLE APPROACH FOR CLEANING METAL CONTAMINATED WATER USING PYROLYZED BANANA PEELS. Bluyé Bruke DeMessie (demessiem@aol.com), 4291 Serpentine Way, Mason, OH 45040, George Sorial (sorialga@ucmail.uc.edu) School of Energy, Environmental, Biological, and Medical Engineering, Environmental Engineering Program, University of Cincinnati, Endalkachew Sahle-Demessie (Sahle-Demessie.Endalkachew@epa.gov), Office of Research and Development, NRMRL, U.S. Environmental Protection Agency.

Adsorption of bivalent heavy metal ions from polluted water was studied using dried powdered banana peels and banana peel pyrolyzed at 500°C and 600°C. The results were compared with adsorption using commercial activated carbon F-400. The morphology, physical, and chemical properties of the adsorbents were characterized using thermogravimetric analysis, Fourier transfer infrared spectroscopy, pH electrophoresis, surface area analysis, scanning electron microscopic imaging, and X-ray diffraction analysis. Pyrolysis of dried banana peels formed a porous, large surface area adsorbent (50 – 60 m²/g), with negative surface charges resulting in increased adsorption capacity of by two orders of magnitude. Factorial design of 18 experiments that includes two levels of four factors, 2⁴, with two central points, were performed for each adsorbent, we optimized factors: mass of adsorbent, pH of solution, tumbling time and initial Cu(II) concentration. The equilibrium adsorption data was modeled with the Freundlich and Langmuir isotherms. The degree of favorability of adsorption of Cu(II) ions and the adsorption capacity were 0.75, and 4.87 mg/g for banana peel, and 1.25 and 351.1 mg/g for pyrolyzed banana peel. Adsorption kinetics followed pseudo-second order model. Fixed bed column studies were conducted to determine the flow effects and breakthrough point. The Thomas model and the Yoon–Nelson model were employed to determine parameters, such as adsorption rate and adsorption capacity, useful for process design. Extracting metal pollutants from water using pyrolyzed banana peel as an adsorbent is a low cost, suitable and sustainable, alternative for cleaning contaminated waters. The banana peels were dried in the sun for two weeks during the summer, when the average day time temperature was 28°C. The dried banana peel were crushed using a coffee grinder and the powder was placed in tube furnace with a flow nitrogen blanket and pyrolyzed at 500°C or 600°C. The pyrolyzed banana peel was further ground using a mortar.

Poster Board No. 049 THE EFFECT OF MICROWAVES ON PLANT GROWTH AND DEVELOPMENT. Emily L. Fendinger (nfendinger@cinci.rr.com), 8226 Hidden Mill Court, West Chester, OH 45069. (St. Susanna Parish School)

The purpose of this project was to see if microwave radiation affected plant germination and growth. My hypothesis was that microwave radiation would have a negative impact on plant germination and growth. Three different types of plants were used; sunflowers, beans, and grass. All plants had the same amount of water, sunlight,

heat, and the same potting soil. Three of each type of plant seeds was micro-waved for five seconds, ten seconds, twenty seconds, and forty seconds. The control plants were not micro-waved. The plants were measured on regular intervals for twenty-eight days. The plant seeds that were micro-waved for five, ten, and twenty seconds were significantly taller and germinated faster than the plants that were not micro-waved. Although these results were good, the plants that were micro-waved for forty seconds did not do as well. The forty-second plants did worse than the control plants. The conclusion was that if plant seeds received micro-waved radiation, then the plants will grow faster, but if you micro-wave them for too long, or receive too much radiation, then the plants will not do as well. The conclusion proved the hypothesis wrong as the hypothesis stated that plants that were micro-waved would not develop as well as plants that were not micro-waved. The conclusion could also relate to real-life because NASA is planning to use microwaves to transport information from space, the microwaves could affect the environment. For gardeners, however, about ten to twenty seconds of micro-waving the plants seeds should speed up the growth and development of the plants.

Poster Board No. 050 THE EFFECT OF LENSES ON SOLAR ENERGY PRODUCTION. Emily Pallaki (mcorrigan@metrohealth.org), 304 Regatta Dr, Avon Lake, Ohio 44012.

The earth is running out of some fossil fuels. The generation of electricity from solar energy is relatively clean and long lasting. One means of capturing the sun's energy is accomplished by solar cells. Lenses focus light in different ways, may have an impact on solar energy production. Lenses can focus and disperse light from the sun. The convex lens takes light and focuses it to one point. Concave lenses, used to see distances, take light and spread it out. The Fresnel lens is used in car headlights. Fresnel lenses are a series of lenses that take light from all directions and focus it like a spotlight. The Fresnel lens is hypothesized to produce the most energy relative to the other lenses, because it can capture the most light. In this study lenses are placed above a solar panel. Each lens's position is rotated: north, south, west, and east. The energy output is measured in amps and volts with a volt meter. Watts are calculated, and compared. The twenty trials (N=20), consisted of eighty readings for the four directional positions tested the hypothesis. After comparing concave, convex, and Fresnel lenses to the control-no lens, the Fresnel focused the light best and produced the most energy measured in watts. In order from greatest to least the averages are as follows: Fresnel-104.3 watts, control-89.6 watts, convex-87.7 watts, and concave-81.4 watts. In this study Fresnel's concentric convex lenses focus light better onto solar panels. The Fresnel lens produced more energy than the control by 14.7 watts on average. The data supported the hypothesis. Solar energy is a widely used resource, and Fresnel lenses could have an effect on energy production.

Poster Board No. 051 ARCTIC OIL SPILL CLEAN-UP. Abigail L. Myers (myersa13@embarqmail.com), 4251 N. County Line Rd., Sunbury OH 43074. (Big Walnut High School)

Increased melting of the Arctic ice cap has opened the region for oil and gas exploration and new shipping routes. Extreme Arctic conditions may affect the ability to clean up accidental spills. This experiment examined the ability of synthetic (polypropylene, polyurethane, and polyester) and natural organic (cotton, straw, and sawdust) sorbents to remove oil from Arctic water conditions through absorption and/or adsorption. A literature search led to the hypothesis: Arctic cold water and ice conditions will minimally affect the ability of sorbents to remove oil from water. Each sorbent was weighed (based upon prior experimentation by Myers: 1.5 g for polypropylene, straw and sawdust; reduced masses of 1.1g polyurethane, 0.8g polyester, and 0.7g cotton) and respectively placed in a beaker containing water (150 ml, 0°C), oil (20 ml, 0°C), and ice (15g, 0°C). Sorbent was retrieved after 5

minutes, and masses of used sorbent and remaining fluids were determined. Individual sorbent oil mass ratios (mass of used sorbent containing recovered oil: mass dry sorbent) were calculated for 180 trials and compared to Myers' previous results for Gulf of Mexico (GoM) warm water conditions. Oil mass ratios are (for GoM/Arctic cold water/Arctic cold water and ice conditions): polypropylene (8.6/10.2/9.2), polyurethane (6.9/5.3/5.8), polyester (17.3/15.5/16.5), cotton (19.8/18.7/15.1), straw (4.0/4.9/4.5), and sawdust (5.3/6.4/6.3). Mean oil mass ratios were 11.0/10.3/10.5 for the synthetic sorbent group and 9.7/10.0/8.6 for the natural organic sorbent group. Experimental results for synthetic and natural organic sorbent groups reveal that the performance in Arctic conditions was comparable to that in warm water.

Poster Board No. 052 A SIMPLE BIO-TEST TO DETERMINE THE LAND OIL SPILL TOXICITY – PLANT GERMINATION & GROWTH. KAVIN S Vedamoorthy (Kavin4804@gmail.com), 4804 Sapwood Drive, 43054 New Albany, Ohio.

Incidences of oil spills are happening very frequently on land as well as underwater (Gulf of Mexico oil spill in 2010). Oil spills under water can be carried away to far distances and end up on land. Spilled oil makes the soil conditions unfavorable for plant growth by depleting nutrients and adding toxicity. Extensive pollution of the environment by crude oil also constitutes socioeconomic and Public Health Hazards. The oil pollutant gets enriched as the food chain goes upwards from plants to humans. My hypothesis is that the seed germination and plant growth impairment serves as a direct measure of the level of crude oil toxicity. A simple bio-test was developed to assess the impact of crude oil toxicity on plant germination and growth. Dry Cicer arietinum seeds were soaked in water and placed in crude oil [1 or 5% (v/w), collected from Gulf of Mexico, Texas, and Canada refineries], and mixed with top-soil (10 seeds per container). The number of seeds germinated, shoot and root lengths, and protein content were analyzed statistically using Student t-test. Crude oil treatment affected the percentage of seed germination and growth significantly in a concentration dependent fashion (**P<0.001). The length of shoots and roots were significantly decreased in 1% and 5% oil (*P<0.05; **P<0.01; ***P<0.001) respectively. Furthermore, protein contents were also significantly decreased (**P<0.01; ***P<0.001). To further extend, the impact of crude oil toxicity on plant (oxidative) stress was studied and observed an increase in reactive oxidants formation in the treated groups (***P<0.001). This simple bio-test could also be useful in assessing the effectiveness of cleanup process and protecting our environment.

Poster Board No. 053 THERMAL ENERGY TRANSFER ACROSS ALASKAN OIL PIPELINE. Nitin Y. Paulett (pantherN@cinci.rr.com), 11413 Village Brook Dr., Cincinnati OH 45249. (Sycamore Junior High School)

Cold temperatures in Alaska make oil inside a pipeline more viscous. This slows down oil flow and could lead to an expensive pipeline shut-down. This project tested the hypothesis that insulators with a low thermal conductivity will slow down the cooling of a liquid inside a metal container more effectively than insulators with a greater thermal conductivity. Thermocouples were used to measure cooling of windshield wiper fluid in a tin box after it was placed on a dry-ice block inside a Styrofoam box. Four different insulation materials made of polyethylene and polyurethane were tested along with a control. From time-dependent temperature profiles, apparent cooling rates were calculated using the linear decrease in fluid temperature inside the tin box and compared to the control experiment without insulator. Each experiment was performed three times. For the best insulator, the Noble Gov Foam Sill Sealer™, the temperature of the liquid decreased at a rate of $0.0188 \pm 0.0003^{\circ}\text{C s}^{-1}$ (N=3), which is ~17-fold slower than without an insulator ($0.3239 \pm 0.0377^{\circ}\text{C} \times \text{s}^{-1}$, N=3). Based on these results, insulating the pipeline with this polyethylene-based material may help to reduce

rapid heat loss across the pipeline. As a consequence, oil viscosity remains low, and oil flows more quickly from the oil fields to the Valdez Marine Terminal for transportation.

Poster Board No. 054 EFFECTS OF POLLUTANTS IN GREAT LAKES REGION ECOSYSTEMS ON DAPHNIA MAGNA AND ELODEA CANADENSIS. Halle A. Miller (mille728@miamioh.edu), 13684 Janell Drive, Columbia Station, Ohio 44028.

The objective was to determine the effects of cultural pond pollutants on *Daphnia magna* (water flea) and *Elodea canadensis* (waterweed). In this context, the term "cultural" refers to man-made or man-caused pollutants. The subjects were chosen for specific reasons, based on background research. The *Daphnia* were chosen for this experiment because of their known sensitivity to changes in their common living environment. The *Elodea* was chosen because of their commonness to the region being studied, as well as their sensitivity to changes in their surrounding environment. The hypothesis was if pollutant rates are higher, then the water fleas and waterweeds will not be able to survive as long in any environment, compared to samples with lower pollution levels. Water samples were collected from five ponds in a set region of Northeast Ohio, on two separate days of similar and moderate temperature, for each pond. Test strips and tablets were used to test for nitrate, sulfate, iron, copper, phosphorus, dissolved oxygen and pH. From each site, 20 mL of water were put into four petri dishes total, with five *Daphnia magna* in each of two petri dishes for each day. The same was done for five *Elodea canadensis* leaves. Observations and results were recorded for ten days by counting live *Daphnia* using an observation microscope and rating *Elodea* using color, shape and structure scales. This scale was developed specifically for this project, based on background research on the range of healthy and polluted *Elodea* appearance, where 1 was the best result possible and 5 was the worst result possible. Pond 5 consistently had the highest pollutant levels, as well as the fewest *Daphnia* present on Day 10 (1.25 average) and the highest ratings for the *Elodea* scales, (color=5, shape=4.5 and structure=4.5) which were out of 5. Pond 1 regularly had the lowest pollutant levels, as well as the most live *Daphnia* present on Day 10 (8 average) and the lowest ratings for the *Elodea* (color=3.8, shape=2.8 and structure=2.3). Samples from Ponds 2, 3 and 4 were in between the results of Pond 1 and Pond 5. Therefore, the hypothesis of an inverse correlation was supported; the ponds with the lowest overall pollutant levels supported the largest number of *Daphnia magna* and *Elodea canadensis*.

Poster Board No. 055 SPICES AS FLY DETERRENTS. Morgan J. Nelson (buckeyemo13@gmail.com), 6780 Coffman Rd, Dublin, OH 43017. (Coffman High School)

Flies spread diseases when they land on food. People from cultures in hot climates where flies are abundant and bacteria grows quickly tend to use a lot of spices; the explanation is that spices inhibit microbe growth so people develop a preference for spicy food because they are less likely to get sick. The goal of this experiment was to determine whether flies prefer meat without spices. In Experiment 1, unseasoned and seasoned pieces of beef (n=8/group) were placed outside for 4 hours, then 48 hours later the number of larvae were counted. Beef with garlic had fewer larvae than unseasoned beef while beef with cayenne pepper had no larvae (H=15.09, p<0.05). In Experiment 2, ten fly eggs (*Musca domestica*) were placed on beef seasoned with garlic or cayenne pepper versus unseasoned beef. Seasoning had no significant effect on the proportion of larvae that hatched (p>0.05); thus, spices cause avoidance of egg laying rather than inhibition of egg hatching. In Experiment 3, flies were placed in a container with four 45 gram ground beef balls containing 0, 1, 2 or 3 grams of cayenne pepper. Seven of 10 flies demonstrated a preference for the unseasoned beef and three showed a preference for the beef with 1 gram of cayenne pepper. In conclusion, flies prefer unseasoned meat for laying

eggs and feeding. If flies avoid seasoned meat, then there is reduced opportunity for fly-borne disease; this may be another explanation for why spicy foods are preferred by people in hot climates.

Poster Board No. 056 ANTIOXIDANT LEVELS IN THREE COMMON BERRIES. Justin M. Nelson (rmelson@osu.edu), Sells Middle School (8th Grade), Dublin, OH 43017.

Oxidative stress is thought to speed up aging and cause many types of diseases, including cancer, Alzheimer's Disease, cardiovascular disease, eye disease, and Parkinson's disease. Fortunately, many foods, including fruits, have high levels of antioxidants, which the body can use to counteract oxidative stress. The goal of this experiment was to compare the antioxidant power of three common types of berries that were fresh versus two weeks older. The hypotheses were: (1) that blueberries would have higher antioxidant levels than strawberries and blackberries, and (2) that older berries would have less antioxidants than fresh berries. Five samples of each type of fresh and old berries were homogenized and then the antioxidants were extracted with water and the samples were filtered. An assay was used to determine the Trolox equivalent units (TEU) in each sample. Data were analyzed with an analysis of variance test. There were no significant differences in the antioxidant levels of the $p > 0.05$). The antioxidant levels also did not decrease in old strawberries (52.9 ± 22.8 TEU/g) and old blackberries (62.1 ± 6.2 TEU/g). However, antioxidant levels were significantly lower in old blueberries (13.1 ± 6.6 TEU/g; $p < 0.05$) compared to all other groups. In conclusion, fresh blueberries, blackberries, and strawberries are equally good sources of antioxidants, but blueberries rapidly lose this benefit after purchase.

Poster Board No. 057 FAT SENSITIVITY AND BODY MASS INDEX: IS THERE A LINK? Vineet S Prasad (vineetsprasad@yahoo.com), 4513 Riverstone Way, Mason, OH 45040. (Mason High School)

The increasing prevalence of obesity in United States has been paralleled by increase in fat intake. Objective of this experiment was to investigate if there is a correlation existing between the fat sensitivity and body mass index (BMI). Experimental research was based on the taste studies with questionnaire using 58 subjects (BMI categories included normal 18.5 to 24.9, high > 25.0 to < 29.9 and obese BMI > 30.0) with model system with varying in fat. Samples were ranked according to preference and data was analyzed based on percentage of preference data plots. Conclusions supported the correlation which exists between fat preference and body mass index. (r^2 value of 0.52). Subjects who were in higher BMI range had a strong preference to high fat base (75.86%) and strong dislike to the nonfat base (69%). Normal BMI participants showed more of a preference to the high fat base (37.03%), however, this result seem complicated because the nonfat base was their second choice (29.62%). Research shows promise in understanding further on role of genetics and taste receptors in fat perception to help reduce obesity as it is the leading cause of various diseases and preventable cause of death worldwide.

Poster Board No. 058 THE EFFECT OF ENERGY DRINKS ON HEART RATE. Lily A. Ganim (lilyganim@gmail.com), 5217 Adena Trail, Cincinnati Ohio 45230.

Energy drinks have been implicated in causing the death of several teenagers in recent years. The effect of energy drinks on the heart has been one of the mechanisms thought to contribute to these deaths. Because most energy drinks contain high amounts of caffeine and other stimulants, it raises the question: Do energy drinks affect the heart rate? It is possible that the consumption of energy drinks raises heart rate. This increase in heart rate could strain the heart, and Monster® was used as an example of an energy drink. Ten *Daphnia magna* were exposed to 0.05% Monster® (Test *Daphnia*) and ten *Daphnia magna* were

exposed to 0% Monster® (Control *Daphnia*). The *Daphnia* were observed under the microscope and their heart beats were recorded over 30 seconds. The average heart rates were calculated (beats per minute, or bpm) from these data. The Control *Daphnia* had an average heart rate of 265 ± 20 bpm. The Test *Daphnia* had an average heart rate of 350 ± 30 bpm. A mean increase in heart rate of 85 bpm ($P < 0.0001$) in the *Daphnia* exposed to 0.05% Monster®. This result supports the hypothesis that if the heart is exposed to energy drinks, then the heart rate will increase. Energy drinks could have contributed to the deaths of the individuals who consumed them prior to their fatal event.

Poster Board No. 059 AN OPTIMAL LOCATION PROBLEM WITH AN OBSTRUCTION. Richard Huang (huang89@gmail.com), 2593 Thomas Jefferson Drive, Beavercreek OH, 45434. (Beavercreek High School)

In the problem studied, Corporation A needs to visit the facilities P1, P2, P3 with k1, k2, k3 trips every week, respectively. An obstacle, such as a river, runs across the area from east to west. P1 and P2 are north of the river while P3 is south of the river. There exists only a bridge connecting the regions north and south of the river. The streets in the area run east-west or north-south. The problem posed is to find an office location for Corporation A such that the total distance it travels every week to these three facilities is minimal. The hypothesis is that the optimal location should heavily depend on k1 + k2 (trips north) and k3 (trips south). The problem was solved by converting it into a mathematical problem of finding the minimum of a somewhat complicated distance function. By the nature of this problem, the distance travelled from point (x1, y1) to point (x2, y2) is not given by the typical Euclidean distance, but by $|x_2 - x_1| + |y_2 - y_1|$ if both points are on the same side of the river and by $|x_1| + |y_1| + |x_2| + |y_2|$ if both points are on opposite sides of the river. The mathematical formulas for the optimal locations were derived and confirmed the hypothesis precisely: if $k_1 + k_2 > k_3$, the optimal location is on the same side as P1 and P2; if $k_1 + k_2 < k_3$, P3 is the optimal location; if $k_1 + k_2 = k_3$, a suitable portion of the vertical street through the bridge can be selected for the optimal location. The optimal location minimizes the usage of fuel and manpower for Corporation A.

Poster Board N. 060 PROTECTIVE EFFECTS OF OLIVE OIL AGAINST HIGH-FAT DIET-INDUCED HEPATOCELLULAR OF OLIVE CARCINOMA. Olivia Tse¹ (olivia9tse@gmail.com), Nathan A. Berger² (Project P.I.) (nab@case.edu), Annie E. Hill-Baskin³ (aeh2@case.edu), Sarah Gafter³ (sfg17@case.edu), ¹25831 Annesley Road, Beachwood, OH 44122 (Hathaway Brown School), ²Case Comprehensive Cancer Center, Case Western Reserve University School of Medicine, ³Department of Genetics, Case Western Reserve University School of Medicine.

Hepatocellular carcinoma (HCC) is one of the most common and deadly cancers worldwide. Despite decades of comprehensive research efforts that have decreased the onset of most cancers, incidence of HCC is still increasing. Risk factors include viral hepatitis, alcohol abuse, obesity, and other metabolic diseases. Previous studies showed that a high-fat (58% total consumed calories by fat [kcal]) coconut oil diet produced obesity and a 70% incidence of liver tumors in susceptible mice, indicating a connection between high-fat diet and liver tumorigenesis. The goal of this study is to test the hypothesis that olive oil is protective against diet-induced HCC regardless of fat content. In the method, C57BL/6J (B6) mice were used to test the tumorigenesis effect of high and low-fat olive oil diets and its association with obesity and HCC. B6 males at the age of 30 ± 3 days old were introduced to a high- (58% kcal; n=3) and low-fat (10.5% kcal; n=6) olive oil diet to test long-term (440 days) diet effects on HCC incidence. The mice were monitored and weighed every 2 weeks, and tumor-examining autopsies were performed at the end of the study. It was found that both high- and low-fat olive oil

possessed protective properties against diet-induced HCC. High-fat olive oil diet produced obesity in B6 mice while B6 mice on low-fat olive oil diets remained thin, but liver tissue analyses for both high- and low-fat olive oil diets yielded 0% (0/3 and 0/6, respectively) occurrence of HCC, regardless of susceptibility to diet-induced obesity. More mice have since been put on the diet to provide further evidence. These results support the hypothesis that diet-induced HCC susceptibility is independent of obesity and olive oil is protective against liver tumor development regardless of low or high-fat content.

Poster Board No. 061 DRINKING BOTTLED NATURAL SPRING WATER CAN PROVIDE 35% OF OUR DAILY CALCIUM REQUIREMENTS AND OTHER MINERALS. Kareem Muakkassa (rmuakkassa@hotmail.com) and Camille Muakkassa, 3655 Sanctuary Dr Akron OH 44333. (St Hilary School)

Calcium (Ca^{2+}) is an important mineral needed for building strong bones, teeth and in preventing osteoporosis. Natural spring water consumption is on the decline, and more and more Americans are drinking municipal and bottled purified water. Our objective was to determine if there is a difference in Ca^{2+} levels and minerals in water taken from different water sources. We used a Ca^{2+} testing kit to measure Ca^{2+} and a total dissolved solids (TDS) meter to measure dissolved substances as an indirect measurement of minerals. Our hypothesis states: 1) that natural mineral water has higher TDS and Ca^{2+} than tap and filtered water 2) drinking natural mineral water can supply a substantial amount of the daily Ca^{2+} requirement and minerals. We tested the amount of Ca^{2+} and TDS in 17 different bottles of water from different countries like France, Italy, Germany, Fiji, Spain, USA and Ohio tap and filtered city and well water. Calcium and TDS were consistently higher in natural mineral waters than tap or filtered water. The range of the Ca^{2+} in the water was from 0-380 mg/l and the range of the TDS was from 0-523 mg/l. The European mineral water had higher Ca^{2+} and TDS levels than the American water. The natural spring water from the USA was higher in Ca^{2+} and TDS levels than the American tap and filtered water. Our hypothesis was supported by the findings. There was a difference in the Ca^{2+} levels and minerals of water from different sources. Drinking water rich in calcium can account for as much as 35% of our daily requirements and has health benefits.

Poster Board No. 062 BATTLING INFECTIOUS DISEASES: ARE PLANT PRODUCTS BETTER AND HEALTHIER ALTERNATES TO STANDARD COMMERCIAL ANTIBIOTICS IN TREATING INFECTIONS? Ashwin Veeramani (ashwinveeramani@yahoo.com), 9388 Chesapeake Drive, North Royalton OH 44133. (Incarnate Word Academy)

This project analyzed the susceptibility of *Staphylococcus aureus* to five different plant product extracts, namely: ginger, turmeric, gooseberry, black pepper, and garlic in three different concentrations of various mediums: water, 21 percent alcohol, and 70 percent alcohol. It compared the efficiency of the plant product extracts to that of standard antibiotics: Gentamicin, Vancomycin, Clindamycin, Bacitracin, Ampicillin, and Erythromycin to determine if the plant extracts are viable alternates to commercial antibacterial agents. The susceptibility tests using Kirby Bauer Disk Diffusion method showed inhibition zones of 18.5 mm, 25 mm, and 14 mm for garlic; 33 mm, 0 mm, and 18 mm for black pepper; 19 mm, 22 mm, and 0 mm for turmeric; 0 mm, 0 mm, and 35 mm for gooseberry in the three mediums respectively; and all three mediums showed 0 mm for ginger. Standard antibiotics had zones ranging from 18 mm to 46 mm. Serial broth dilution method was used to conduct the MIC and MBC tests at seven different extract concentrations: 1/2, 1/4, 1/8, 1/16, 1/32, 1/64, and 1/128 for each of the selected plant extracts. Four different methods, namely: Plating, Slide, Gram staining, and Mannitol Salt Agar methods were used for

establishing MIC and MBC values. Garlic extract again gave strong results with MICs of 119 $\mu\text{g/ml}$, 60 $\mu\text{g/ml}$, and 30 $\mu\text{g/ml}$ and MBCs of 238 $\mu\text{g/ml}$, 119 $\mu\text{g/ml}$, and 119 $\mu\text{g/ml}$ in the three mediums respectively. Black pepper had MICs of 106 $\mu\text{g/ml}$, 53 $\mu\text{g/ml}$, and MBC of 212 $\mu\text{g/ml}$ in water and isopropanol mediums, respectively. Turmeric gave MIC and MBC of 180 $\mu\text{g/ml}$ in water and 21 percent alcohol medium. These results were obtained from a total of 21 trials of susceptibility tests, 56 trials of MIC tests, and 56 trials of MBC tests. They support garlic, black pepper, and turmeric's ability to effectively kill *Staphylococcus aureus* and provide healthy and affordable alternatives to commercial antibiotics, while also serving as important spices in many international cuisines. lity is independent of obesity and olive oil is protective against liver tumor development regardless of low or high-fat content.

Poster Board No. 063 AN IN VITRO MODEL OF AGE-RELATED CATARACT FOR IDENTIFICATION OF OXIDATION SITES IN LENS PROTEINS AND DEVELOPMENT OF CATARACT RESISTANT EYE LENSES. Grant L Hom (ghom97@gmail.com), 4420 Valley Forge Dr. Fairview Park, OH 44126, Vincent M Monnier (vmm3@case.edu), Xingjun Fan (xxf3@case.edu), Benlian Wang (bxw37@case.edu).

A cataract is a clouding of the lens inside the eye that leads to a decrease in vision. A common way cataract forms is through aging. This is caused by the increasing formation of disulfide bonds by oxidation and thus, formation of protein aggregates as one becomes older. Cysteine residues are the prime targets in disulfide bond formation because of their thiol group that can be oxidized. The hypothesis of this research was that oxidation of cysteine residues into disulfide bonds leads to the formation of disulfide-linked high molecular weight crystallin aggregates that scatter light. The goal of this research was to determine the specific cysteine sites that significantly promote protein aggregation in a mouse lens crystallin. First, a mouse model was created that showed protein aggregation in a mouse lens that was the result of disulfide bonds. This was confirmed by an SDS gel electrophoresis. Then another experiment was completed that showed the time points at which there was significant increase in aggregation. These time points were then used in an ICAT labeling procedure to identify the specific cysteine sites. The results of the ICAT labeling procedure show the specific cysteine sites in each lens protein crystalline that were oxidized. Some of the key cysteine sites that were oxidized include site 150 in the Beta Crystallin B1, site 110 in the Gamma Crystallin, and site 100 of Beta Crystallin A1. The specific sites that were oxidized should next be mutated into alanine or serine sites and then retested to see if there still is a significant amount of aggregation without disulfide bonds forming at these sites. A drug or cataract-resistant lens could then be engineered that would be resistant to cataract formation.

Poster Board No. 064 INCREASED LEVELS OF ANTIMICROBIAL RESISTANCE IN LARGE SCALE LIVESTOCK EFFLUENT COMPARED TO THE BLANCHARD RIVER. Dominic Schroeder, Miller City New Cleveland Middle School- Grade 7, 16228 Road H13, Continental OH 45831.

Antibiotics are commonly used in agriculture to prevent disease and increase livestock growth. This leads to the question of whether there is increased antimicrobial resistance found in livestock effluent being discharged into ditches and streams compared to the Blanchard River in Putnam County, Ohio. Water samples were collected from the Blanchard River and streams adjacent to seven different large-scale livestock farms. One milliliter samples were inoculated onto Petri dishes of Tryptic Soy Agar with 5% Sheep Blood. Penicillin, neomycin, streptomycin, and tetracycline disks were each placed into one quadrant of the samples. Three samples were collected from each testing site. The zone with no growth surrounding the disk was then measured in millimeters (mm). The zones were then compared. A smaller zone indicates more resistance

to the antibiotic. Penicillin zones were decreased in hog and turkey farms. Neomycin zones were consistent among controls and livestock farms. Streptomycin zones were decreased in dairy farms. Tetracycline zones were decreased in all livestock farms compared to control. This data shows there is increasing antimicrobial resistance in livestock effluents.

Poster Board No. 065 A COMPARISON OF THE NUMBER OF BACTERIAL CFUS FOUND ON CATS' PAWS AFTER USING CLAY, SCOOPABLE, AND RECYCLED NEWSPAPER LITTER. Wesley R. Wolf (billwwolf@gmail.com), 5095 Shattuc Ave., Cincinnati, OH 45208.

This experiment was designed to determine if the type of cat litter used would change the amount of bacteria found on cats' paws. It was hypothesized that scoopable cat litter would transfer more bacterial contamination to the subjects' paws because only the fecal material and urine are taken out, and not all of the litter is thrown away. This could allow for a large amount of bacteria to remain in the litter box that could contaminate the subjects' paws. Three types of cat litter were tested in this experiment; clay, scoopable, and recycled newspaper. The cats' paws were cleaned before they were placed with the correct cat litter and left with that litter for 36 hours. The samples were taken by placing the cats' right front paw pads on both blood and MacConkey agar plates. The samples were diluted with 200 μ l of sterile water and then spread using the spread plate method. The plates were incubated at 38.3°C (feline body temperature) in a bacterial culture incubator for 48 hours. The CFUs (colony forming units) were counted and recorded every 24 hours. The type of litter did not significantly alter the amount of bacterial contamination found on the cats' paws. However, recycled newspaper had the higher total number, with 1619 CFUs. The scoopable had a total CFU count of 1342, and the clay had 1005 total CFU. This research has importance for cat owners, especially those with compromised immune systems, when choosing a cat litter that best suits their needs.

Poster Board No. 066 IS THERE MORE BACTERIA ON ATHLETES' CELL PHONES THAN NON-ATHLETES' CELL PHONES AT WHEELERSBURG HIGH SCHOOL? MARY, M, Martin (mmmarymarlene99@gmail.com), 7613 Sun Hill Drive Portsmouth, Ohio 45662.

The purpose of this project was to determine whether higher quantities of contaminant are present among athletes' cell phones as compared to non-athletes' cell phones. The hypothesis was that contaminant does exist in greater quantities on athletes' cell phones because athletes expose their cell phones to more contaminated environments, like locker rooms, than non-athletes. To test this hypothesis, an independent sample of ten cell phones was uniformly swabbed from each of the following groups: football, cheerleading, cross country, volleyball, marching band, soccer, and a control group of non-athletes. The five percent sheep blood agars were kept in a lab for seven days at 22 degrees Celsius, and were then taken to Dr. Cassity's lab. Dr. Cassity, a microbiologist at Southern Ohio Medical Center, and I identified and counted the contaminants by performing morphology and coagulase tests. The following types of contaminant were found on the cell phones: saprophytic *Corynebacterium*, coagulase negative *Staphylococcus*, *Bacillus*, and *Bacillus cereus*. However, only saprophytic *Corynebacterium* and coagulase negative *Staphylococcus* were found in greater values than the control group. For example, the football team had 1.79 and 0.91 standardized values of these contaminants greater than the control group respectively, the cheerleading team had 0.97 and 9.09, the cross country team, 1.07 and 0.24, the volleyball team, 0.63 and 0.1, the marching band, 0.61 and 0.28, and the soccer team, 0.31 and 0.24. In conclusion, certain types of bacteria, including saprophytic *Corynebacterium* and coagulase negative *Staphylococcus*, were found in a greater quantity on athletes' cell phones

than non-athletes' cell phones, supporting the hypothesis.

Poster Board No. 067 GENE REGULATORY MECHANISMS CONTROLLING BRAIN SEROTONIN PRODUCTION AND ANTIDEPRESSANT DRUG TARGETS. Mia K. Yeager (yeagerm14@gmail.com), Steven Wyler (scw58@case.edu), Evan Deneri (esd@case.edu), 10835 Robert Lane, Chagrin Falls OH 44023. (Hathaway Brown School), Department of Neuroscience, Case Western Reserve University.

Serotonin (5-HT) levels have been linked to depression, autism, and other cognitive and behavioral disorders. This lab found that the transcription factor, Pet-1, controls the low capacity, high-affinity serotonin transporter (Sert). Sert's main function is to clear serotonin from the synapse. The class of antidepressant called SSRIs inhibits the serotonin transporter to increase extracellular serotonin and ameliorate symptoms of depression. These antidepressants however, only work in a subset of patients. Therefore, research to identify additional antidepressant targets is necessary. Current research has identified another serotonin transporter: the organic cation transporter 3 (Oct3 or Slc22a3). The objective of this experiment is to investigate possible Pet-1 regulation of Oct3 expression. Studies have shown that inhibiting Oct3 together with SSRIs can have a synergistic, antidepressant effect. It's theorized that when Sert is inhibited, Oct3 activity continues to decrease extracellular serotonin. The hypothesis is that Oct3 is regulated by Pet-1 because of its similarity to Sert in function. The method was to isolate RNA from the embryonic hindbrains of nine mice (*Mus musculus*) (Pet-1^{+/+}, n=5; Pet-1^{-/-} n=4) to quantify gene expression of Oct3 and Sert using the quantitative real time polymerase chain reaction. The data show that relative to control mice, Sert expression in Pet-1^{-/-} mice is reduced to 22.05% \pm 7.19% (p=0.006) and Oct3 gene expression is reduced to 41.11% \pm 21.23% (p=0.09). Thus, Pet-1 is required for expression of both the high affinity, low-capacity and low affinity, high capacity serotonin transporter antidepressant target genes.

Poster Board No. 068 THE RUBBER BAND STRIKES BACK. Zachary Z. Zhou (zachary.z.zhou@gmail.com), Andrei A. Roman (roman.45@osu.edu). 6968 Ernest Way, Dublin OH 43017. (Dr. Henry Karrer Middle School)

Hooke's Law predicts the force exerted by an extended rubber band is directly proportional with the elongation. The purpose of this study is to demonstrate whether a launched projectile using rubber bands obeys the mathematical equation based on Hooke's Law. The force elongation relationship of a rubber band was first studied. Weights were hooked to a rubber band vertically and the weight was increased in increments of 10 grams and the rubber band displacement was recorded. Next, the same rubber bands were used to launch a projectile, which was attached to a horizontally stretched fishing line and launched by a homemade Legos-Rubber band model. The projectile horizontal travel distance and the rubber band elongation were recorded. A digital camera was used to film motion of the projectile, which showed that the rubber band's elongation was directly proportional to the force, but do not satisfy Hooke's Law when the large stretch was applied. The distance covered by the projectile was 50% of the predicated distance based on the initial launching speed, and 35% of the distance in an ideal mathematical model. In conclusion, rubber bands do satisfy Hooke's Law at small stretches and behave differently in a nonlinear proportion pattern when large stretches are applied. Launching a projectile using rubber bands does not obey the proposed simple mathematical model, suggesting that energy loss occurs during launching. A better launching device is required to reduce vibration and transfer the elastic potential energy fully to the projectile.

Poster Board No. 069 THE EFFECT OF WIRE WRAPS ON ELECTROMAGNETIC STRENGTH. Jameson L. Hern (Jameson@jimhern.com), 10340 Stoudertown Rd. Pickerington Ohio 43147. (Liberty Union High School)

The experimentation on the effect of wire wraps around an iron nail on electromagnetic strength. Electromagnetism is the driving force of our modern world. Electromagnetism powers modern technology and is beneficial to everyone. If research into electromagnetism is further looked into it could pave a path to an advanced world of clean energy, efficient transportation, and outstanding computer technology. To further the knowledge on the subject of electromagnetism would benefit people everywhere. The required materials are as follows: An iron Nail, 47 inches of 24 gauge copper wiring, several C batteries, and metal tacks. These materials will be assembled into an electromagnet to proceed with the experiment. The experiment consists of measuring and recording the amount of metal tacks that the electromagnet can lift for each of the varying levels of wire wraps for the experiment. Results have shown as the amount of wire wraps increases so does the electromagnetic strength. This is observable until the level of 40 wire wraps. This is when the amount of metal tacks retrieved peaked at 18 tacks and then began to drop. It has been concluded the possible explanation for this is the amount of surface area on the iron nail decreases as the amount of wire wraps increases. Thus decreases the available area for a metal tack to attract to. Another possible explanation could be the dying strength of the batteries from their use. This is an unexpected set of data and provides need for further experimentation.

Poster Board No. 070 CELL PHONE SAFETY: THE IMPACT OF DIFFERENT MATERIALS ON RADIO FREQUENCIES. Ananya Rajagopal (ananyaraj2016@gmail.com), 7662 Fulmar Drive, Dublin OH 43017. (Dublin Coffman High School)

The comparative question is - How do commonly used materials (Aluminum, Glass, Plywood, Acrylic, and Polycarbonate) affect Radio Frequencies differently? With over 70 percent of the world's population having access to cell phones, harmful effects of its prolonged usage cause concern. While this is still inconclusive, the main objective was to research and understand the behavior of radiofrequencies on these materials with a goal of creating better Radiofrequency (RF) shields. There were three hypotheses: First, the Aluminum (metal) would block the most RF signal. Second, the glass would be completely "transparent" to the RF signal. Lastly, different cell phone frequencies will not change the material's behavior with RF. To test this experiment, two antennas were made with the two copper cylinders at either ends of a wooden block exactly 10 cm apart, secured with rubber bands or glue. The inner tube of the antenna is exposed $\frac{1}{2}$ an inch from the top. At the midpoint of the wooden block, a slit is created for placing the materials (in approximately 9' by 12' sheets) under test. The antennas are then hooked to the Aeroflex-7200 RF generator and all the materials are tested at different frequencies. The difference in decibels between the control and material signifies the material's RF blocking effectiveness. Metal (Aluminum) had a variance of -8.7 decibels. This was higher than all the other materials tested, thus proving the first hypotheses correct. However, there were unexpected occurrences, and the glass was not completely transparent. At different frequencies, materials gave multiple results. Through this experiment it is evident that Radiofrequencies are very complex and more research is needed.

Poster Board No. 071 THE DANGERS OF PURPLE: COMPACT FLUORESCENT LIGHTBULBS AND ULTRAVIOLET LIGHT EMISSION. Luis E. Gomes-Ortega (gomesortega@icloud.com), 3021 Pine Trails Circle, Hudson, OH 44236.

Studies have linked compact fluorescent lightbulbs (CFLs) to skin cell damage and photosensitivity reactions. Defective manufacturing can lead to cracks in the phosphorus coating in glass tubing of CFLs. It was hypothesized that if exposure to CFLs were harmful, then evidence of ultraviolet light (UVL)-induced toxicity would be identified because gaps in the phosphorus coating impair its ability to absorb the UVL produced by mercury gas in CFLs. The spectrum

of light emitted by CFLs and incandescent bulbs (IBs) of equivalent lumens was assessed with a spectrometer. Ultraviolet irradiance was measured with an UV meter (Arbor Scientific). Agar culture plates (six for each group) of UVL-sensitive yeast strain (*Saccharomyces cerevisiae*) not exposed to light (control group) and exposed to CFL and IBs (experimental groups) served as indicators of UVL-related DNA damage. The results are given in median and interquartile range (IQR). Wilcoxon rank sum test was used to determine statistical significance. The spectrometer revealed UVL emission only by CFLs. Compared to IBs, in which it was unmeasurable, ultraviolet irradiance was significantly higher in CFLs (35, IQR: 3 Vs. 0 mW/m²; $p=0.006$). Colony-forming units (CFUs) of yeast exposed to IBs were similar to those of controls (49.5, IQR:13.3 Vs. 47, IQR:25 CFUs; $p=0.4$), whereas there were significantly less in the CFL-exposed group (5.5, IQR:5 Vs. 47, IQR:25 CFUs; $p=0.002$). Emission of UVL by CFLs, but not by IBs, was demonstrated in this study. Exposure to CFLs was associated with impaired yeast growth due to UVL-induced DNA damage.

Poster Board No. 072 THE EFFECT OF HUMIDITY ON THE PITCH OF A FLUTE. David D. Gross (dd.gross@yahoo.com), 817 Stoneybrook Dr., Kettering OH 45429. (Archbishop Alter High School)

Many know that when humidity increases, wood expands; when humidity decreases, wood shrinks. These changes in humidity affect the pitches of wooden instruments. Humidity's effect on metal instruments (e.g. a flute), however, is negligible. The pitch of a flute is principally due to the properties of the air column within the flute. Humidity is one notable property. To play in tune on the flute, it helps to know how humidity affects a flute's pitch. It was hypothesized that if the relative humidity surrounding a flute were increased or decreased from 36% (the control humidity), the pitch of the flute would increase or decrease, respectively, when played. The student put the flute in an environment with near-constant temperature and pressure. The humidity was modified in 1 – 2% increments/decrements throughout the tests as the independent variable. The student played the note 'A4' on the flute and measured the pitch using a tuner. The average change in pitch of the corrected frequencies was ± 0.31 Hertz per $\pm\%$ change in humidity, respectively. Most of the tests supported the hypothesis; two tests did not support it due to student error and the correction factor from slight temperature differences among tests. The results were primarily consistent with the hypothesis because decreased humidity means fewer particles and greater distances to travel. This causes a slower speed of sound and a lower frequency; the opposite is true when humidity increases. The results of this experiment can be used to better play in tune on the flute.

Poster Board No. 073 OBSERVING FRACTAL GROWTH IN LIQUID CRYSTALS. Krisztian T. Kosa (kosakriszi@gmail.com), 5930 Eastham Way, Hudson OH, 44236. (Hudson High School)

Fractals are not just mathematical abstractions. Fractal-like shapes appear in several physical phenomena and even in nature. This project investigates the fractal-like growth patterns exhibited in certain liquid crystals. Usually, when liquid crystals cool from isotropic to liquid crystalline (lc) phase, they form circular domains that grow into each other. These circular regions have a Euclidean dimension of $D=2$. Bent-core (banana shaped) liquid crystals, however, exhibit a rather peculiar behavior while going through the phase transition. This process can be observed in a polarizing microscope as a transitions from complete darkness to light leaking (bright) textures of the investigated material. The material transitions from isotropic to liquid crystalline phase at 175°C. Depending on the cooling speed, this sample forms spiral like threads first that become increasingly chaotic. These patterns closely resemble mathematical fractals and it is hypothesized that

they are indeed fractals. We developed a program that utilizes the 'box-counting' method to determine the fractal dimension for any two dimensional shape. By recording and evaluating images at different times, we followed the time evolution of the fractal dimension, D , as the material completed the phase transition. We found fractal dimensions between 1 and 2, validating the hypothesis. D monotonously approached 2 as the phase transition completed throughout the field of view. The reason for the appearance of the fractal-like phase boundary is discussed briefly. To further test the capability of our program, we identified and analyzed multiple examples of fractal like objects occurring in nature. Through our observations it was concluded that fractals do occur on very different scales ranging from microscopic to geographical.

Poster Board No. 074 SYNTHESIS OF PHOTO-HEALABLE AND THERMAL SHAPE MEMORY DISULFIDE POLYMERS. Emily J. Spencer¹ (espencer15@hb.edu), Stuart J. Rowan² (stuart.rowan@case.edu), Brian T. Michal² (brian.michal@case.edu), ¹35070 Jackson Road, Moreland Hills, Ohio 44022 (Hathaway Brown School), ²Case Western Department of Macromolecular Science and Engineering.

To combine multiple stimuli-responsive functions into one polymer would result in a more versatile structure capable of fulfilling more functions than a singularly stimuli-responsive polymer. The objective of this experiment was to synthesize multifunctional stimuli-responsive polymers. It was hypothesized that cross-linked semi-crystalline polymers that exhibit photo-healable and thermal shape memory (the ability to revert to a remembered shape when exposed to heat) properties could be synthesized. Cross-linked polymers were synthesized with disulfide bonds and then tested. Each test was run on 5 films for 3 different crosslink densities (15 total). The films were then exposed to UV light at a wavelength of 320–390 nm and intensity of 2000 mW/cm² for 5 min. When exposed to UV light the disulfide bonds broke and the material became fluid allowing any damage to be corrected. Films could recover almost completely from scratches up to 50% of their thicknesses 100% of the time. To test the shape memory component the poly-disulfide network was heated to 80°C, and a force of 0.10 N was applied. The films were then cooled to 25°C and held at this temperature for 1 min. The force was then removed, and after 1 min the polymer was heated back up to 80°C and held for 1 min before being allowed to cool to room temperature. The recovery ratio (R_r) is given as the percentage of strain recovered ($(\epsilon_m - \epsilon_r) / \epsilon_m \times 100$). All films had recovery ratios >95%. Thus it is concluded in the data that reactions to multiple stimuli can be integrated into one material effectively. This material has many industrial and medical applications such as insulation and artificial muscle as well as uses in aerospace engineering.

Poster Board No. 075 BIRTH ORDER; WHO IS THE BEST CHILD? Mary Catherine Good (marycgood11@gmail.com), 2880 Chippendale Drive, Hudson OH 44236. (Hudson High School)

The purpose of the experiment is to see if there is a correlation between one's order of birth and their personality traits. The researcher created an experiment to see if certain personality traits corresponded with a certain placement in birth order. The experiment was comprised of 30 different personality traits that were all stereotypical of a specific birth order: oldest child, middle child, youngest child, or only child. The experiment was carried out using the website, <https://www.surveymonkey.com>, to collect results in an easy and fast mode. The 30 questions were asked in the survey along with three background questions; what is your birth placement, what is your gender, and do you think of yourself as looking from the viewpoint of a child or of a parent. In total 61 people participated in the survey; 29 oldest children, 13 middle children, 15 youngest children, and 4 only children. At the conclusion of the experiment, certain traits had a stronger association to a birth placement once all the traits with a

variance of less than three were eliminated. Oldest children were more strongly correlated with; natural leader and smartest. Middle children were more strongly correlated with; negotiator and peacemaker. Youngest children were more strongly correlated with; gets away with more and carefree, easy-going, and fun-loving. While certain traits noticeably favor a certain birth position, other traits could be for any birth position such as, social butterfly, rebellious, does not like to admit mistakes, most secretive, and class clown. From the research, certain birth order positions may exemplify certain traits, but not every trait is a result of ones birth order. This research could in the future be used to help figure out how much of one's personality is made up of nature and nurture.

Poster Board No. 076 LEAK RATE DETERMINATION OF SILICONE RUBBER ELASTOMER MATERIALS AFTER SPACE EXPOSURE. Emily C. Imka (eimka15@gmail.com), Olivia C. Asmar (ocasmar98@gmail.com), Henry C. DeGroh (henry.c.degroh@nasa.gov), 16810 Auburn Springs Dr., Chagrin Falls, OH 44023 (Hathaway Brown School), Advanced Metallics Branch, NASA Glenn Research Center.

Spacecraft docking and hatch seals are typically made of silicone elastomers. Seals exposed to low-Earth-orbit (LEO) can suffer damage from ultraviolet (UV) radiation and atomic oxygen (AO, or monoatomic oxygen, the predominant oxygen species in LEO). This experiment flew on International Space Station and measured the effects of LEO on seal materials S0383-70 and XELA-SA-401. Samples flown in different orientations received different amounts of UV and AO. The hypotheses were that most of the damage would be from UV, and 10 days in LEO would badly damage the seals. Eighteen seals were exposed for 543 days in ram (windward), zenith (way from Earth), or wake (leeward) orientations, and 15 control samples (not flown) provided undamaged base-line leakage. To determine post-flight leak rate, each of the 33 seals were placed in an o-ring groove and pressure tested over time. LABView programs were used to analyze the temperature and pressure and calculate leakage. Average leakage of control samples was 2.6 x 10⁻⁷ lbs/day. LEO didn't considerably damage XELA-SA-401. The S0383-70 flight samples leaked at least 10 times more than XELA-SA-401 in all cases except one, demonstrating XELA-SA-401 to be a more suitable sealing material in LEO. AO caused greater damage than UV; samples in ram orientation (receiving 4.3 x 10²¹ atoms/cm²) and in wake (2.9 x 10²⁰ atoms/cm²) leaked more than those in zenith orientation (1.58 x 10²⁰ atoms/cm²), whereas variations in UV exposure did not seem to affect the samples. Exposure to LEO did less damage to the seals than hypothesized, and the data did not support the conjecture that UV causes more damage than AO.

Poster Board No. 077 THE EFFECT OF MUSIC ON DOMESTIC CAT ANXIETY BEHAVIOR. Andrea J. Oprandi (stphopr@gmail.com), 1201 S. Nickelplate St., Louisville OH 44641. (Louisville High School)

This study attempts to explore whether music has an effect on anxiety behavioral in domestic cats. The hypothesis for this study is that music played to cats will help reduce domestic cat anxiety. The problem is that there is a substantial population of domestic cats in the United States abandoned in part due to negative behaviors. There are limited techniques to fight cat anxiety behaviors. Based on existing literature, anxiety behaviors ("biting or scratching", "hiding", "food seeking", "low social interaction") and non-anxiety behaviors were identified. The participants (N=4) in the study were domestic adult cats who were tested in multiple trials (N=60). Music was played for 10 minutes per trial (N=30) over a period of approximately twenty weeks. Behavior observations were recorded in a notebook. Behavior was also recorded without music (N=30) for 10 minutes each over the same time period. The notebook observations were organized and recorded. A One-Way ANOVA was conducted with a significance established at ($p = 0.05$), which showed interaction" category. Low social interaction behavior in a statistical significance ($p = 0.065$)

in the “low social” (e.g. family room when people are present) and not seeking attention (e.g. not wanting petted). Overall, the hypothesis in the study was partially positive, which means that the treatment had an effect on one anxiety behavior. In future studies, the type of music could be varied to test the effect of music variation on domestic cat anxiety behavior.

Poster Board No. 078 EMPLOYING BIOINFORMATICS IN DETERMINING GENE EXPRESSION PROFILES FOR GASTRIC ADENOCARCINOMA. AJAY A. Saraf (ajayasaraf@live.com), 5646 Hawthorn Ct. Mason, OH 45050.

Gastric cancer is the fourth leading cancer in the world, and the second leading cause of death. These, along with several other problems which gastric cancer poses to humanity, are some of the main issues posed to human life today. This experiment studied the genomic differences between Serial Analysis Genome Expression sequences of DNA, ranging to a maximum of 10 nitrogenous bases (Short SAGE tags). Short SAGE tags of normal gastric tissue, from an average compilation of data concerning both sexes and ages 18-65, were compared to genes acquired from adenocarcinoma of that same region in two different pools. The procedure was accomplished utilizing a tool known as bioinformatics. It was predicted at the beginning of the experiment that the tissue affected with adenocarcinoma would result in severe overexpression of certain genes. The data shows that over 50% of the tags expressed in pool “B”, or the adenocarcinoma, were overexpressed in those individual tags themselves. The identification of over 170 gene tags overexpressed solely in the gastric adenocarcinoma relative to the healthy stomach tissue is among one of the many findings this experiment provides for the scientific community. Furthermore, the overexpressed genes were all clustered corresponding to particular Q ratios, making it possible to identify many overexpressed genes at once through False Discovery Rate Statistics for manipulation in genetic, research, and medical purposes. The results of this experiment conclusively prove that severe overexpression was evident among the adenocarcinoma, as compared to normal gastric tissue. was evident among the adenocarcinoma, as compared to normal gastric tissue.

Poster Board No. 079 DEVELOPMENT OF BIOMIMETIC NANOFILTRATION MEMBRANES. Jordan A. Mitchell (jordan.mitchell15@sjtitans.org), 2048 Richmond Road, Toledo, Ohio, 43607, Priyesh A. Wagh (priyesh.wagh@rockets.utoledo.edu), Isabel C. Escobar (isabel.escobar@utoledo.edu), University of Toledo.

Biomimetics is a new and quickly growing area of science. Nanofiltration is a water treatment technology that utilizes membranes with nanometer size pores for separations of contaminants from water. Aquaporin (Aqp), a highly selective water channel protein, can form biomimetic membranes with high flux and rejection for water reuse and desalination. The central hypothesis of the entire project is that once AqpZ is incorporated into a membrane, it will act as a molecular water channel to increase water permeability and give rise to a biomimetic membrane that can provide pure water more efficiently. The first step of the project which is presented here has the sub-hypothesis that polybenzimidazole (PBI) can be effectively modified using a carbodiimide compound to making it less brittle, applicable as a nanofiltration membrane, and eventually a bed for Aquaporin Z (AqpZ). The following materials were used Polybenzimidazole (PBI), dimethylacetamide (DMAc), 4-(chloromethyl) benzoic acid (CMBA), N-(3-dimethylaminopropyl)-N'-ethylcarbodiimidehydrochloride (EDCH) and N-hydroxysuccinimide (NHS). All PBI flat sheet membranes were prepared in the lab via the phase inversion technique and were then modified. The work presented here applies the idea of biomimetics to make more efficient membrane filtration materials for water treatment applications. The project developed a modification methodology for PBI. These membranes with chemically activated surfaces were prepared and

subsequent functionalization was done in order to introduce aquaporin onto the surface of the membranes. Future plans for expanding this research include introducing treated aquaporins to the modified membranes. We will also characterize the biomimetic membranes chemically, structurally and with respect to membrane pure water permeability and salt permeability.

How to get to Walsh University

From Toledo, Michigan, Canada

(Approximately 2.5 hours from Toledo)

- I-80 East to Hudson, Exit 180
- South on OH-8 (turns into I-77 S)
- Take exit 111 turn left on Portage St.
- Turn right on Reams then a quick left on Maple St.
- WU is located on the right (approximately 1.7 mile)

From Cleveland, Northern Pennsylvania, New York

(Approximately 1 hour from Cleveland)

- Keep straight onto I-76/I-77 S
- Exit I-77 S towards Canton
- Take exit 111 turn left on Portage St.
- Turn right on Reams then a quick left on Maple St.
- WU is located on the right (approximately 1.7 mile)

From Youngstown, Pennsylvania

(Approximately 1 hours from Youngstown)

- Take I-80 W to I-76 W
- Take exit 38 - OH-5/OH-44 S towards Ravenna (approx 16 mi)
- Bear right on Columbus Rd
- Bear right on Easton St. NE (approx 5 mi)
- Cross Market Ave, WU on left

From Central Ohio

(Approximately 2.25 hours from Columbus)

- I-71 N to US-30 E (exit 176) towards Woster
- Merge onto I-77 N for 4 mi
- Merge US-62 E via exit 107B
- Take Market Ave N/OH-43 exit
- Turn left onto Market Ave, WU on left approx 4 mi.

From Dayton

(Approximately 3.5 hours from Dayton)

- I-70 E towards Columbus
- Merge onto I-270 N via exit 93B towards Cleveland
- Merge onto I-71 N via exit 26
- Take exit 176 (US-30 E) towards Woster
- Merge onto I-77 N for 4 mi
- Merge US-62 E via exit 107B
- Take Market Ave N/OH-43 exit
- Turn left onto Market Ave, WU on left approx 4 mi.

From Athens, OH

- Take US-50 E to I-77 N (crossing into W. Virginia, approx 40 mi)
- Merge onto I-77 N towards Marietta (crossing into Ohio)
- Merge US-62 E via exit 107B
- Take Market Ave N/OH-43 exit
- Turn left onto Market Ave, WU on left approx 4 mi.

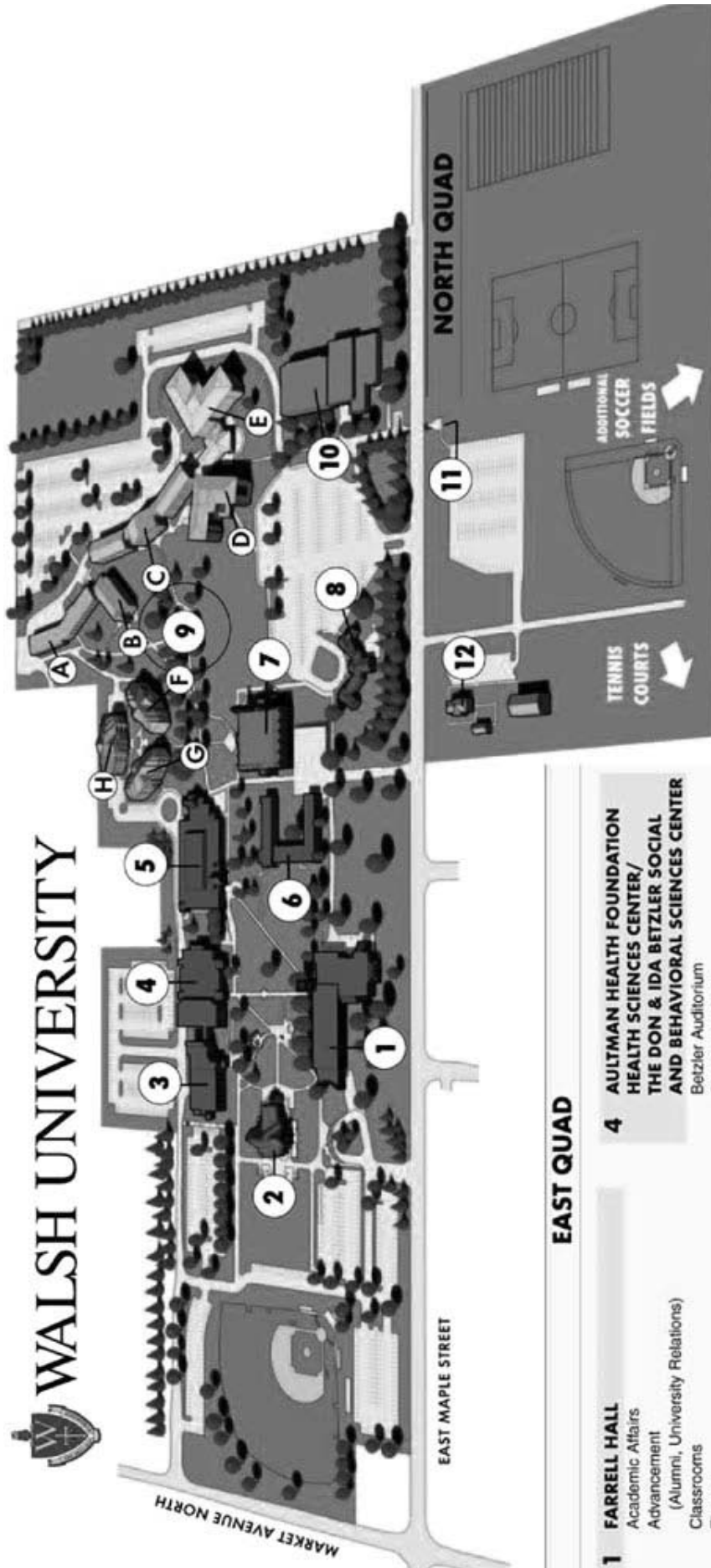
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Page 1 of 2

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Continued on page 2

Page 2 of 2

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

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123rd Annual Meeting

April 5th, 2014

Walsh University

Advance registration must be received by March 28, 2014

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April 5, 2014

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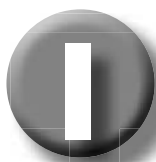
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TABLES and FIGURES. For review purposes, insert tables and figures into manuscript. Additionally, tables must be typed double spaced, one table to a page, numbered consecutively, and placed in the manuscript after Literature Cited. Since tables must be individually typeset, consolidation of data into the smallest number of tables is encouraged. A horizontal double underline should be made beneath the title of the table, and single underlines should be made the width of the table below the column headings and at the bottom of the table. Do not use vertical lines, and do not place horizontal lines in the interior of the table. Use footnotes, to clarify possible questions within the table, should be noted by asterisks, daggers, or other symbols to avoid confusion with numerical data. All illustrations are referred to as "Figures" and must be numbered consecutively. Tiff files are preferred. Figures may be photographs, computer generated drawings or graphs. Illustrations other than those generated by the author(s) must bear permission for use and credit to the originator. Each figure must have a complete legend. The legend should not be placed on the figure, but should be typed in order, double-spaced, on a separate sheet which precedes the figures in the manuscript. Figures should be referred to parenthetically in the text, for example (Fig. 1). The size and proportion of each illustration should be suitable for reduction to a single column. Excessive white space should be avoided. Illustrations will be reduced to one column width (3 and 3/8 inches) or two column width (7 inches) at the discretion of the editor. Lettering should be done of a size to ensure that it can be read after reduction. Incorporate a graphoc scale on maps and other illustrations where original size is a concern.

FOOTNOTES. Text footnotes **should not be used** with the following exceptions. A footnote to the title may be added editorially to state the dates of manuscript submission and revision. A footnote to name(s) of author(s) may be used to indicate present address different from that at which the research was done, or to indicate the author to whom inquiries should be directed. All other material or comments must be incorporated into the text. Literature Cited should not be inserted as foot-notes. Footnotes to tables are permissible, and are encouraged to promote clarity.

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Ohio State's Island Campus on Lake Erie

STONE LABORATORY

Apply Now for summer 2014 courses. For more information, including details about scholarships and jobs, visit stonelab.osu.edu or call 614.292.8949.

INTRODUCTORY COURSES

The courses listed to the right are one-week courses running Sunday–Saturday and are open to advanced high school and current college students.



One-Week Courses – 2 credits

ENR 2360	Ecology and Conservation of Birds.....	June 15–June 21
EEOB 1930	Introduction to Biological Studies – Aquatic Biology	June 15–June 21
KNSFHP 1140.05	Lake Erie Sport Fishing	June 15–June 21
EARTHSC 1107	Field-Based Introduction to Oceanography.....	July 27–August 2
EEOB 1930	Introduction to Biological Studies – Aquatic Biology	July 27–August 2
ENTMLGY 1260	Introductory Insect Field Biology	July 27–August 2
EEOB 1930	Introduction to Biological Studies – Aquatic Biology	August 3–August 9
EEOB 1910	Introduction to Biological Studies – Local Plants.....	August 3–August 9

UPPER-LEVEL COURSES

Open to college students who are studying biological sciences, education, and natural resources, as well as science teachers.



Five-Week Courses – 4 credits

EEOB 5420	Aquatic Ecosystems – Ecology of Inland Waters.....	June 22–July 26
EEOB 3410	Ecology.....	June 22–July 26
EEOB 3310	Evolution.....	June 22–July 26
EEOB 5940	Field Zoology.....	June 22–July 26
EEOB 5930	Ichthyology.....	June 22–July 26

One-Week Courses – 2 credits

EEOB 5910	Field Herpetology	June 15–June 21
EEOB 4950	Field Ecology	July 27–August 2
EEOB 5210	Spider Biology.....	August 3–August 9
ENR 5194	Group Studies: Climate and Sustainability.....	August 3–August 9

Other Courses

EEOB 3189	Field Course: Environmental Science	June 10–July 4, 2 credits, 3 weeks on the Flagship <i>Brig Niagara</i>
ENR 5699	Current Topics in Environment and Engineering	June 22–July 26, 1 credit, 5 weeks
EEOB 5970	Larval Fish Identification Workshop.....	June 29, .5 credit, 1 day
EEOB 5950	Algae Identification Workshop.....	August 11–August 12, .5 credit, 2 days

NON-CREDIT WORKSHOPS

Non-credit workshop courses last one to three days and are open to the public. Participants must be at least 18 years of age and have completed high school.

Larval Fish Identification Workshop.....	July 29
Algae Identification Workshop.....	August 11–August 12
Dealing with Cyanobacteria, Algal Toxins and.....	August 13–August 14
Taste & Odor Compounds	
Outdoor Photography Workshop.....	August 15–August 17
Lake Erie Sport Fishing Workshop	August 29–August 31
Fish-Sampling Techniques Workshop	October 11–October 12

SCIENCE COURSES FOR EDUCATORS

Classes are open to classroom teachers, non-formal educators, and education majors with a rank of junior or above by the class date.

One-Week Courses – 2 credits

EARTHSC 5189.05	Geologic Setting of Lake Erie	TBD
EARTHSC 5584	Principles of Oceanography for Educators.....	June 15–June 21
EEOB 4950	Field Ecology	July 27–August 2
ENR 5194	Group Studies: Climate and Sustainability.....	August 3–August 9
ENR 5614	Marine and Aquatic Education.....	August 3–August 9

REU PROGRAM

Expand your research skills with Stone Lab's Research Experience for Undergraduates (REU) Scholarship Program. Students spend their non-class days working one-on-one with research supervisors, collecting data, analyzing discoveries, and preparing a final presentation.

Reproductive biology of the round goby (Ichthyology)
Distribution and ecology of crayfish (Ecology)
Survival rates of birds of the Lake Erie Islands (Ornithology)
Fisheries techniques: research and fish survey development (Fisheries Management)
Lake Erie Watersnake field and laboratory research (Herpetology)
Exploration of Lake Erie nutrient loading, hypoxic events (the "dead zone"), and harmful algal blooms (Limnology)

Course credits are based on the Ohio State University semester credit system and are transferable to most colleges and universities.

TUITION ASSISTANCE AND JOBS

All students taking for-credit courses are eligible for scholarship funds, which typically range from \$100 to \$2,500. Students enrolled in five-week courses can also apply for Stone Lab's part-time positions or find jobs at local Put-in-Bay businesses. For more information, [visit stonelab.osu.edu/applynow](http://stonelab.osu.edu/applynow).

F.T. Stone Laboratory, The Ohio State University's Island Campus, is the Lake Erie research and teaching laboratory for the Ohio Sea Grant College Program. Course credits are based on the Ohio State University semester credit system and are transferable to most colleges and universities.

