The Ohio Journal of SCIENCE

OPEN ACCESS • ONLINE • INTERNATIONAL • MULTIDISCIPLINARY

Volume 120 No. 1
April Program
Abstracts

Special Notice

The 129th Annual Meeting of The Ohio Academy of Science, described herein, was not held due to the coronavirus disease 2019 (COVID-19) pandemic. However, all abstracts were peer-reviewed and constitute valid scientific publications.

The online version of this publication is available at https://doi.org/10.18061/ojs.v120i1.7574 .

The OHIO JOURNAL *of*
SCIENCE
ISSN: 0030-0950 (print) | ISSN: 2471-9390 (online)
Open Access online

EDITORIAL POLICY

General

The Ohio Journal of Science (OJS) has published peer-reviewed, original contributions to science, education, engineering, and technology since 1900. The OJS encourages submission of manuscripts relevant to Ohio, but readily considers all submissions that advance the mission of The Ohio Academy of Science: To foster curiosity, discovery, innovation, and problem-solving skills in Ohio. The Academy produces two issues annually: peer-reviewed April Program Abstracts (Issue No. 1) and peer-reviewed full papers in December (Issue No. 2). The Ohio State University Libraries publishes both issues Open Access online on behalf of The Ohio Academy of Science. The Academy distributes a print version of the April Program Abstracts at the annual meeting. **Peer-reviewed articles are published as accepted throughout the year** and compiled at year end into a single online volume. Because the OJS is an international multidisciplinary journal, authors should write clearly and concisely, avoid excessive jargon, and include sufficient explanation of underlying concepts to assure broad understanding of the work by those in different fields than the author.

The OJS considers original contributions from members and non-members of the Academy in all fields of science, technology, engineering, mathematics, and education. Submission of a manuscript is understood to mean that the work is *original* and *unpublished*, and is not being considered for publication elsewhere. All manuscripts considered for publication will be peer-reviewed. Any opinions expressed by reviewers are their own, and do not represent the views of The Ohio Academy of Science or the OJS.

Page Charges

Publication in *The Ohio Journal of Science* requires authors to assist in meeting distribution expenses. These costs will be assessed at $50 per page for nonmembers. **Members of the Academy do not pay page charges to publish in *The Ohio Journal of Science*.** In multi-authored papers, the first author must be a member of the Academy at the time of publication to be eligible for the reduced member rate. Papers that exceed 12 printed pages may be charged full production costs.

How to Submit a Manuscript

Go to https://ohiojournalofscience.org to peruse recent issues of *The Ohio Journal of Science*. Read the "Information for Authors" linked there. Register at that site and upload your manuscript and illustrations.

For technical questions about electronic formats or other details for submission, contact:

The Ohio Academy of Science
5930 Wilcox Pl., Suite F, Dublin OH 43016
Phone: 614-389-2182 • Fax: 614-389-2470
Email: ojs@ohiosci.org • https://www.ohiosci.org

Please contact the editor directly for general questions regarding content or appropriateness of submissions:

Dr. Lynn E. Elfner, Editor—Email: Elfner1@gmail.com

Indexing

The Ohio Journal of Science is indexed by:
Academic OneFile | Biological Abstracts/BIOSIS Previews
CAB Abstracts | EBSCOhost Databases | Google Scholar
Knowledge Bank (The Ohio State University Libraries)
ProQuest Databases | SciFinder Scholar | Zoological Record

FUTURE ACADEMY MEETINGS

The 130th Annual Meeting of The Ohio Academy of Science, April 24, 2021, hosted by Edison State Community College, Piqua, Ohio

International Exposure

During the past decade OJS online articles were accessed more than 4,793,609 times by researchers in more than 150 countries at an average rate of more than 1,300 per day.

The OJS is now an Open Access online journal. According to the *Directory of Open Access Journals* (DOAJ), https://doaj.org/about, as of 01 April 2020 the number of Open Access journals has grown from 300 in 2003 to 14,451 today—with the number of accessible articles (in excess of 4.76 million, globally) climbing by the hour.

Fully Keyword-Searchable Archives

The Ohio State University Libraries archive fully keyword-searchable issues of the OJS from November 1900 through 2014 here: https://kb.osu.edu/handle/1811/686

The Libraries' Online Journal Systems archives issues from 2014 through February 2020 here: https://ohiojournalofscience.org/issue/archive

This year's articles appear here: https://ohiojournalofscience.org/issue/view/244

Date of Issue—April 2020

Printing courtesy of:

CAS®
A DIVISION OF THE
AMERICAN CHEMICAL SOCIETY

The Ohio Journal *of* Science

AN OPEN ACCESS, ONLINE, INTERNATIONAL, MULTIDISCIPLINARY JOURNAL

Volume 120 **April 2020** **Number 1**

https://doi.org/10.18061/ojs.v120i1.7574

Special Notice

The 129th Annual Meeting of The Ohio Academy of Science, described herein, was not held due to the coronavirus disease 2019 (COVID-19) pandemic. However, all abstracts were peer-reviewed and constitute valid scientific publications.

CONTENTS

129th Annual Meeting

The Ohio Academy *of* Science

Hosted by
Cleveland State University
April 18, 2020

FRONT COVER PHOTO: The CSU Student Center is the centerpiece of CSU's $500 million campus makeover. The building is one of the final design projects by the late Charles Gwathmey, award-winning New York architect and is three-stories with a predominately glass exterior, a multi-level atrium and a central public forum. Photo and text courtesy of Cleveland State University. https://www.csuohio.edu .

The Ohio Academy *of* Science

129th Annual Meeting

Hosted by
Cleveland State University
Cleveland, OH 44115
April 18, 2020

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; pre-college, undergraduate, and graduate students; and interested lay citizens in the Ohio region.

WELCOME!

Cleveland State University welcomes you to the 129th 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 attendees and is included in the abstract submission fee. Register online at:
https://www.ohiosci.org/annual-meeting-registration .
On-site registration will be available.

The Ohio Academy of Science must receive registration by **April 1, 2020**.

Access to sessions is by name tag only. Name tag, information, and receipt will be available at the meeting.

Registration is by credit card on-line at **https://www.memberleap.com/members/evr/regmenu.php?orgcode=OAS .**

For further information, please call 614-389-2182.

Saturday, April 18: Registration at the Student Center (SC) on the 3th floor.

7:30 AM - 10:00 AM. On-site registration can be paid either by check, VISA®, or Mastercard®. Cash is discouraged.

MEETING LOCATION

Most Ohio Academy of Science events take place on the 3th floor of the Student Center (SC), 2121 Euclid Avenue, Cleveland, Ohio 44115-2214. Two podium venues are located in the connected Berkman Hall (BH). The Student Center is in the center of the campus, immediately south of Rhodes Tower.

DRIVING INSTRUCTIONS TO CAMPUS

The main address for the Cleveland State University is 2121 Euclid Avenue, Cleveland, OH 44115-2214.
Phone: 216-687-2000.

Driving instructions are at
https://www.csuohio.edu/about-csu/directions

PARKING ON CAMPUS

Preferred parking is at the South Garage (SG), 2101 E. 21st St., located two blocks south of the Student Center (SC). A campus map is on page 30 and 31 of this issue and online at
https://www.csuohio.edu/sites/default/files/media/about_csu/documents/campusmap.pdf

MEALS

Saturday, April 18th – Box lunches may be pre-ordered with registration for $35.00 and will be available for pick-up at noon on the 3th floor of the Student Center (SC).

Box lunches must be ordered by **April 1, 2020**. **https://www.memberleap.com/members/evr/regmenu.php?orgcode=OAS .**

The Ohio Academy of Science

5930 Wilcox Pl. • Suite F • Dublin, OH 43016
Phone 614-389-2182 • Fax 614-389-2470
info@ohiosci.org • https://www.ohiosci.org

Fostering curiosity, discovery and innovation to benefit society.

GENERAL SCHEDULE

Saturday, April 18, 2020

Most events take place on the 3th floor of the Student Center (SC), two podium venues are in Berkman Hall (BH).

7:30 AM - 10:00 AM	Breakfast (SC 3rd floor)
7:30 AM - 10:00 AM	Meeting Registration (SC 3rd floor)
8:45 AM	Annual Meeting of the Members (SC Room 315) (see below)
9:00 AM - 10:00 AM	Poster Session (all presenters) (SC Room 311—Ballroom)

Note: All posters will be displayed in both morning and afternoon sessions.

10:15 AM - Noon	Podium Sessions (SC Room 313, Room 315) (BH Room 201, Room 202)
12:15 PM - 1:15 PM	Box lunch pick up (at registration table)
12:15 PM - 1:15 PM	Lunch, State of the Academy/ All-academy Lecture (SC Room 311—Ballroom)
1:30 PM - 3:00 PM	Poster Session (all presenters) (SC Room 311—Ballroom)

Note: All posters will be displayed in both morning and afternoon sessions.

Annual Meeting of the Members

The Ohio Academy of Science will hold one annual meeting of the members each calendar year. The annual meeting will take place during the first or second calendar quarter of each year, and will be held at a time and place that the Board designates. The purpose of each annual meeting will be to conclude any old business and conduct any new business that may properly come before the members. The business session of this meeting shall be conducted in accordance with the most recently published edition of "Robert's Rules of Order" or "the Modern Rules of Order."

Our Institutional Host

Cleveland State University is a public research institution located in the heart of downtown Cleveland. Our urban campus is home to Cleveland State University's *engaged learning* approach, where students and ideas connect in the classroom, the real world and beyond. With more than 16,300 students, 175+ academic programs and the largest footprint in downtown Cleveland, CSU is Northeast Ohio's only public, four-year urban campus, and is dedicated to helping students succeed while preparing for life after graduation. Engaged Learning connects CSU students with 3,000 co-ops, internships and research training opportunities with employers and healthcare institutions ensuring they graduate fully prepared to succeed in their chosen professions.

CSU has strengthened its ties to Cleveland through a series of forward-thinking partnerships. Campus International School and MC^{2}STEM High School provide pathways to college with the Cleveland Metropolitan School District. CSU serves unmet health-care needs in our community through the Partnership for Urban Health. According to the Brookings Institution report, *Ladders, Labs, or Laggards? Which Public Universities Contribute Most*, CSU ranks in the 5th percentile in the U.S. among 342 public universities that provide upward mobility *and* conduct impactful research; CSU is the only university in Ohio in the "Best of the Best" category.

CSU has a diverse student body and a vibrant campus. Recent additions to the CSU campus include the Center for Innovation in Medical Professions, designed as a collaborative space for health sciences, a striking new addition to the Washkewicz College of Engineering, and a new School of Film & Media Arts.

Visit www.csuohio.edu

CLEVELAND STATE UNIVERSITY

Notes!

Brief Schedule of Abstracts

See **Fields of interest index** on page 29
and **First author index** on page 29

Poster Session 9:00 - 10:00 AM
and
Poster Session 1:30 - 3:00 PM

Note: All posters will be displayed in both morning and afternoon sessions.

Located in the Student Center (SC Room 311—Ballroom)

Pre-college Student
See page 12

College and Professional
See page 22

Podium Sessions 10:15 AM - 12:00 Noon

Podium Session 1
Botany, Zoology, and Environmental Science
10:15 AM - 12:00 Noon
Meeting Room – SC Room 313
See page 5

Podium Session 2
Medicine and Health Science
10:30 - 11:45 AM
Meeting Room – SC Room 315
See page 7

Podium Session 3
Information Technology
10:15 - 11:45 AM
Meeting Room – BH Room 201
See page 8

Podium Session 4, Part 1
Engineering and Technology
10:15 - 11:00 AM
Meeting Room – BH Room 202
See page 10

Podium Session 4, Part 2
Zoology
11:00 AM - 12:00 Noon
Meeting Room – BH Room 202
See page 11

10:15 AM - 12:00 Noon
Podium Session 1
Botany, Zoology, and Environmental Science
Meeting Room – SC Room 313

10:15 - COMPARISON OF 2 METHODS FOR RAPID BIOASSESSMENT OF CYANOBACTERIAL HARMFUL ALGAL BLOOMS IN LAKE ERIE'S WESTERN BASIN. Douglas Kane, dkane@defiance.edu, Defiance College, 701 N Clinton St, Defiance OH 43512, Thomas Bridgeman, thomas.bridgeman@utoledo.edu, Professor of Ecology, University of Toledo, Toledo OH.

Cyanobacterial Harmful Algal Blooms (cHABS) have been a major problem in the western basin of Lake Erie for the past 2 decades. Because of the ability of these cHABS (mostly made of *Microcystis*) to negatively impact beneficial uses of the lake, methods of rapid bioassessment are needed. cHAB samples were collected in Maumee Bay and the western basin of Lake Erie during 2018 with a 64 µm plankton net fitted with a General Oceanics 2030R flowmeter and preserved in sugar formalin. Samples were poured into a filtration cone, allowed to settle overnight and, their biovolume measured. Later, samples were poured into a 100 mL graduated cylinder, which was capped with plastic film and inverted 3 to 5 times, and then allowed to settle for at least 24 h. For this second method, the measured volumes of cHABS were standardized by dividing them by the amount of lakewater originally sampled, which was obtained from flowmeter readings, giving Volumetric Index of the Plankton (VIP) values. An increase in cHABS was first detected in mid-July with peak values in mid-August to early September for both methods. Linear regression analysis showed a significant ($p=0.009$) linear relationship between the 2 index values based on the same plankton samples ($n=37$). However, a low amount of the variability in the data was explained by this linear relationship ($r^2=0.18$), particularly at higher levels of index values. Continued comparisons of these values over a number of years of sampling could elucidate whether the VIP is useful as a rapid bioassessment tool.

10:30 - INVESTIGATING THE ENVIRONMENTAL DRIVERS OF PHYTOPLANKTON COMMUNITY COMPOSITION IN THE MAUMEE RIVER. Audrey Laiveling[1,2], audreylaives@gmail.com, Douglas D. Kane[1,3], dkane@defiance.edu, Crista Kieley[1,4], ckieley@une.edu, Justin D. Chaffin[1], chaffin.46@osu.edu, [1]The Ohio State University, Franz Theodore Stone Laboratory Ohio Sea Grant, P.O. Box 119, 878 Bayview Ave, Put-in-Bay OH 43456-0119, [2]University of Cincinnati, 2600 Clifton Ave, Cincinnati OH 45221, [3]Defiance College, Natural Science, Applied Science, and Mathematics Division, 701 N Clinton St, Defiance OH 43512, [4]University of New England, 11 Hills Beach Rd, Biddeford ME 04005.

Cyanobacterial blooms in Lake Erie have been well documented, but there is a lack of understanding of cyanobacterial dynamics in the Maumee River. Six recreational sites along the Maumee River were sampled weekly for algal assemblage compositions (taxa-specific chlorophyll-*a* concentrations) and nutrient concentrations, from May through October during 2018 and 2019, to provide insights into riverine cyanobacteria dynamics. Because of a spring of record-breaking precipitation and cancelled crop planting in the Maumee watershed in 2019, algal biomass was predicted to be less than in 2018. Analysis of Variance (ANOVA) showed total chlorophyll-*a* concentrations differed significantly across sampling dates ($P<0.001$) and across sampling sites ($P=0.001$). Cyanobacteria concentrations differed significantly across dates ($P<0.001$) but not across sites ($P=0.467$). Concentrations of phosphorus and nitrogen were higher than levels known to support cyanobacterial

blooms in both years, but nutrients could not explain the differences in cyanobacteria biomass between the 2 years. Warmer temperatures and lower river discharge in 2018 correlated to a higher cyanobacteria abundance, whereas low low-flow conditions did not occur in 2019 and resulted in lower cyanobacteria abundance. This demonstrates that low low-flow conditions in the Maumee River provide a favorable habitat for cyanobacteria and that high high-flow conditions prevent cyanobacteria from reaching high biomass. Further studies to understand how environmental conditions and nutrient availability interact to affect riverine phytoplankton community structures and cyanotoxin production are warranted.

10:45 - EFFECTS OF LEAF LITTER ON ORGAN SIZE PLASTICITY AND MICROBIOME COMPOSITION IN LARVAL GRAY TREEFROGS, *HYLA VERSICOLOR*. Delaney Lyons, delaney.lyons@otterbein.edu, Dani McCauley, Sarah Bouchard, Otterbein University, Department of Biology and Earth Science, Westerville OH 43081.

Leaf litter can influence growth and development of amphibians by providing nutrients, structural support, and chemical leachates to the water. The purpose of this research was to determine the effects of red maple, *Acer rubrum*, and pin oak, *Quercus palustris*, on organ size plasticity and microbiome composition in larval gray treefrogs, *Hyla versicolor*. Larvae were raised in outdoor mesocosms, each containing 20 tadpoles. The treatments included: no leaf litter, maple litter, and oak litter. There were also treatments in which leaves were soaked in advance to remove leachates. This separated leaf structure from chemical make-up. Each treatment was replicated 4 times. To standardize developmental stage, tadpoles were selected based on size. Four size-matched larvae were sampled from each tank for organ analysis and 3 were sampled for microbiome assessment. Guts, livers, pancreas, fat bodies, and brains were weighed. Guts were also preserved in the −20 °C freezer for analyses of their microbiome. Data were analyzed with linear mixed effects models. There was no effect of leaf litter on growth rate in oak or maple treatments. Preliminary analyses indicate that leaf litter has a significant effect on organ size plasticity. For example, the livers of tadpoles reared with oak leaf litter were 42 percent larger. Additional dissections and microbiome analyses will allow for more definitive conclusions.

11:00 - METABOLIC PLASTICITY AND ORGAN SIZE IN AMERICAN TOADS, *ANAXYRUS AMERICANUS*. Emma C. Kimberly, emma.kimberly@otterbein.edu, Justin McCurdy, Sarah S. Bouchard, Otterbein University, Department of Biology and Earth Science, Westerville OH 43081.

Metabolic plasticity allows organisms to conserve energy when resource availability is low. Competition induces lower metabolic rates in *Agalychnis callidryas* tadpoles. This change was associated with larger guts, and smaller livers, pancreases, and brains. In *Anaxyrus americanus* tadpoles, extreme levels of competition induce lower metabolic rates, but less extreme levels do not. The purpose of this study was to determine if *A. americanus* tadpole metabolic rates correlate with changes in organ sizes. In a previous study, tadpoles were reared without competition (5 tadpoles per 12 L tank), with competition (20 tadpoles), and extreme levels of competition (40 tadpoles). Metabolic rates were measured, and tadpoles were preserved in 10% formalin. In the current study, the guts, livers, pancreases, and brains of those tadpoles were weighed. The brains were photographed to determine medulla oblongata, optic tectum, and forebrain area. Data were analyzed with linear mixed effect models. Competition level did not affect gut mass or pancreas mass. However, the livers of tadpoles reared without competition were twice as big as those of tadpoles facing extreme levels of competition ($p < 0.0001$). Competition did not affect brain mass, but for a given brain length the brains of tadpoles that experienced competition weighed less. Additionally, extreme competition induced significantly smaller optic tecta ($p = 0.00029$) and forebrains ($p = 0.003$). To understand differences at the cellular level, isotopic fractionation will be used to examine neuronal composition. The metabolic rate decrease under extreme competition could be attributed to decreases in liver size and neuronal brain composition.

11:15 - WHAT ARE THE EFFECTS OF A STRESS GRADIENT AND COMPETITION ON THE GROWTH OF *JUNIPERUS VIRGINIANA*? Samia Hamati[1], shamati@kent.edu, Dr. Juliana Medeiros[2], Dr. David Ward[1], dward21@kent.edu, [1]Kent State University, P.O. Box 5190, Kent OH 44242-0001, [2]The Holden Arboretum, Kirtland OH.

Juniperus virginiana is a native range-expanding species. This species contributes to the decline of plant biodiversity because it competes with native species for nutrients and other resources, and changes the landscape of the areas where it encroaches. The abundance of *J. virginiana* may be related to climate change and the ability of this species to tolerate a wide range of climatic conditions. This study tested the effect of a climate gradient on encroachment by *J. virginiana* in northeast Ohio. Lake-effect snow is a unique weather pattern that occurs on the east side of the Great Lakes in the United States, with regions closer to the lakes being colder and receiving more snowfall. The effect of increasing temperature and decreasing snowfall with increasing distance from Lake Erie is of particular interest. A field experiment was conducted in 3 different sites (Geauga, Portage, and Tuscarawas) at increasing distances from Lake Erie. The effects of temperature were examined as well as the effects of intra-specific competition on the growth and survival of *J. virginiana* seedlings. The height and trunk diameter were measured to estimate seedling performance. Results suggested that there was no effect of temperature gradient on *J. virginiana* growth rate. There was, moreover, no significant effect of intraspecific competition across the climate gradient. However, results show facilitation between neighboring *J. virginiana* at the Tuscarawas site only (farthest from the lakes). Future studies need to determine if climatic conditions and competition are the main factors affecting the encroachment of *J. virginiana* into new habitats.

11:30 - OAK TREE DIFFERENTIATION OF REGROWTH, DEFENSE, AND RE-ALLOCATION STRATEGIES IN RESPONSE TO HERBIVORE PRESSURES. Cindy Perkovich, cthoma16@kent.edu, David Ward, dward21@kent.edu, Kent State University, P.O. Box 5190, Kent OH 44242-0001.

Plant strategies against herbivory may involve defending themselves by producing plant secondary metabolites (PSM), compensation or overcompensation in regrowth that minimizes injuries from tissue loss (tolerance), or reallocating resources that protect from further damage. This study investigates the strategies of oak plants that minimize herbivory by investment in tannins and re-allocation of non-structural carbohydrates from leaf to root storage. Oak species may differentially invest in regrowth, defenses, and re-allocation of nutrients depending on the location and intensity of herbivore feeding. Tissues from saplings were removed from either the apical (25% or 75%) or lateral meristem (25% or 75%) and a control (no tissue removal). Using 12 oak species from different parts of a well-supported molecular phylogeny, the 5 above-mentioned treatments were applied in a full-factorial design. The 12 species were chosen to represent a broad array of geographical and phylogenetic diversity. After treatment, sapling height, lateral growth, and stem diameter were recorded biweekly for the following year. Saplings were harvested after the one year. Leaf and root tissues were analyzed for chemical defense and

nutrient concentrations. An untransformed statistical analysis found that oak species invest differentially in defensive mechanisms. A phylogenetic comparative analysis found differences in regrowth, defense, and re-allocation strategies that are associated with particular oak lineages.

11:45 - COMPARATIVE ANTIBIOTIC, ANTIOXIDANT, AND ANTI-INFLAMMATORY ACTIVITY OF 4 *MONARDA* SPECIES. Alyssa Griffith, a-griffith.1@onu.edu, Rand Abdullatef, r-abdullatef@onu.edu, Luke Fickenworth, l-fickenworth@onu.edu, Linda Mull Young, David H. Kinder, Jill Bennett-Toomey, Vicki Abrams Motz, v-motz@onu.edu, Ohio Northern University, 525 South Main Street, Ada OH 45810.

The genus *Monarda* (Lamiaceae) has extensive ethnobotanical history as a food, and in antibiotics, analgesics, anti-inflammatories, anti-oxidants, and anti-cancer treatments; but functions have not been considered comparatively along phylogenetic lines. Monardas have been grouped along evolutionary lines both morphologically and via ribosomal DNA analysis. This study compared biological activity of the closely related *M. citriodora* and *M. punctata* to *M. didyma* and *M. fistulosa* which are closely related to each other but distantly related to the other 2. *M. fistulosa* exhibited greatest zones of inhibition against the respiratory pathogens ($p=0.009$ by ANOVA) by Kirby-Bauer analysis. *M. citriodora* was most effective in blocking LPS-induced inflammation in mouse granulosa cells as evidenced by immunocytochemistry. None of the species tested had anticancer effects against HT29 colorectal cancer cells by XTT testing. *M. punctata* and *M. citriodora* had significantly greater antioxidant capability than the others in end-of-season samples ($p=0.033$ by ANOVA); however, the greatest antioxidant activity was seen in *M. fistulosa* and *M. citriodora* in flower ($P=2.0 \times 10^{-20}$ by ANOVA). While presence of some chemical constituents and antibiotic activity did appear to be along phylogenetic lines, reproductive state of the plants, month of harvest, and seasonal rainfall, all appeared to impact biological activity.

10:30 - 11:45 AM
Podium Session 2
Medicine and Health Science
Meeting Room – SC Room 315

10:30 - PERCEPTIONS OF ELECTRONIC HEALTH RECORDS IN THE HEALTHCARE COMMUNITY OF INDIA AND THE USA. Kokila Varadarajan, kvaradarajan@capital.edu, Dr. Kerry Cheesman, kcheesma@capital.edu, Capital University, 1 College and Main, Columbus OH 43209-2394.

Electronic health records (EHRs) contain patients' medical history and statistics. EHRs were created in 1991 to enhance medical security and efficiency, improving the overall quality of healthcare. According to The Commonwealth Fund, both the USA and India have had slow adoption rates in practice, leading to consistently poorer ratings of overall healthcare than European countries. This project's purpose was to elicit perspectives about EHRs from healthcare workers and consumers in the USA and India. It was hypothesized that the participants from the USA are more familiar with EHRs than those from India. An electronic questionnaire was circulated to healthcare workers, students, and consumers. Results from 427 surveys were received: 363 from the USA and 64 from India; 58 physicians, 132 other healthcare workers, 120 students, and 117 consumers. Results show inconsistent knowledge about EHRs among most groups. For example, nursing students ($n=34$) scored an average of 5.61 (out of 10) in familiarity, while pre-medical students ($n=70$) scored 2.77. Physicians in India ($n=12$) scored an average of 6.33 in familiarity while physicians in the USA ($n=46$) scored an average of 8.39; likely because EHR adoption rates are greater in the USA than in India. Most physicians and nurses in the USA enter their own data, while in India most hire others to do this job. Consumers from both countries were concerned that they did not have access or full ownership of their records, making these difficult to retrieve for a second opinion.

10:45 - INFLUENCE OF CLIMATIC FACTORS IN THE DEVELOPMENT OF WEST NILE DISEASE IN CALIFORNIA HUMANS, BIRDS, AND MOSQUITOES FROM 2004 TO 2015. Lisa Beltz, lisabeltz01@gmail.com, Cellular Technology Limited, 2600 Cleveland Avenue NW, Canton OH 44709.

West Nile virus causes severe neurological disorders in a small percentage of those infected, including birds and humans. The virus is primarily transmitted by infected Culex mosquito bites. This study examined effects of climatic factors (drought, precipitation, and temperature) upon infection of humans, birds, and mosquitoes on a monthly basis for each California county from 2004 to 2015. The correlation coefficient was determined between humans, birds, and mosquitoes with the above climatic factors for each county, monthly from 2004 to 2015. Climatic information was derived from a database produced at Malone University based on United States Geological Survey data. Infection data was derived from weekly California Department of Health Bulletins. In 15 California counties, correlation coefficients between birds or mosquitoes and average, minimal, and maximal temperatures ranged from 0.45 to 0.6, and an additional 6 counties had correlations ≥ 0.6. No significant correlations existed between numbers of bird or mosquito infections and the Palmer Drought Severity Index or precipitation levels. No significant correlation was found between human infection and any climatic factor. Climate change, particularly in temperature and precipitation, is believed to increase human infection with zoonotic microbial diseases, especially those transmitted by mosquitoes. Interestingly, no significant correlation was found between human infection and any of those climatic factors when examined per county per month in California for 12 years. Also, no significant correlation was found between bird or mosquito infections and drought index or temperature. These findings suggest that more studies are needed to examine how climate changes affect incidence of arthropod-derived human infections.

11:00 - OVARIAN HYALURONAN CONTENT DECLINES DURING PHYSIOLOGIC AGING AND RADIATION-INDUCED, ACCELERATED AGING IN MICE. Lacey R. Harris[1], lharris@lec.edu, Jordan Surgnier[1], Bruce Kimler[2], Francesca E. Duncan[3], Michele T. Pritchard[1,4], University of Kansas Medical Center, [1]Department of Pharmacology, Toxicology and Therapeutics, [2]Radiation Oncology, [4]Liver Center, [3]Northwestern University, Department of Obstetrics and Gynecology.

Mammalian ovaries develop chronic, low-grade inflammation and fibrosis as they age, disrupting organ architecture and possibly function. Iatrogenic insults (chemotherapy and radiation) accelerate ovarian aging, leading to premature loss of function. Naked mole rats (NMR) exhibit life-long fertility and produce high levels of hyaluronan (HA), a glycosaminoglycan associated with cancer resistance and longevity. It was predicted that HA content is related to ovarian aging. This was tested by examining HA in ovarian tissue sections from following models using a HA binding proteins assay: NMR (2 to 10 years old), CD1 and CB6F1 mice (0 days to 22 months old), and in BALB/c (radiosensitive) and 129s2 (radioresistant) mice exposed to 1 Gy total body irradiation. HA was expressed as a percent of total

tissue area. HA was localized to the stroma surrounding primordial and primary follicles in the ovarian cortex of NMR; in the stroma surrounding theca and granulosa cells of secondary and antral follicles, and in follicular fluid of both NMR and mice. HA content was greater in NMR than mice. HA was highest in mice 0, 5, and 10 days post-birth; levels decreased thereafter. This was paralleled by HA content in CB6F1 mice; younger mice had more HA than older mice. Radiation exposure decreased HA in radiosensitive BALB/c mice, but not in radioresistant 129s2 mice. These data suggest HA may contribute to maintenance of mammalian fertility. Preventing HA loss, or enabling HA synthesis, may be a novel therapeutic strategy to delay ovarian aging.

11:15 - RESPIRATORY AND METABOLIC EFFECTS OF ELECTRONIC CIGARETTE INHALATION IN MALE C57/BL6 MICE. Alexis Phillips, aphill18@ashland.edu, Dr. Dolly Crawford, dcrawfo9@ashland.edu, Ashland University, 401 College Avenue, Ashland OH 44805.

The effects of e-cig exposure on respiration and metabolism are poorly understood. Chronic e-cig exposure has been shown to increase airway resistance, but additional studies are needed. An untested relationship between e-cig use and dysfunction in glucose metabolism suggests that e-cig ingredients cause a shift to a lipid-based metabolism. The hypotheses being tested are that e-cig inhalation will precipitate respiratory dysfunction and a shift to lipid metabolism in male C57/BL6 mice between 47 to 807 days (n=17). Physiological parameters were measured using indirect calorimetry and a 1L exposure chamber that was calibrated to the O_2 and CO_2 levels of room air. Mice were exposed to room air or 15 seconds of e-cig vapor over a period of 30 minutes. The volume of oxygen consumed (O_2), and carbon dioxide produced (CO_2) was measured using a GA-200 gas analyzer (iWorx® Systems Inc.). A ratio of CO_2 to O_2, or respiratory exchange ratio (RER), $\leq$0.70 is indicative of lipid metabolism; a RER $\geq$0.70 indicates carbohydrate metabolism. Animals exposed to e-cig demonstrated greater CO_2 production ($F(1, 107) = 12.38$, $p = 0.006$ using R v.3.4.3), and reduced O_2 consumption ($F(1, 110) = 13.29$, $p = 0.051$). This result suggests that e-cig inhalation may lead to dysfunction in respiratory dynamics. No effect of e-cig exposure on metabolism was noted.

11:30 - EVALUATION OF CHRONIC EFFECTS OF E-CIGARETTE INHALATION ON RESPIRATION AND METABOLISM IN FEMALE C57/BL6 MICE. Taylor Williams, twilli45@ashland.edu, Dr. Dolly Crawford, dcrawfo9@ashland.edu, Ashland University, 401 College Avenue, Ashland OH 44805.

The effects of e-cigarette (e-cig) exposure on respiration and metabolism are poorly understood. Chronic e-cig exposure has been shown to increase airway resistance, but additional studies are needed. An untested relationship between e-cig use and dysfunction in glucose metabolism suggests that e-cig ingredients cause a shift to a lipid-based metabolism. The hypotheses being tested are that e-cig inhalation will precipitate respiratory dysfunction and a shift to lipid metabolism in female C57/BL6 mice. Indirect calorimetry was used. Fourteen mice aged between 497 to 635 days were selected for study. Mice were exposed to room air or 15-second puffs of e-cig vapor in a 1L exposure chamber over a period of 30 minutes. The volume of O_2 consumed (O_2) and CO_2 produced (CO_2) was measured using a GA-200 gas analyzer (iWorx® Systems Inc.). The ratio of CO_2 to O_2 is the respiratory exchange ratio (RER). A RER of 0.70 is indicative of lipid metabolism, and a RER of 1.00 indicates carbohydrate metabolism. Statistical analysis control and experimental data (n=40 and 64, respectively) examined the effect of independent variables on the dependent variables (RER, O_2, CO_2) using R v.3.4.3. RER was significantly lower in e-cig animals (0.77) compared to controls (0.82; $F(1, 87) = 4.39$, $p = 0.039$) and decreased with the number of exposures ($F(1, 87) = 3.04$, $p = 0.054$). Animals exposed to e-cig demonstrated greater CO_2 production ($F(1, 87) = 14.68$, $p = 0.002$) and lower O_2 consumption ($F(1, 87) = 15.65$, $p = 0.001$). These results suggest that e-cig use can alter patterns of lung ventilation. The observed decrease in RER demonstrates the potential interaction between inhalation and metabolism.

10:15 - 11:45 AM
Podium Session 3
Information Technology
Meeting Room – BH Room 201

10:15 - APPLICATIONS OF BLOCKCHAIN TECHNOLOGY IN CRYPTOCURRENCY, BANKING, AND HEALTHCARE. Bilal Gonen, bilal.gonen@uc.edu, Hari Ponnakanti, ponnakha@mail.uc.edu, University of Cincinnati, CECH School of IT, 2610 McMicken Circle 150 Teachers-Dyer Complex, Cincinnati OH 45221.

This paper examines the opportunities and challenges of implementing blockchain technology across the medical, financial, and banking sectors, and provides a clear view which can enable blockchain for broader applications. Detailed research on underlying blockchain technology was conducted. Blockchain offers distributed governance, an immutable audit trail, provenance of data, robustness, and privacy. This study contrasted blockchain innovations and identified prominent applications of blockchain related to historically decentralized cryptocurrencies, banking systems, and healthcare. Blockchain has an extensive history in banking and cryptocurrency, and is currently broadening into the healthcare industry by enhancing medical record processing, genomics, enhancing insurance claim systems, and streamlining clinical research, biomedicals, and pharmaceuticals. One of the drawbacks this study encountered was that implementing blockchain in the medical sector consumes substantial computing resources. Moreover, every sector of society is using blockchain in their respective ways for getting relevant outcomes. Most prominently, the importance of blockchain technology in the medical sector is clearly increasing day by day, and many technologists and scientists are investigating its future possibilities. Finally, this project identified several possible challenges facing the implementation of blockchain technology in banking, healthcare, and cryptocurrency.

10:30 - THE RISE OF RANSOMWARE IN LOCAL GOVERNMENTS—A CASE STUDY OF 20 VICTIM GOVERNMENTS. Nesibe Karatas, karatane@mail.uc.edu, Said Varlioglu, varlioms@mail.uc.edu, Murat Ozer, ozermm@ucmail.uc.edu, Nelly Elsayed, elsayeny@ucmail.uc.edu, University of Cincinnati, CECH School of IT, 2610 McMicken Circle 150 Teachers-Dyer Complex, Cincinnati OH 45221.

Over the past 2 years, ransomware has become one of the biggest concerns for local government agencies. Especially in 2019, many cities in the US reported devastating ransomware attacks. In this study, 20 victim governments were examined in 3 categories: attacker behavior analysis, victim behavior analysis, and the consequences of the attacks. Case studies demonstrated that almost 50% of governments paid the ransom to the attackers. The number and density of the attacks have been perceptibly increasing for 2 years. Since the existence of the non-traceability feature of cryptocurrencies, attackers want

the victims to pay a ransom in cryptocurrencies to unlock the systems. Also, the attackers keep their promise and give the passwords to the victims. This behavior is considered a demonstration of reliability for future attacks. Victim governments, even police departments, tend to agree to pay the attackers. On the other hand, thousands of people are affected, a significant amount of PII (personal information identification) is stolen, all services are shut down, damage is significant on the city budgets, and even police departments are targets in ransomware attacks. Sixty-three percent of attacks are conducted via phishing emails, 37% are committed via other exploit kits that are sophisticated cyberattack tools that target vulnerabilities. Phishing emails include trojans that provide an ability to open unauthorized access for attackers. The City of Riviera Beach, Florida, lost 2 years of data in 2019 and agreed to pay $600,000 worth of bitcoin to hackers. Future research can analyze prevention and tracking systems.

10:45 - A CASE STUDY OF A NEW CYBERCRIME: CRYPTOJACKING. Said Varlioglu, varlioms@mail.uc.edu, Nelly Elsayed, elsayeny@ucmail.uc.edu, Murat Ozer, ozermm@ucmail.uc.edu, University of Cincinnati, CECH School of IT, 2610 McMicken Circle 150 Teachers-Dyer Complex, Cincinnati OH 45221.

Cryptojacking is the unauthorized use of computers to mine cryptocurrency using malicious scripts. It emerged after 2017. Over 10 million web users had been victims every month before Coinhive—which was a mining service provider—shutdown in March 2019. This study explores the consequences of the Coinhive shutdown by testing 500 websites out of the 2,770 cryptojacking webpages. Of the 500 websites, 344 were found to no longer be running mining scripts, 92 were shut down, 58 were still attempting to connect Coinhive using "coinhive.min.js" script, and 6 were using other mining scripts. Out of 500 websites we surveyed manually, 68.8% of websites removed all hidden malicious scripts, 18.4% of websites have stopped their service, 11.6% of websites still use Coinhive scripts, and 1.2% of websites still continue Cryptojacking activities. As a case study, "cinecalidad.to" which is a free movie website that employs a cryptojacking script connecting mining deployer: "enaure.co/javas.js". Enaure.co is a domain that hosts mining scripts. It connects the "Moneroocean.stream" mining pool that assigns mining tasks and returns rewards to miners. The network traffic relies on a WebSocket and WebAssembly connection to get the victim permanently connected. It performs a "long task" with 4 JavaScript workers. The workers run on 4 blob links. Finally, the patterns in a Cryptojacking website can be listed in 6 categories: (1) WebSockets, WebAssembly connections, (2) Four WebWorkers (JavaScript workers), (3) Long Tasks in Call Stack Threads, (4) the existence of "var miner", "throttle", "start miner" phrases in the redirection links, (5) the abnormality of CPU, and (6) battery usage.

11:00 - PUBLIC KEY CRYPTOSYSTEM BASED ON LOWER TRIANGULAR MATRICES. Zekeriya (Yalcin) Karatas, karatazy@ucmail.uc.edu, University of Cincinnati Blue Ash College, Math, Physics & Computer Science Department, 9555 Plainfield Rd, Blue Ash OH 45236, Erkam Luy, erkm.ly@hotmail.com, Erciyes University, Bilal Gonen, gonenbl@ucmail.uc.edu, Said Varlioglu, varlioms@mail.uc.edu, University of Cincinnati, CECH School of IT, 2610 McMicken Circle 150 Teachers-Dyer Complex, Cincinnati OH 45221.

The implementation of different algebraic structures is a very common method in creating novel cryptosystems. One of the most common algebraic structures is the set matrices. In particular, there are many public-key cryptosystems in the field which use the special subsets of the matrices. These public-key cryptosystems are mainly practical in key-exchange protocols. Since the exponentiation of the matrices takes such a long time in general, the conjugation of the matrices is considered in some public cryptosystems which makes the cryptosystem much faster. In this project, a public-key cryptosystem was created based on upper triangular matrices of the general linear group over the residue ring of integers modulo some integer n, which is a subset of the matrices. This work also generalized a public-key cryptosystem established in 2015 by some researchers. The cryptosystem primarily uses the algebraic properties of the conjugation, and these properties of the cryptosystem make it faster and more efficient than the ones which use exponentiation. The speed of the process can be determined by the choice of the matrix size, which could be done at the beginning of the implementation process. The security of the cryptosystem can be increased by increasing the matrix size. As a result, this cryptosystem will be very efficient in key-exchange protocols for symmetric ciphers, and it could be implemented in many other areas of cryptography.

11:15 - IDENTIFYING TRANSACTION PATTERNS ON ILLEGAL DARKNET MARKETS. Bilal Gonen, bilal.gonen@uc.edu, Victor Adewopo, adewopva@mail.uc.edu, University of Cincinnati, CECH School of IT, 2610 McMicken Circle 150 Teachers-Dyer Complex, Cincinnati OH 45221.

Darknet is an encrypted network technology that uses the internet infrastructure and can only be accessed using special network configurations and software tools. The contents of darknet are not indexed by search engines. The availability of sophisticated technologies for perpetrating criminal activities in cyberspace is a pertinent societal problem. In countries with oppressive regimes and media censorship, journalists and freedom fighters seek anonymity using darknet technologies; however, the majority simply exploit it for illegal activities. The danger inherent in Tor hidden services is significantly high compared to the perceived benefit. This study surveyed related past work on darknet markets. In the light of this comprehensive literature review, it is evident that researching darknet activities is vital for public safety. The aim was to identify patterns of transactions on darknet, and ultimately to optimize how data-driven insights can be utilized to support governmental agencies in unraveling the depths of darknet technologies. The research question addressed was: how can information sharing across agencies be improved to support investigations and prosecution strategies? Illegal darknet markets were reviewed to identify transaction patterns which can help to reduce drug overdose incidents, for example. Only a few studies explored the impact of illegal drug activities on healthcare, from 1997 to 2013. There were over 300% increments in deaths due to drug overdose and over 11.4 million people misused opioids in 2018. It was concluded that these combined techniques can be applied in supporting enforcement agencies to deanonymize darknet-related bitcoin transactions.

11:30 - IS CRIME SEASONAL? Said Varlioglu, varlioms@mail.uc.edu, Norah Hartlipp, hartlinh@mail.uc.edu, Murat Ozer, ozermm@ucmail.uc.edu, Nelly Elsayed, elsayeny@ucmail.uc.edu, University of Cincinnati, CECH School of IT, 2610 McMicken Circle 150 Teachers-Dyer Complex, Cincinnati OH 45221.

Understanding the relationship between crime and seasonal factors is important regarding crime prevention. The dataset consists of violent crimes (n=24,189) and property crimes (n=130,448) for a period from 2011 to 2018 in the city of Cincinnati. Based on descriptive statistics, the number of crimes—including violent and property crimes—is declining since 2011. Whereas 27% of crimes were committed in the summer, 22.07% of crimes were committed in winter. Besides, from the temporal perspective, more property crimes occur in the afternoon

peaking at 2 p.m. and more violent crimes occur at night peaking at 10 p.m. One-way ANOVA test demonstrates that violent and property crimes are seasonal ($p<0.05$). For violent crimes, while there is a statistically significant difference in crime occurrence for winter compared with all the other seasons (Sig=0.019), there is no difference for spring compared with summer (Sig=0.061) and fall (Sig=0.966); there is no difference for summer compared with fall (Sig=0.172). For property crimes, while there is a significant difference for winter compared with summer (Sig=0.002) and fall (Sig=0.033), there is no difference for winter compared with spring (Sig=0.901). Also, there is no significant difference for summer compared with fall (Sig=0.754). On the other hand, the chi-square tests demonstrated that property crime is seasonal ($p<0.05$) whereas violent crime is not seasonal ($p>0.05$). In conclusion, the "violent crime is seasonal" hypotheses can be rejected by the chi-square test but not by the ANOVA test. The "property crime is seasonal" hypotheses cannot be rejected by both chi-square and ANOVA tests.

10:15 - 11:00 AM
Podium Session 4, Part 1
Engineering and Technology
Meeting Room – BH Room 202

10:15 - EFFECT OF AC INTERFERENCE ON THE STRESS CORROSION CRACKING SUSCEPTIBILITY OF STEELS UNDER CATHODIC PROTECTION. Lizeth Sanchez, ls147@zips.uakron.edu, Hongbo Cong, hcong@uakron.edu, University of Akron, Engineering Research Center, Akron OH 44325-3906.

The oil and gas pipeline industry requires reliable and safe modes of operation. Pipelines can be compromised if corrosion is present in the structure. Corrosion in pipelines can lead to catastrophic failures that results not only in serious structural and environmental damages but also casualties. One of the types of corrosion that threatens the integrity of buried pipelines is induced by alternating current (AC) signals. AC produced by high-voltage transmission lines (HVTL) impose an AC voltage onto the underground pipelines located in close proximity and accelerate the rate of general corrosion. Pitting corrosion has also been reported to occur in the presence of AC interference, although the mechanism remains unknown. Since stress corrosion cracking (SCC) is prone to initiate in large pit density zones, catastrophic failure of pipelines can be accelerated by AC. Therefore, the goal of this research is to develop a fundamental understanding of the AC effect on the cracking behavior of the carbon steels by using slow strain rate testing (SSRT), with advanced characterization and electrochemical techniques. The tests were carried out under different AC voltages (1, 2, and 3 V rms) and cathodic protection potentials (−0.77 to −1.12 V vs. SCE) in a NS4 solution. The preliminary results indicated that the imposition of AC voltage has a detrimental effect of decreasing the ductility of carbon steels. This effect also depends on the cathodic potential applied. At the cathodic potential of −0.77 V/SCE, higher susceptibility was found at higher AC voltage compared to −1.12 V/SCE.

10:30 - THERMAL MANAGEMENT PROPERTIES OF 3D PRINTED MULTI MATERIALS FOR AEROSPACE APPLICATIONS. Paul A. Warkentien II[1,2], awarkentien@gmail.com, Mrityunjay Singh[3], Michael C. Halbig[4], Hunter Leonard[5], Anton Salem[6], Regan Silvestri[1], rsilvestri@lorainccc.edu, [1]Lorain County Community College, 1005 N Abbe Rd, Elyria OH 44035, [2]Ohio Space Grant Consortium, [3]Ohio Aerospace Institute, [4]NASA Glenn Research Center, [5]Rochester Institute of Technology, [6]Washington University at St. Louis.

Additive manufacturing/3D printing is becoming increasingly important in industrial applications owing to its relative ease of use and the ability to make production changes quickly. A variety of filaments are being created for 3D printing to fill specific needs in respective industries. Subsequently, it is necessary to understand how printed materials will perform in their intended environment and application. NASA is especially interested in thermal management, and the evaluation of new materials is a critical part thereof. The thermal properties of materials used within fused deposition modeling (FDM®)-based 3D printing have been evaluated, along with the effect of different processing variables. The materials studied were ULTEM® 9085 resin and carbon fiber impregnated ULTEM 9085 resin. Samples were printed of the 2 different materials and also the materials in bi-layer configurations. Thermal properties were evaluated including thermal diffusivity, thermal conductivity, and specific heat—with results for thermal diffusivity proving to be most enlightening. For example, at 40 °C the thermal diffusivity of ULTEM 9085 is 6,116 mm^2/sec and the thermal diffusivity of carbon fiber impregnated ULTEM 9085 is 902 mm^2/sec. By comparison, when these 2 materials are laminated in a bi-layer configuration the thermal diffusivity is 1,858 mm^2/sec, demonstrating that the increased mechanical strength of the bi-layered configuration can be achieved without an extensive sacrifice in thermal properties. Lastly, the effects of the thermal testing methods themselves were observed on the microstructure of the materials, as observed by optical microscopy. Ultimately, insights were gained into various aspects of both pre- and post-printing variables and their effects on thermal properties.

10:45 - TIME OF DAY IMPACT ON MAPPING AGRICULTURAL SUBSURFACE DRAINAGE WITH THERMAL INFRARED DRONE IMAGERY. Barry J. Allred, Barry.Allred@ars.usda.gov, USDA – Soil Drainage Research Unit, 590 Woody Hayes Drive, Room 234, Columbus OH 43210.

Based on past research success, further investigation was needed to determine the best time of day to obtain drone thermal infrared (TIR) imagery for mapping agricultural drainage pipes. A senseFly® SA (Cheseaux-sur-Lausanne, Switzerland) eBee® Plus RTK/PPK fixed-wing drone—mounted with a senseFly thermoMAP TIR camera—was tested for drainage pipe mapping at 4 different locations in Ohio (Hardin County, 01 Jul 2019; Morrow County, 06 and 07 May 2019; Ross County, 31 May 2019 and 06 Nov 2019; and Seneca County, 21 and 22 Jun 2019). Drone surveys were conducted from sunrise to sunset, with each site having bare ground covered (to a greater or lesser extent) by crop residue/stubble. Late morning and afternoon TIR drone surveys worked fairly well at all 4 sites for determining drainage system patterns, with the soil over the drain lines at this time warmer than the soil between the drain lines. At 3 of the sites (Morrow, Ross, and Seneca Counties) TIR drainage pipe mapping results obtained at sunrise and/or sunset showed soil over the drain lines to be cooler than soil between the drain lines. Due to high humidity and/or surface temperature uniformity, difficulties were often encountered with processing TIR imagery collected at sunrise or sunset. Interestingly, in those cases where the imagery could be processed, some of the best drainage mapping results were obtained at sunrise/sunset. Consequently, strictly on a consistent basis, late morning and afternoon are the good times for locating drainage pipes with TIR drone surveys; although, in some cases, TIR drone surveys at sunrise/sunset can also provide good, maybe even the best, drainage pattern mapping results.

11:00 AM - 12:00 Noon
Podium Session 4, Part 2
Zoology
Meeting Room – BH Room 202

11:00 - CREATING AN AGING MODEL IN OOCYTES USING TRICHOSTATIN A. Haley Arena, arenah@findlay.edu, Emma Hicks, hickse@findlay.edu, Miranda Mentler, Brian Whitaker, whitaker@findlay.edu, University of Findlay, 1000 N Main Street, Findlay OH 45840.

An aged oocyte is one that was not fertilized during the optimal time window after ovulation and potentially has a diminished rate of fertilization and embryonic development success. The objective was to test the efficacy of trichostatin A (TSA) to stimulate the effects of aging in an in vitro pig oocyte model. The hypothesis that TSA can be used to create a working model for oocyte aging was tested by maturing oocytes (n=2,370) with or without TSA (100 ng/mL) for 24 or 48 h (OM1) and 16 h of additional maturation (OM2) without TSA. Oocytes were evaluated for meiotic progression and cumulus cell expansion (CCE). Oocytes from each treatment group were stained to determine levels of reactive oxygen species (ROS) (n=476) or mitochondrial electrochemical potential gradient dissipation (n=403). Remaining oocytes (n=801) were fertilized, and embryos were evaluated for fertilization characteristics, two-cell and blastocyst formation. Oocytes matured without TSA for 24 h had a higher percentage of oocytes in metaphase II after OM2. Oocytes matured with or without TSA for 48 h and without TSA for 24 h had less CCE compared to oocytes matured with TSA for 24 h. ROS levels differed. Oocytes matured without TSA for 48 h had higher mitochondrial membrane potential. Supplementation of TSA decreased penetration rates. Percent embryos cleaved by 48 h after in vitro fertilization was higher in oocytes matured for 40 h compared to those matured for 64 h. Results indicate TSA stimulating aging in pig oocytes remains a valid option.

11:15 - ZINC CHLORIDE IMPROVES OVARIAN TISSUE VITRIFICATION IN PIGS. Emma C. Hicks, hickse@findlay.edu, Haley A. Arena, arenah@findlay.edu, Megan Martz, martzm@findlay.edu, Brian D. Whitaker, whitaker@findlay.edu, University of Findlay, Department of Animal and Preveterinary Studies, 1000 N Main Street, Findlay OH 45840.

Vitrification is a fast freezing method of cryopreservation of tissues, but one that causes oxidative stress damage affecting the quality and development of these tissues. An antioxidant, zinc chloride, reduces damage caused by reactive oxygen species in vitrification. The objective of this study was to determine the effects of adding 5 µg/mL zinc chloride during vitrification to measure in vitro follicle development, post-thawing fertilization success, and embryonic development. Ovarian cortex samples (5×5 mm) (n=63) were isolated from cycling gilt ovaries and incubated, first in an equilibrium solution followed by a vitrification solution for 5 min each—both with 5 µg/mL zinc chloride. Following incubation, cortexes were placed in liquid nitrogen for 7 d. Twenty-seven of the cortexes were thawed in oocyte maturation media, cultured for 48 h, then fixed in formalin. Sections were subjected to histological assessment of follicle morphology. The remaining 36 cortexes were thawed, and oocytes were aspirated from antral follicles. Oocytes (n=162) were incubated in maturation media for 40 to 44 h and subjected to in vitro fertilization (IVF) and embryo culture. Post-IVF, a portion of potential embryos were evaluated for penetration, polyspermy, and male pronuclear formation rate. The remaining embryos were evaluated at 48 h after IVF for cleavage and at 144 h for blastocyst formation. Ovaries supplemented with zinc chloride during vitrification had improved follicular integrity, and while oocytes had decreased polyspermic penetration and increased male pronuclear formation, no differences were observed in embryonic development.

11:30 - DECLINING POPULATION TRENDS OF OBLIGATE GRASSLAND BIRDS ON A RECLAIMED SURFACE MINE ACROSS 6 FIELD SEASONS. Macey Mills, maceym@muskingum.edu, Ryan Smith, rjsmith@muskingum.edu, Shyla Burke, sburke@muskingum.edu, James Dooley, jdooley@muskingum.edu, Danny Ingold, ingold@muskingum.edu, Muskingum University, Biology Department, 10 College Drive, New Concord OH 43762.

Although reclaimed surface mines provide suitable nesting habitat for numerous grassland bird species, several studies during the past decade suggest that woody vegetation encroachment is now altering former mine sites (mined approximately 40 to 50 years ago). This succession changes these sites such that they may no longer be suitable as breeding habitat for obligate grassland bird species. However, few long-term studies examining population trends of grassland birds on reclaimed mines have been undertaken. To this end, the presence/absence of 4 grassland bird species (Henslow's Sparrows, *Centronyx henslowii*; Grasshopper Sparrows, *Ammodramus savannarum*; Bobolinks, *Dolichonyx oryzivorus*; and Eastern Meadowlarks, *Sturnella magna*) were monitored using 40 point count stations during May, June, and July of 2013, 2014, 2015, 2016, 2018, and 2019. Colonization and extinction probabilities between each sampling year, for each species, were estimated using program *PRESENCE*. Year-to-year colonization (previously absent but currently present) probabilities across our study site declined while year-to-year extinction (previously present but currently absent) probabilities generally increased for all 4 grassland bird species. Habitat analyses conducted during the same period provided strong evidence that Common Yellowthroats (*Geothlypis trichas*), a shrubland species, was encroaching across the grassland habitats.

11:45 - DOES TURBIDITY TYPE AFFECT LURE COLOR PREFERENCE IN SMALLMOUTH BASS? Luke Bobay, bobay.11@osu.edu, Suzanne Gray, gray.1030@osu.edu, The Ohio State University, 420B Kottman Hall, 2021 Coffey Rd, Columbus OH 43210.

Algal blooms and storm events change water clarity and the color of light underwater, potentially altering the ability of fish to visually locate prey. Little is known, however, about the effects of algal turbidity (i.e., suspended algal cells) on the visual capabilities of sport fish. Here, the preference of Smallmouth Bass (*Micropterus dolomieu*) for gold and pink lures was tested in clear, sedimentary turbidity, and algal turbidity treatments (both approximately 20 NTU). A gold lure and a pink lure were presented simultaneously to individual Smallmouth Bass. Lure color preference was determined based on the amount of time the fish spent near each lure during a 30-minute trial. Trials in which the fish failed to swim to a lure were excluded from analyses. The fish approached the lures in 6 clear trials, 5 sediment trials, and 1 algal trial. Bass spent a greater proportion of time near the pink lure than the gold lure in the clear and sediment treatments, but not in the algal treatment ($t_{8,1}=3.75$, $p=0.005$). The proportion of time spent near each lure did not vary significantly between the clear and sediment treatments ($p=0.103$), and the difference in lure color preference between the algal treatment and the 2 other treatments, though significant, is unreliable because the fish approached the lures in only 1 algal trial. The apparent preference of Smallmouth Bass for pink lures over gold lures in the clear and sediment treatments presumably results from their ability to see red wavelengths of light more easily than yellow wavelengths.

Pre-college Student Poster Sessions
9:00 – 10:00 AM
and
1:30 – 3:00 PM
SC Room 311 – Ballroom

Note: All posters will be displayed in both morning and afternoon sessions.

Poster Board No. 01 - THE IMPORTANCE OF BIOMARKERS IN PREVENTING MISDIAGNOSIS OF, AND MORE ACCURATELY PROGNOSTICATING, FIBRILLARY ASTROCYTOMAS (FA). Cyril M. Andrews, candrews22@us.edu, 7343 Shelford Drive, Solon OH 44139 (University School).

The distinction between fibrillary astrocytoma (FA) and oligodendroglioma is important from prognostic and treatment standpoints. It is known from past studies that some FAs demonstrate IDH1 or-2 mutations and can also have deletions on chromosomes 1p or 19q (often smaller deletions compared with the full arm deletions seen in oligodendrogliomas). The World Health Organization (WHO) currently defines oligodendrogliomas by the presence of 1p/19q codeletion as well as an IDH mutation. Only rare cases of FA have shown codeletions on chromosomes 1p/19q, which could potentially lead to an erroneous classification of the tumor as an oligodendroglioma—especially if an IDH mutation is also evident. The study retrospectively reviewed the molecular pathology results of FAs encountered at 1 institution over a 3-year period (n=359). Eleven patients (6 males, age ranges 37 to 86 years; 8 WHO grade IV tumors, 2 grade III, and 1 grade II) who had 1p/19q codeletions by fluorescent in situ hybridization were identified and formed the study group. Only 1 tumor demonstrated an IDH-1 mutation. Four tumors demonstrated p53 immunostaining of 30% or more. ATRX mutation was seen in 2 tumors. EGFR amplification was noted in 5 cases. The FA that was 1p/19q codeleted and IDH-1 mutated, also demonstrated evidence of ATRX and p53 mutations. Loss of heterozygosity testing showed only partial losses on both chromosomes. In conclusion, coexistent codeletions and IDH mutations were seen in a rare FA. In this case, other molecular markers were helpful in avoiding a potential erroneous diagnosis of oligodendroglioma.

Poster Board No. 02 - BIOPHYSICAL STUDIES OF THE VARIABLE DOMAIN (VD) OF DYNAMIN RELATED PROTEIN 1 (DRP1). Sraavya Anne, aashianne@hotmail.com, 370 Shetland Court, Highland Heights OH 44143 (Mayfield High school).

Mitochondria are dynamic organelles that constantly undergo fission and fusion. Drp1, a member of the dynamin superfamily, is a large GTPase that mediates mitochondrial fission. Mutations in Drp1 have been attributed to many neurological disorders including Alzheimer's disease, Charcot-Marie-Tooth Syndrome, and Parkinson's disease. It is known that Drp1 forms expanded helical oligomers that contract to perform mitochondrial fission. However, there are many unknown aspects of Drp1's structure, particularly within its variable domain (VD), which interacts directly with the membrane. The aim of this project was to better understand the structure of the VD and how it contributes to the function of Drp1. The overarching hypothesis was that an N-terminal VD segment, called Morf1 (molecular recognition feature 1), forms an amphipathic helix that is involved in membrane insertion and cardiolipin (CL) recognition. To determine which residues were most important for its membrane interactions, the following single amino acid substitutions were made: F501A, L507A, M508A, and I512A. Each mutant protein was characterized through different assays to determine the structural and functional importance of the residue. Size-exclusion chromatography coupled multi-angle light scattering (SEC-MALS) for determining oligomeric structure, and a malachite-green GTPase activity assay for function, were performed to determine the properties of the mutated protein. The mutant F501A substantially reduced Drp1's GTPase activity and only allowed the protein to form dimers. In addition, M508A only showed intermediate GTPase activity. These results indicated that Morf1 plays a crucial role in the self-assembly properties of Drp1 in solution as well as in its membrane interactions.

Poster Board No. 03 - GENES OF THE NUCLEOTIDE-BINDING OLIGOMERIZATION DOMAIN-LIKE RECEPTOR SIGNALING PATHWAY ARE UPREGULATED IN DISCOID LUPUS. Irene Calderon, irene.mina.calderon@gmail.com, 1138 E Rookwood Dr, Cincinnati OH 45208 (The Summit Country Day School).

Discoid lupus erythematosus (DLE) is a skin disorder that is caused by defects in the adaptive immune system. However, only 35% of patients have autoantibodies, indicating other pathogenetic mechanisms must be involved. It is hypothesized that genes associated with defects in the innate immune system would be differentially expressed in DLE skin compared to normal controls. Using the Gene Expression Omnibus, gene expression data from skin biopsies of patients with DLE and normal controls were compared using GEO2R. All available datasets were used: GSE109248, GSE81071, GSE52417, and GSE95474, with a total of 54 DLE and 37 normal skin samples. STRING (Search Tool for the Retrieval of Interacting Genes/Proteins), GeneCards®, and KEGG® (Kyoto Encyclopedia of Genes and Genomes) were used to identify the interaction and function of specific genes. Genes associated with the nucleotide-binding oligomerization domain-like receptor (NLR) signaling pathway were differentially expressed in DLE skin samples compared to normal skin (p-value<8.74e−05). Five genes associated with the NLR signaling pathway were found to be upregulated in skin samples of DLE patients compared to normal controls in all datasets: STAT1 (signal transducer and activator of transcription-1), Oligoadenylate Synthetases (OAS1, OAS2, OAS3), and AIM2 (absent in melanoma-2). These genes are involved in transcription activation, regulation of viral infection, and interferon response. Genes associated with the NLR signaling pathway are differentially expressed in the skin of DLE patients compared to normal controls, supporting the role of the innate immune system in the pathogenesis of DLE.

Poster Board No. 04 - MODULATION OF MACROPHAGE PHENOTYPE THROUGH GENIPIN CROSSLINKED COLLAGEN MESH FOR TREATMENT OF STRESS URINARY INCONTINENCE. Suhas Cingireddi, scingireddi22@us.edu, 3160 Old Brainard Rd, Pepper Pike OH 44124 (University School).

The response of the body to implanted biomaterials is crucial to biocompatibility of the material. Recent work demonstrates that genipin crosslinked woven collagen biotextile is a treatment for stress urinary incontinence by increasing anti-inflammatory M2-macrophages, which promote repair and regeneration. It is hypothesized that genipin cross-linking produces a favorable response through induction of M0 to M2 polarization of macrophages while reducing the activity of the M1 macrophages. The objectives are to demonstrate that M0 can polarize into the desired macrophage and whether the M2 polarization phenotype is promoted and maintained on aligned genipin crosslinked collagen scaffolds. Collagen threads were wound to form collagen scaffolds, which were crosslinked using genipin. Following sterilization, scaffolds were seeded with macrophages and cultured.

Experimental groups included M0 (n=3), M1 (n=3), and M2 (n=3). Scaffolds are assessed for cell attachment, proliferation, structure, and protein expression. Phalloidin staining demonstrated that M0 macrophages aligned with the collagen fibers while M1 and M2 alignment did not. Protein expression highlighted the presence of arginase I and the absence of iNOS in the M0 cells. Results suggest genipin collagen scaffolds induce polarization of M0 macrophages to M2 macrophages and inhibit M1 macrophage activity. Genipin-crosslinked collagen scaffolds support macrophage attachment and survival.

Poster Board No. 05 - DESIGNING A NEW COATING DEVICE AND FABRICATION PROCESS TO DEVELOP CERAMIC MICROTUBES. Edward Dan, edw656@gmail.com, 6955 Woodlands Ln, Solon OH 44139-4664 (Solon High School).

Ceramic microtubes are especially attractive due to their resistance to thermal shock, high temperature, pressure, and corrosion; their biological stability; and (in some cases) their thermal or electrical conductivity. They have a wide variety of applications including liquid and gaseous component separation in the chemical, oil and gas, steel, power and electronics, paper and pulp, pharmaceutical, biotechnology, food and beverage, and drinking water industries. In this research, ceramic microtubes were made using removable templates covered by layers of ceramic materials using sol-gel technology. A low-cost device was designed and built for coating multiple layers of slurry onto templates efficiently. Tested templates included silk (single and triple strands), cotton thread, and angel hair pasta coated with 1, 5, 10, 15, 20, or 25 layers of slurry and then fired with a 5-stage heating cycle up to 1,100°C/1,450°C over a period of 20 hours. Samples were analyzed using a scanning electron microscope (SEM). Average diameters were calculated by measuring 30 diameters from different locations of each tube. The 20× and 25× coatings on the single silk strand, sintered at 1,450°C, resulted in the strongest and most density-uniform microtubes by decreasing the porosity. The single silk strand with 20× coating under 1,450°C firing formed a 25 µm diameter hole and an average outer diameter (OD) of 39.90 µm with a standard deviation of 0.97 µm, while the 20× coating under 1,100°C resulted in an average 67.46 µm OD with a standard deviation of 1.14 µm. The 25× coating resulted in a 49.89 µm OD with standard deviation of 0.99 µm when fired up to 1,450°C.

Poster Board No. 06 - EXAMINING THE HIF-MEDIATED ENDOTHELIAL RESPONSES TO 5-FLUOROURACIL AND DEXAMETHASONE. Nikita Davidenko, ndavidenko20@us.edu, 1408 Golden Gate Blvd, Mayfield Heights OH 44124 (University School).

Hypoxia inducible factors (HIFs) are essential master oxygen (O_2) sensing heterodimeric transcription factors. In the presence of O_2, HIF-a subunits are degraded following their hydroxylation, but are stabilized under hypoxia by dimerizing with an aryl hydrocarbon nuclear translocator (ARNT, HIF-1ß). HIFs may provide important survival signals via endothelial cells, partially through signaling by the vascular endothelial growth factor (VEGF-A), which helps maintain the bone marrow's blood stem cell niche. The goal of this project was to test the hypothesis that treatment of endothelial cells (ECs) with the anti-inflammatory dexamethasone (DEX) could provide protection from 5-fluorouracil (5-FU), a chemotherapeutic drug known to kill proliferating cells and used to treat blood cancers. Wild type (GFP) and HIF-deficient (CRE) ECs were treated with 100 µM DEX and/or 100 µM 5-FU and cultured under normoxia (21% O_2) and hypoxia (2% O_2). At 24 hours, RNA was isolated and reversed transcribed to measure transcript levels by real-time PCR. In the control ECs, hypoxia and 5-FU treatments altered the expression of HIF genes and, relative to DXM alone, 5-FU stimulated the expression of VEGF-A and its receptors. Thus, HIFs may promote EC survival through the VEGF pathway. Colorimetric MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) assays, used to analyze cell viability through 96 hours, revealed opposite trends for growth/survival between normoxic and hypoxic cultures for WT and CRE ECs irrespective of DEX and/or 5-FU. MTT data were inconclusive. Conditions with less confluent cells are expected to provide more effective toxicity by 5-FU and correspondingly protective effects by DEX.

Poster Board No. 07 - THE USE OF CRYOABLATION AS AN ALTERNATIVE TREATMENT FOR RMS. Anjali Dhanekula, anjali.dhanekula@gmail.com, 3050 Cabot Way, Twinsburg OH 44087 (Hathaway Brown School). Jay T. Myers, jay.myers@case.edu, Alex Y. Huang, ayh3@case.edu, Mohammad Alshebremi, mxa535@case.edu, Case Western Reserve University, Cleveland OH.

Rhabdomyosarcoma (RMS), a malignant soft tissue cancer, is the third most common solid childhood tumor type with approximately 250 cases diagnosed in the US each year. RMS is currently treated using surgery, chemotherapy, and radiation therapy. Cryoablation is a process which involves using very cold temperatures—such as liquid nitrogen—to freeze and destroy diseased tissue. This allows the release of certain molecules from the tumor that can activate the immune system. Immune cells were tested in vitro with supernatant from RMS cells which were cryoablated. This resulted in increased activation of antigen-presenting dendritic cells and a decrease in markers for anti-inflammatory macrophages. With this information, 1 million cells were injected subcutaneously in the leg or back and then tumor growth was monitored weekly. Two different RMS cell lines, RMS M39M and RMS 76-9, were used for comparison. After 2 weeks, RMS 76-9 demonstrated more consistent growth in both the back and the leg. A different group of mice were then injected with 50,000 RMS 76-9 in the left leg. After 12 days, the mice were split into 2 groups—with and without cryoablation—and tumors were measured for an additional 24 days. Mice treated by cryoablation showed slower tumor growth. These results indicate that cryoablation may be a possible treatment for RMS.

Poster Board No. 08 - THE EFFECT OF MOUNTING ANGLE AND CONVECTION TYPE ON VOLTAGE OUTPUT OF PHOTOVOLTAIC PANELS. Grace Elhindi, gelhindi@roadrunner.com, 377 Kirkshire Ct, Highland Heights OH 44143 (Beaumont School).

This experiment tested the relationship of the mounting angle of a photovoltaic panel (PP) on the voltage produced. The trials included evaluation of the PP panel installed with mounting angles between 15 degrees and 60 degrees and under natural and forced convection. Forced convection was created by a floor fan that generated air velocity of 3 m/sec, simulating 10.8 km/h wind. The hypothesis was that photovoltaic panels installed with a higher mounting angle will exhibit higher voltage output. Furthermore, panels tested under forced convection will generate higher voltage levels than panels tested under natural convection. This study aimed to explore differences in the panel's performance and to identify the optimum mounting angle and convection conditions that maximize voltage output. The panel was exposed to 1,000 W high-intensity light within a reflective housing. The trials were conducted indoors under the same ambient conditions. Temperature and voltage measurements were collected using digital data recorders and generated over 2,400 data points. During the natural convection trials, at steady state, the panel mounted at an angle ≥45 degrees produced higher voltage—20.85 volts—and thus partially supported the hypothesis. Under forced convection, at steady state, the panel mounted at an angle <45 degrees produced higher voltage ranging between 21.95 volts and 22.05 volts,

thus partially supporting the hypothesis. Under forced convection the voltage output ranged between 21.7 volts and 22.05 volts whereas voltage output under natural convection was between 20.15 volts and 20.85 volts, which fully support the hypothesis.

Poster Board No. 09 - ECO/MIR200C NANOPARTICLES REDUCE THE INVASIVENESS AND MIGRATORY ABILITIES OF TRIPLE NEGATIVE BREAST CANCER. Carolyn Glasener, cglasener21@hb.edu, 7302 Winchester Dr, Solon OH 44139 (Hathaway Brown School). Andrew Schilb, als241@case.edu, Dr. Zheng-Rong Lu, xzl125@case.edu, Case Western Reserve University, Department of Biomedical Engineering, Cleveland OH.

Triple negative breast cancer (TNBC) is a highly metastatic and invasive subtype of breast cancer characterized by the lack of progesterone, estrogen, and HER2 receptors. This leads to the use of cytotoxic chemotherapies as a standard treatment, which prove effective at first, but relapse and distant drug-resistant metastases often occur. Currently, multiple siRNA/miRNA-based gene therapies are in clinical trials to treat TNBC, but are met with limited success due to off-targeted effects and immune reactions. This indicates an urgent need for the development of effective targeted gene delivery systems to deliver therapeutic gene therapies for the treatment of drug-resistant TNBC with minimal off-target effect. To address these challenges, an amino lipid gene carrier known as ECO has been previously developed and shown to have promising results in silencing oncogenes. The tumor suppressor miR-200c has been shown to be downregulated in paciltaxel-resistant TNBC. To address this, we utilize ECO to upregulate miR-200c within TNBC cells. Upon delivery, successful upregulation and silencing of downstream oncogenic targets of miR-200c have been shown through qRT-PCR and western blot. TNBC were treated with miR-200c nanoparticles and used within Transwell® and on-top spheroid assays, which showed that upregulation of miR-200c hindered invasiveness and spheroid formation. Additionally, CCK-8 assay was utilized to show that proliferation of paciltaxel-resistant TNBC was impaired upon upregulation of miR-200c. This evidence shows that miR-200c can be utilized to hinder paclitaxel-resistant TNBC aggressiveness.

Poster Board No. 10 - DESCRIPTIVE EPIDEMIOLOGY ON VESTIBULAR SCHWANNOMAS FROM 2004 to 2016. Kaitlyn Greppin, kgreppin22@hb.edu, Kailey Takaoka, ktakaoka22@hb.edu, 22401 Shaker Blvd, Shaker Heights OH 44122 (Hathaway Brown School).

Vestibular schwannomas, also known as acoustic neuromas, result from an overproduction of Schwann cells on the eighth cranial nerve. This benign brain tumor affects hearing and balance. To perform this statistical analysis, data on 52,926 patients were acquired from the Central Brain Tumor Registry of the United States (CBTRUS) from 2004 to 2016. Neurofibromatosis (9540/1), neurilemoma (9560/0), and neuroma (9570/0) in the acoustic nerve (C72.4) defined vestibular schwannomas. Frequencies and age-adjusted incidence rates (AAIR) were calculated using SEER*Stat. Of the patients, 48.1% were male (n=24,938; AAIR: 1.197, 95% CI 1.182 to 1.212) and 51.9% were female (n=27,988; AAIR: 1.229, 95% CI 1.215 to 1.244). The highest incidence appeared in white individuals (87.7%; n=46,412; AAIR: 1.301, 95% CI 1.289 to 1.313) and lowest in black individuals (12.3%; n=2,516; AAIR: 0.503, 95% CI 0.483 to 0.524). Vestibular schwannomas were most common in patients 65 to 74 years old (27.1%; n=14,361; AAIR: 3.405, 95% CI 3.339 to 3.472) and least common in patients 0 to 19 years old (1.4%; n=767; AAIR: 0.07, 95% CI 0.065 to 0.075). Out of the total population, 44.8% were microscopically confirmed, 38.3% received surgery, and 23.8% received radiation. Vestibular schwannomas are slow growing and not detected easily; therefore, determining at risk populations is crucial to diagnosis and improving patient care.

Poster Board No. 11 - ALGORITHM DEVELOPMENT TO DETECT COMPENSATORY STRATEGIES DURING WALKING. Kathleen Y. Guo, kguo22@hb.edu, 3165 Oakwood Trail, Broadview Heights OH 44147 (Hathaway Brown School). Mark Nandor[2,3], Ronald J. Triolo[2,3], Nathaniel Makowski[2,3,4], nmakowski@fescenter.org, [2]Louis Stokes Cleveland Veteran Affairs Medical Center, [3]Case Western Reserve University, [4]MetroHealth Medical Center.

Stroke survivors often use compensatory strategies, such as circumduction instead of flexing their knee, to facilitate toe clearance during swing. These walking patterns are less efficient and increase strain on joints. Many individuals with mild impairment can flex their knee when focused on the task, but have difficulty otherwise. A device was developed to measure thigh orientation and vibrate the back of the thigh when the thigh abducts beyond a threshold angle, cueing knee flexion and reducing compensatory strategies. This study evaluated whether the device correctly distinguished between walking with and without a compensatory strategy. An algorithm was developed to detect abduction and dynamically adjust the threshold for providing feedback on a step by step basis. To test device detection capability, a single individual without paralysis walked down a hallway, turned around, and walked back. Walking was completed with and without the participant simulating circumduction compensation. Data were collected with at least 50 steps in each condition. The number of correct and incorrect detections were measured during each trial. Circumduction was correctly detected in 89% of the steps while walking with compensatory strategies. Six percent of the steps walking without compensatory strategies resulted in false positives. Inaccurate detections primarily occurred during turns. Accuracy of the device and algorithm were high enough that they may accurately provide feedback for individuals with paralysis to correct walking impairments, which will be tested in the future. Future modifications will incorporate turn detection to improve the device's accuracy.

Poster Board No. 12 - IN SILICO PREDICTION OF MHC CLASS II EPITOPE OF ANTIGENIC 14-3-3 ζ. Shrey Gupta, shreyguptau@gmail.com, 5661 Mallard Pointe Ln, Sylvania OH 43560 (Sylvania Northview High School). Jenna McGowan, Jenna.Mcgowan@utoledo.edu, Ritu Chakravarti, Ritu.Chakravarti@UToledo.edu, Department of Physiology and Pharmacology, University of Toledo, Toledo OH.

14-3-3 ζ is a highly conserved eukaryotic protein that is well known for its role in cellular signaling and division. Recently this protein has been shown as an autoantigen in the human large vessel vasculitis. This novel function of 14-3-3 ζ activates T-cells and is responsible for cytokine production. The antigenic epitope of 14-3-3 ζ is not known. Using bioinformatic web portal, 7 predicted epitopes were identified. To find out the most dominant epitope, we developed a strategy to use the peptide simulation using PEP-FOLD and docking predictions of the individual 14-3-3 ζ peptide to the human major histocompatibility complex (MHC) HLA-DRB1*0401 (PDB# 5NI9) using ZDOCK. Further editing using PDB Editor was used to screen ZDOCK output to make it compatible with the Prodigy-based calculations. The predictions were refined using FlexPepDock and resulted in 10 accurate forecasts of the docking. The results were fed to Prodigy to calculate the binding affinity between the peptide and the MHC. The results showed one of the peptides with a value of −9.5 kcal/mol for the ΔG and 1.2E^−7 M for the Kd value as the energetically viable epitope to interact with HLA-DRB1*0401, which will

be validated using an experimental setup. Overall, this study has optimized a strategy to identify viable antigenic epitopes that are specific to individual HLA alleles. This technique has a wide range of applicability in the field of immunology and beyond.

Poster Board No. 13 - ULTRA-THIN, VERY HIGH NANOFILLER CONTENT NANOCOMPOSITE WITH A FLEXIBLE MATRIX AS AN EFFECTIVE FLAME RETARDANT. Isabel Hsieh, ihsieh21@hb.edu, 629 Charles Place, Highland Heights OH 44143 (Hathaway Brown School). Irlaine Machado, ixm121@case.edu, Hatsuo Ishida, hxi3@case.edu, Case Western Reserve University, Cleveland OH.

In order to address the need for flame-retardant materials, a high nanofiller content nanocomposite was developed using a flexible benzoxazine matrix for use as a flame-retardant coating. To synthesize the benzoxazine, the compounds catechol, aminopropyl-terminated polydimethylsiloxane (PDMS), and paraformaldehyde were selected to increase polymer flexibility, so as to not affect the physical properties of the polyurethane foam (PUF), as well as adhesion between the polymer matrix and the nanofiller. ^{1}H NMR was used to characterize the structure of the monomers. In previously published literature, nanofiller content in nanocomposites rarely exceeds 15 wt% due to poor matrix/nanofiller interfacial interactions. However, the research described utilized high nanofiller content made possible by the strategically chosen monomer reactants, with the goal of increasing thermal stability. The nanofiller laponite was dispersed in water and combined with the benzoxazine monomers with laponite content of 60 wt%, 70 wt%, 80 wt%, 90 wt%, and 95 wt%. The fire behavior of both the polymer and the resulting nanocomposites was tested using microscale combustion calorimeter (MCC), and the peak heat release rates were found to be 58.5 W/g and 21.9 W/g, respectively, which is evidence of good flame-retardant properties. PUF was then coated in the nanocomposites using a single-dip coating method. Through both modulus and compression testing, it was seen that the coated PUF did not exhibit a notable decrease in tensile strength nor a prominent change in compression behavior as compared to the uncoated PUF. In conclusion, the developed nanocomposite does not affect PUF flexibility and shows promise as a potential flame-retardant nanomaterial.

Poster Board No. 14 - IDENTIFICATION OF *ESCHERICHIA COLI* O157:H7 OUTER MEMBRANE PROTEINS WHICH MEDIATE ADHERENCE TO BOVINE ENDOTHELIAL CELLS. Vishnu Iyer, csvenk1@hotmail.com, 11722 Bennettwood pl, Zionsville IN 46077 (University High School).

Escherichia coli O157:H7 is a human pathogenic bacterium known to cause foodborne outbreaks of bloody diarrhea and hemolytic uremic syndrome. Cattle are the primary reservoirs of *E. coli*, which are shed in the feces and transmitted to humans through contaminated milk products and uncooked meat. The purpose of the study was to identify bacterial outer membrane proteins (OMPs) involved in the colonization of bovine endothelial cells. It was hypothesized that similar *E. coli* O157:H7 OMPs would be involved in adhesion to both human and bovine endothelial cells. An optimized "pull-down" technique was developed to identify *E. coli* OMPs involved in adherence to endothelial cells. Biotin-labeled bovine endothelial cell surface proteins (CSPs) were selectively anchored onto a streptavidin bead matrix incubated with *E. coli* OMPs. After washing the beads, bound OMPs were eluted and analyzed by peptide sequencing. A total of 90 proteins were identified including significant hits of OmpA, OmpX, Omp slp, and flagellin, in addition to several chaperone proteins. This is the first study to demonstrate the role of these OMPs for attachment of *E. coli* to bovine endothelial cells. Identification of bovine specific bacterial OMPs involved in colonization of endothelial cells can lead to development of effective therapeutic strategies to prevent spread of infection.

Poster Board No. 15 - AFFINITY BETWEEN SORAFENIB, DOXORUBICIN, AND CYCLODEXTRIN. Zuha Jaffar, zuhajaffar@gmail.com, 3380 Concord Circle, Avon OH 44011 (Hathaway Brown School).

Cyclodextrin (CD) is a family of compounds consisting of several glucose subunits and has an affinity for small molecule drugs. In the pharmaceutical industry, CD has mainly been used as a complexing agent to increase aqueous solubility of poorly soluble drugs and to increase their stability. Multiple drugs are used during cancer treatment, hence the term "broad-spectrum chemotherapy": prescribed because it targets different types of cancer cells. Tumors can develop a tolerance for a single drug if it is used for a long period of time. Combinations of cancer drugs have a synergistic effect. Sorafenib and doxorubicin are both therapeutic drugs used to treat hepatocellular carcinoma. The effectiveness of sorafenib was tested first, through several leaching studies in which disks made of beta cyclodextrin (bCD) and dextran were loaded with sorafenib and inserted in DMSO. Over a period of time, the amount of drug that leached out was measured in order to determine how much sorafenib can be loaded into a disk. Results showed an average of 5.9 µg of sorafenib leached from the bCD disks and 3.7 µg of sorafenib leached from the dextran disks. A similar experiment is being performed in PBS and PBS tween™ to mimic human body conditions as well as cell studies inserting N1S1 hepatocellular carcinoma cells into sorafenib solutions. Preliminary testing drew no conclusions. Future studies involve determining the effectiveness of using both sorafenib and doxorubicin as well as finding the most effective ratio of doxorubicin and sorafenib to use.

Poster Board No. 16 - ANALYSIS OF VITAMIN A METABOLISM IN STRA6 KNOCKOUT MICE MODELS. Jonathan Jang, jjang21@us.edu, 3255 Legends Way, Pepper Pike OH 44124 (University School).

Vitamin A is critical for ocular development and maintenance. Cellular uptake of vitamin A is mediated by the stimulated by retinoic acid 6 (STRA6) receptor. Mutations in this gene encoding a key component of vitamin A metabolism are associated with inherited blindness. The goal of this experiment was to quantify the molecular and histologic consequences of STRA6 deficiency in the eye. Three wild type mice and 3 STRA6 knockout mice were used for this experiment. These mice were raised for 3 months before their eyes were harvested. Before harvesting their eyes, the dimensions of the outer nuclear layer (ONL), a layer of the retina that houses photoreceptors, were compared using optical coherence tomography (OCT). Additionally, the presence of persisting vessels—optically dense vascularized structure within the vitreous of the eye associated with vision impairment —was sought using scanning laser ophthalmoscopy (SLO). Western blot technique was applied to confirm the lack of STRA6 protein in the STRA6 knockout mice. Finally, the ocular retinoid contents were measured using high-performance liquid chromatography (HPLC). STRA6 knockout mice lacked STRA6 protein expression and displayed reduced ocular retinoid content in the eye when compared to wild type controls. OCT analysis revealed smaller ONL in STRA6 knockout mice, and SLO analysis detected persisting vessels in the vitreous of their eyes. This study reaffirms the importance of STRA6 in ocular development and maintenance. Furthermore, this study demonstrates that mutations in the *STRA6* gene result in molecular and histologic features of vitamin A deficiency in the eye.

Poster Board No. 17 - DRUG DISCOVERY FOR OSTEOPOROSIS AND ENDOPLASMIC RETICULUM (ER) STRESS IN ALZHEIMER'S DISEASE (AD) MICE. **Caroline Jung, cjung21@hb.edu, 650 Norbury Dr, Hudson OH 44236 (Hathaway Brown School). Jinxiu Pan, jxp757@case.edu, Wen-Chen Xiong, wxx119@case.edu, Case Western Reserve University, Department of Neuroscience, Cleveland OH.**

Alzheimer's disease (AD) is the most common form of dementia and is caused by the destruction of neuronal connections, worsening over time. Preliminary data has shown a possible correlation between AD and osteoporosis, a bone disease reducing bone density. Cell senescence and endoplasmic reticulum (ER) stress, both stress responses, are currently being studied for a correlation with AD. ER stress results from the aggregation of misfolded proteins. Osteoporosis is associated with a decrease in osteoblasts, potentially due to senescence of bone marrow stromal cells (BMSCs). BMSCs from wild type control mice were cultured and pretreated with 1 of 3 drugs (1 mM metformin, 5 nM rapamycin, and 10 µM 4-PbA). Metformin and rapamycin treated cells were tested for presence of senescence with a western blot that probed Grp78 as an ER stress marker. 4-PbA treated cells were tested using $p16^{INK4a}$ as a senescent cell marker. Results showed that rapamycin reduced the number of senescent cells and 4-PbA reduced the number of cells exhibiting ER stress, but metformin and the control had darker bands. In a second experiment, BMSCs treated with the same drugs were pretreated and differentiated into osteoblasts. There was a trend toward an increase in the number of osteoblasts in cells pretreated with metformin (20.36%), rapamycin (23.31%), and 4-PbA (24.02%) than the control (8.92%). In the research for drug discovery for osteoporosis and ER stress in mice, results have shown a positive yield towards metformin, rapamycin, and 4-PbA.

Poster Board No. 18 - ANATOMICAL CORRELATION BETWEEN MITRAL AND TRICUSPID VALVE ANNULUS. **Sohum Kapadia, skapadia21@us.edu, 210 East Orange Hill Circle, Orange OH 44022 (University School).**

Patient prosthesis mismatch, which occurs about 45% of the time in heart valve surgeries, is a major problem. To replace the annulus, a circular sphincter around the valve, doctors currently estimate the replacement ring size based on overall dimensions of the heart. Previous research—using sheep hearts as a model—showed that the mitral annulus (MA) and tricuspid annulus (TA) in sheep hearts have a significant correlation ($r=0.87$; $p=0.007$). The primary objective of this project was to determine whether there was a similar correlation in humans between the MA and TA. Any correlation found would allow doctors to use measurements of the undamaged annulus to provide a better estimate of the appropriate replacement ring size for the damaged annulus. Measurements of the MA and TA were taken from CT scans of subjects ($n=100$) with no underlying heart condition around either annulus. The annular measurements used were the surface area, height, length, width, and circumference. Data collection and statistical analyses were completed using Excel® and JMP® software. Findings showed a significant correlation between MA and TA length ($r=0.84$; $p=0.01$). These findings will reduce patient prosthesis mismatch and increase the success rate for surgeries, patient comfort, and patient satisfaction. From an economic standpoint, department costs will decrease as fewer rings will have to be opened and rejected due to a lack of proper fit. Future steps involve creating a computer model comparing the MA and TA.

Poster Board No. 19 - DEVELOPMENT OF AN ANTI-C6 MONOCLONAL ANTIBODY TO INHIBIT COMPLEMENT-MEDIATED HEMOLYSIS. **Kimberly Lin, klin21@hb.edu, 251 Lake Meade Drive, Chagrin Falls OH 44022 (Hathaway Brown School). Lingjun Zhang[3], Maojing Yang[3], Michael Kong[3,4], Earl Poptic[5], Melanie Hoffner[5], Connie Tam[2], Feng Lin[2,3], [2]Cleveland Clinic, Cole Eye Institute, Cleveland OH, [3]Cleveland Clinic, Lerner Research Institute, Department of Immunity and Inflammation, Cleveland OH, [4]Solon High School, Solon OH, [5]Cleveland Clinic, Lerner Research Institute, Hybridoma Core Facility, Cleveland OH.**

Complement, a key part of the innate immune system, is activated during infections to assemble membrane attack complexes (MACs, C5b-9) in order to eliminate the invading pathogens. However, excessive MAC formation is harmful to self-tissues, leading to many pathological conditions such as hemolysis, anemia, and hemoglobinuria. Since C5 is the first essential component of the MAC, blocking it should prevent complement-mediated hemolysis. An anti-C5 monoclonal antibody (mAb), termed eculizumab, has been developed to treat MAC-induced hemolysis with great success. C5 is not an ideal target, however, because blocking C5 also prevents the release of C5a, a potent anaphylatoxin that can be beneficial to the patients. In addition, eculizumab is not always effective due to residual C5 activities and C5 gene polymorphisms in certain patients. Therefore, C6, the next essential component of MAC, would be a good alternative target for selectively inhibiting MAC formation. This report describes the development of a potent anti-human C6 mAb (clone 1C9) that inhibits complement-mediated hemolysis. By combining multiple assays, including complement-mediated hemolytic assays and ELISA, it was found that this mAb recognizes both free C6 in the blood and C6 within the C5b6 complex—thereby concurrently preventing the binding of C6 to the activated C5b and inhibiting the binding of C7 to the already formed C5b6 complex. Consequently, this anti-C6 mAb potently prevents MAC formation and inhibits complement-mediated hemolysis. This new anti-C6 mAb holds promise as a new therapeutic reagent that selectively targets MAC for complement-mediated pathological conditions.

Poster Board No. 20 - THE KETONE BODY β-HYDROXYBUTYRATE ATTENUATES DEPRESSION IN A RAT GENETIC MODEL OF HYPERTENSION. **Evangelina Louis, evangelinalouis0402@gmail.com, 9564 Arbor Mist Ct, Sylvania OH 43560 (Sylvania Northview High School). Anay Hindupur, Naveena Luke, Muhtasham Ahmad Sifaat, Saroj Chakraborty, Juthika Mandal, Blair Mell, Bina Joe, Program in Physiological Genomics, Microbiome Consortium and Center for Hypertension and Precision Medicine, Department of Physiology and Pharmacology, University of Toledo College of Medicine and Life Sciences, Toledo OH.**

Depression is often observed as a comorbid condition in patients with uncontrolled hypertension. In prior research using the Dahl salt-sensitive (S) rat (a genetic model of hypertension), a hepatogenic ketone body, ß-hydroxybutyrate (BOHB), was demonstrated to lower hypertension. BOHB is reported to have broadly neuroprotective effects in neurodegenerative disease models, but its mechanism of action has not been established. BOHB is also reported as an inhibitor of specific histone deacetylases (HDACs), which are a family of proteins that epigenetically suppress gene expression by deacetylating lysine residues on histones. This study hypothesized that in addition to the observed lowering effect of BOHB on hypertension, BOHB lowers depression via its inhibitory action on HDACs. To test this hypothesis, high-salt-fed S rats—with and without exogenous administration of 1,3-butanediol (a precursor of BOHB)—were tested for depression via the forced swim test. Rats given 1,3-butanediol ($n=5$; immobile: 26±7, climbing: 63±6) were less depressed as observed by (1) their increased time (minutes) spent in the climbing phase and (2) their significantly less time in the immobile phase of the test, this in comparison to the rats

without 1,3-butanediol ($n=5$; immobile: 57±5, $p<0.001$, climbing: 28±7, $p<0.001$). Further, using qRT-PCR (quantitative real-time PCR), brain samples from these rats were examined for expression of 15 genes, including BDNF (brain-derived neurotrophic factor), which are known targets of HDACs. None of these 15 genes were differentially expressed between the 2 groups ($p>0.05$). These results provide evidence to suggest an HDAC-independent mechanism underlying the beneficial effect of BOHB on depression.

Poster Board No. 21 - ELUCIDATING THE MECHANISM OF PP2A DYSREGULATION BY THE MOST RECCURENT CANCER-DERIVED PP2A-A MUTANT, R183W. Julia Madureira, jmadureira21@hb.edu, 2814 E Overlook Rd, Cleveland Heights OH 44118 (Hathaway Brown School). Daniel Leonard, dleonard03@mac.com, Dr. Derek Taylor, djt@case.edu, Case Western Reserve University, Department of Pharmacology, Cleveland OH.

Protein phosphatase 2A (PP2A) is a family of tumor-suppressing phosphatases which regulate many cellular signaling pathways. The biogenesis of an active PP2A heterotrimer is a highly regulated process involving multiple PP2A modulators, including leucine-carboxyl methyl transferase 1 (LCMT1) and PP2A methyl-esterase 1 (PME-1), that function to regulate the assembly of the "A" scaffolding subunit, "C" catalytic subunit, and substrate-specific "B" regulatory subunit. The critical role of PP2A in suppressing tumor growth is apparent by the numerous mechanisms employed in cancer to disrupt PP2A function, such as the most common somatic mutation of the PP2A α subunit of an arginine at position 183 to a tryptophan (R183W). Through its interference in the recruitment of tumor-suppressing B subunits and decrease of PP2A's overall catalytic activity, the R183W mutation reduces PP2A's tumor suppressing capabilities. It was hypothesized that the R183W mutation is incapable of undergoing the requisite biogenesis steps to result in an active heterotrimer. An array of cellular, biochemical, and structural studies were used to investigate the various steps of PP2A biogenesis in this mutant state. The R183W mutant demonstrated a decreased binding to LCMT1 (an essential regulator of B subunit binding), a 50% decrease in methylation compared to wild type Aa, and a consequent enhanced binding to the PP2A chaperone and inhibitor PME-1 in cellular systems. These data characterize the molecular details involved in physiologic PP2A activation and subsequent dysregulation in cancer while providing a framework for the development of cancer-specific therapeutics.

Poster Board No. 22 - A STUDY OF DUCKWEED AS A POTENTIAL RUNOFF MITIGATION TOOL FOR URBAN RETENTION PONDS. Brynn McGrail, brynnmcgrail@gmail.com, Caylee Combs, cbcombs03@outlook.com, 113 Gibraltar Ct, Delaware Ohio 43015 (Rutherford B. Hayes High School).

The purpose of this study was to learn if duckweed (*Lemna minor*), added to retention ponds, would decrease excess nitrate levels and create a healthier environment by absorbing excess nutrients. Because fertilizer runoff concentrations can vary greatly, it was decided to study how well *L. minor* would absorb differing concentrations of nitrates. It was hypothesized that *L. minor* would absorb nitrates up to 3 times the level that is considered healthy for ponds. *L. minor* was obtained from a local pond and identical numbers of the plants were placed in controlled water environments. Increasing levels of slow/fast release nitrate fertilizer were added. With each increase, a colorimeter was used to measure nitrate concentrations at the start and after 3 days. At 10 and 20 mg N/1L H_2O, nitrate levels had decreased by the 3-day mark. Once concentrations of 30 mg N/1L H_2O was reached, average nitrate levels started increasing. At 60 mg N/1L H_2O, nitrate levels increased dramatically (250%) and *L. minor* growth was observed to decrease. Nitrate levels from the control were also observed to increase minimally; this raised the possibility that the fertilizer continued to dissolve after the initial test, releasing additional nitrates. Data indicates that the hypothesis was partially supported: the percent change decreased before the 30 mg N/1L H_2O was reached, while measures of standard deviation suggest the possibility that other variables affected the results. Future studies might focus on removing *L. minor* from ponds before saturation levels of the plants are reached, stabilizing the nutrient cycle of the pond.

Poster Board No. 23 - UPPER STRATOSPHERIC WEATHER BALLOON TEMPERATURE MODEL. Henry Michaelson, hmichaelson20@us.edu, 28925 N Park Blvd, Solon OH 44139 (University School).

A temperature model of the stratosphere would aid weather balloon projects by predicting the conditions the balloon and its payload will encounter. An initial attempt to model the atmosphere was created from "US Standard Atmosphere" temperature data compiled through verified NOAA launches. Using this data, Newton's law of cooling was implemented over short time intervals to create a basic model. This initial model was tested by conducting a weather balloon launch carrying a mercury wall thermometer having an error margin of ±3°C. The weather balloon was launched from Hunting Valley, Ohio: the flight lasted approximately 2 hours and 20 minutes before landing in Ridgway, Pennsylvania. The adjusted temperature model—based off the data collected from this experiment's weather balloon launch—along with the "US Standard Atmosphere" data created a rough approximation of temperature in the stratosphere. The adjusted model created a sixth-degree polynomial regression analysis, and more fully incorporated the factors and calculations prior to launch, and the recorded data from the experiment, to better predict stratospheric temperature. This model, when proven to be accurate enough to be within the thermometer's margin of error, will allow future weather balloon launches to be conducted with a more precise idea of the upper stratospheric conditions. If this model is perfected to be able to predict the upper stratospheric temperature solely from ground data, it would eliminate the need for thousands of NOAA launches per year to carry a thermometer altogether—saving taxpayer dollars.

Poster Board No. 24 - DEVELOPING EDTA-POLYMERIZED CYCLODEXTRIN AS A DRUG-DELIVERING POLYMER FOR USE IN A CORONARY DRUG-ELUTING STENT COATING. Nathan Mu, nmu22@us.edu, 37390 Tidewater Drive, Solon OH 44139 (University School). Kathleen Young[1], kxy205@case.edu, Grace Burkhart[2], grace.burkhart@valpo.edu, Horst A. von Recum[1], hav1@case.edu, [1]Case Western Reserve University, Department of Biomedical Engineering, Cleveland OH, [2]Valparaiso University, Valparaiso IN.

Drug-eluting stents (DES) release anti-proliferative drugs to prevent in-stent restenosis. Current DES, however, do not have sufficient periods of drug release to treat long-term restenosis. Cyclodextrin polymers (pCD) can slow drug release due to unique affinity for small hydrophobic drugs. Ethylenediaminetetraacetic acid (EDTA)-crosslinked pCD, which can chelate to metal stent surfaces, were tested as drug delivery polymers for DES coatings. This study looks at the attachment of these polymers to stent surfaces and compares the drug release patterns of various EDTA-crosslinked pCD particles to verify affinity-based release. It was expected that pCD particles with higher degrees of crosslinking would slow release the most due to tighter concentration of cyclodextrins. Chelation tests with $CoCl_2$, FTIR, SEM, and EDS were used to characterize particles and coatings. Drug release studies were carried out using

drug-loaded particles, and UV-Vis spectroscopy was used to quantify released drug. Sirolimus was used as a model drug. Color change and FTIR data confirmed chelating activity of EDTA-pCD. SEM indicated a texture difference between coated vs. uncoated stents, and EDS showed an increase of 4% in carbon composition—which comes from the coating. Cumulative drug release within 24 hours from highly-crosslinked EDTA-pCD was 82.4% lower than that of control non-affinity EDTA-dextran particles, a reduction attributed to affinity. Compared to highly-crosslinked EDTA-pCD, however, less-crosslinked EDTA-pCD and control EDTA-dextran exhibited longer drug release. These preliminary results indicate that EDTA-pCD particles can chelate to metal stent surfaces, and that less-crosslinked EDTA-pCD particles and EDTA-dextran particles have promising levels of extended drug release.

Poster Board No. 25 - APPLYING ARTIFICIAL INTELLIGENCE APPROACHES TO DUAL-ENERGY CT POST-PROCESSING FOR VISUALIZATION OF INTRASPINAL CONTENTS. Devi Dheekshita Nelakurti, devi.nelakurti@gmail.com, 5252 Sandy Drive, Lewis Center OH 43035 (Metro Early College High School). Luciano M. Prevedello, MD, MPH, Sema Candemir, PhD, Daniel J. Boulter, MD, Xuan V. Nguyen, MD, PhD, The Ohio State University, Department of Radiology, Columbus OH.

Spinal cord and cerebrospinal fluid (CSF) have similar attenuation on CT, which makes it difficult to differentiate. MRI offers superior tissue contrast but may be contraindicated or unable to be performed expediently due to patient factors or scanner availability. Myelography is invasive and time-consuming. In this pilot study, machine learning predictive models were developed and evaluated for potential use in dual-energy CT (DECT) post-processing to detect emergent abnormalities such as spinal cord compression. DECT lumbar spine scans of 6 patients from a convenience sample were exported as images with IRB approval. Three-dimensional regions of bone, fat, CSF, spinal cord were used to generate the voxel dataset for training and testing. Three different predictive modeling approaches were used, each with varying degrees of automation, to improve visualization by encoding CSF as high-intensity pixels and spinal cord and other tissues as low-intensity pixels. Compared to the dual threshold technique, the simple neural network model improves classification accuracy from 77% to 91% for differentiating between the 4 tissue types. Deep machine learning showed very high accuracy (>99%), which may be due to the detection of certain patterns when examining 3D data that was not captured by numerical averages in the other 2 methods. Artifact, noise, and other scan or patient characteristics could potentially limit the generalizability of these models beyond the training and testing voxel dataset. Nevertheless, machine learning techniques can assist in differentiating among specific tissue types in DECT spine scans based on CT intensity values for each voxel and its surrounding voxel neighborhood.

Poster Board No. 26 - HEARING PROTEIN 1, 2, AND 3 PHENOTYPE CHARACTERIZATION IN ZEBRAFISH. John Pape, jpape21@us.edu, 22200 McCauley Rd, Shaker Heights OH 44122 (University School).

Hearing research has traditionally been done using mice. Zebrafish can also serve as model organisms for looking at this system. The ear of the Zebrafish can be easily screened due to Zebrafish transparency for weeks after hatching. The inner ear and hair cell structure are similar in Zebrafish, mice, and humans—suggesting that eliminating certain hearing proteins in Zebrafish, through selective breeding, have similar effects on the human inner ear and hair cells. Hearing protein (HP) 1, 2, and 3 have been characterized in mice, but not Zebrafish. Finding similarities between models for this aspect of hearing is important. Acoustic startle response phenotype assays were used to determine gene importance. Results were compared to previous mice phenotype characterization. The purpose of the acoustic startle response test was to infer if the Zebrafish bred to have HP 1, 2, and 3 knocked out have auditory function. The assays revealed that HP1 (95% response) is less important or not important on its own, relative to mice. The combination of HP2 (22% response) and HP3 (0% response), as well as all 3 together, have an impact on the phenotype compared to the control fish (98% response). Results suggest that HP2 and HP3 noticeably reduced the response percentage. Phenotype assays suggest HP2 is possibly responsible for the hearing loss or damage, and HP3 for complete or severe hearing loss. This research suggests that there are distinctive differences in the relative importance of these proteins for hearing in mammals and fish.

Poster Board No. 27 - ANALYZING THE EFFECT OF [FE/H] VALUES ON THE ABSOLUTE MAGNITUDE IN NON-BLAZHKO RRAB LYRAE LIGHT CURVES. Michelle Park, michellepark314@gmail.com, 31500 Cheswick Pl, Solon OH 44139 (Solon High School).

By analyzing 135 images of 15 non-Blazhko RRab Lyrae variable stars, throughout 9 periods of the day, this study tested the relationship between the metallicity of a star and the resulting changes in the light curves of non-Blazhko RRab Lyraes. Observations were made via remote access using the Canary 2 telescope offered at the Slooh Canary Islands Observatory. The goal of the experiment was to evaluate the correlation between metallicity, which is a variable in the composition of a star, and the oscillating light the star transmits. The programs AstroImageJ and VStar examined the digital images, with help from SIMBAD, to find locator stars and to create light curves. The results showed that a higher metallicity ([Fe/H] value) led to a decrease in the amplitude of the phase plots defined by a negative exponential trend. The decline of the amplitudes of the phase plots represented a reduction in fluctuation between the maximum and minimum absolute magnitudes of the light curves of these stars. The diminished degree of change within the light curves reflects the lower energy of a RR Lyrae with greater metallicity. The correlation in these observations finds the energy production of a RR Lyrae by knowing its composition—allowing it to be more effectively used as a standard candle to measure distances to any astronomical object, and to facilitate future space exploration.

Poster Board No. 28 - THE EFFECT OF TURMERIC ON *E. COLI* GROWTH IN A BACTERICIDAL AND BACTERIOSTATIC MECHANISM. Himani Pattisam, 21pattisam_himani@dublinstudents.net, 5401 Crossing Ln, Dublin OH 43016 (Dublin Coffman High School).

Antibiotic resistance causes over 2 million deaths annually. The goal of this research was to determine whether turmeric, a natural antibiotic, was effective to "cure" and "prevent" *Escherichia coli* growth. This work has application to the antibiotic-resistance crisis. The bactericidal mechanism simulated curing a person, post-contraction of infection, from contaminated produce. The bacteriostatic mechanism simulated treating the produce before contamination. The question: does turmeric (*Curcuma longa*) reduce the growth of *E. coli* in a bactericidal and bacteriostatic mechanism? All groups had 25 µL of *E. coli* on nutrient agar plates and both mechanisms had 25 µL of 50% turmeric-isopropyl alcohol solution (added using micropipettes). For the bactericidal mechanism, turmeric was added after the *E. coli* was incubated for 24 hours at 37 °C. For the bacteriostatic mechanism, the *E. coli* and turmeric were introduced simultaneously. Controls were *E. coli* for 10 days with only 25% isopropyl alcohol (no

turmeric). The area of *E. coli* growth (cm^2) was measured daily for 10 days. The average end growths of the control, bactericidal, and bacteriostatic mechanisms were 14.75 $cm^2 \pm 3.284$, 6.875 $cm^2 \pm 4.883$, and 7.125 $cm^2 \pm 3.643$ respectively. In a t-test comparing bactericidal and control, $p = 0.00014$ ($n = 16$). When comparing bacteriostatic and control, $p = 0.005$ ($n = 16$). At $\alpha = 0.05$, both null hypotheses (turmeric has no effect on *E. coli* growth) were rejected in favor of the alternatives: turmeric has an inhibitory effect on *E. coli* growth in both a bactericidal and bacteriostatic mechanism.

Poster Board No. 29 - OPTIMIZING HYDROGELS IN COSMETICS: CREATING EFFECTIVE SELF-ASSEMBLED NANOSTRUCTURES. Arvind Prasad, arvindprasad926@gmail.com, 11010 Woodlands Way, Cincinnati OH 45241, Govind Nadathur, 212067@sycamoreschools.org (Sycamore High School).

Free radical damage to skin caused by particulate matter and ultraviolet (UV) radiation takes over 9 million lives per year. Current creams can be remedial barriers; however, particles (microns in diameter) and UV radiation may still contact the skin. An experiment was conducted utilizing a peptide amphiphile that self-assembles into hydrogel-nanostructures. If hydrogels are incorporated in a natural cream, consisting of oils and antioxidants, then the skin will be protected from free radical damage. The peptide sequences K2(SLXL)3K2 (where X represents tryptophan, asparagine, or cysteine) were assembled in an amphiphilic solution and tested for optimum conditions (concentration, temperature, pH). The cream was then tested in novel engineered designs against particulate matter and UV radiation. Coupled with optimized hydrogels, the cream was further tested to determine if the presence of nanostructures yielded an increase in sun protection factor (SPF) and antioxidant levels. Additionally, soybean, coconut, and rosemary oils were incorporated and tested for SPF and antioxidant values. Through 174 trials—and with a 95% confidence interval—the natural emulsion with the assembled peptide K2(SLXL)3K2 at a pH of 8.0, a temperature of 24 °C, and a concentration of 10 mg/mL blocked 3 times the pollution as the control commercial cream. Furthermore, the addition of nanostructures integrated with soybean oil increased SPF levels significantly, and antioxidant levels by 20%. Future directions include testing the cream in vivo and creating an application to inform people of natural solutions against free radical damage.

Poster Board No. 30 - CHARACTERIZATION OF ASTHMA-INDUCED INFLAMMATION USING CARBOHYDRATE BIOMARKERS. Emily Qian, eqian21@hb.edu, 7460 Hillside Ln, Solon Ohio 44139 (Hathaway Brown School). Carlos A. Alvarez, cxa166@case.edu, Brian A. Cobb, brian.cobb@case.edu, Case Western Reserve University School of Medicine, 10900 Euclid Avenue, Cleveland OH 44106.

Asthma is the most common chronic respiratory disease, affecting nearly 10% of the population. Hallmarks of asthma include airway hyperresponsiveness, mucus production, airway inflammation, and tissue remodeling, which collectively contribute to significant difficulty in breathing. The complex carbohydrates, or glycans, inside and on the surface of every cell serve as crucial components in cellular health, impacting cell signaling, recruitment, and motility; however, little is known about carbohydrate changes in asthma-associated airway inflammation. Here, 28 fluorescently-labeled carbohydrate binding proteins, known as lectins, with various specificities were used to examine inflamed and non-inflamed lung tissue by confocal microscopy. The data reveal robust changes in α-1,2-linked fucose, terminal galactose, α2,3-linked sialic acid, galactose-β(1-3)-N-acetylgalactosamine, and terminal N-acetylglucosamine during acute lung inflammation. These differences were heightened in chronic asthma models, revealing further changes not observed in the acute models. Although alternations in fucose availability has been previously reported, significant changes in sialylation, galactosylation, and others are novel. In vitro antigen stimulation of human A549 lung epithelial cells also revealed changes in surface glycosylation, indicating that the epithelial cells themselves respond to antigen stimulation even in the absence of immune cells, that similar changes are likely in human lungs, and that these alterations can influence immune cell recruitment and the inflammatory cascade. These data suggest that glycosylation changes during the inflammatory response could lead to improved therapeutic applications to improve diagnosis and reduce disease burden among those suffering with asthma and other inflammatory diseases.

Poster Board No. 31 - THE ROLE OF SERPINB3 IN GLIOBLASTOMA CANCER STEM CELL PROLIFERATION. Sunay Rastogi, srastogi21@us.edu, 417 Longspur Road, Highland Heights OH 44143 (University School).

Glioblastoma (GBM) is the most common primary human malignant brain tumor; the median overall survival of those affected is 14 to 16 months. Poor prognosis can be attributed to the high recurrence rate of the disease, which is due, in part, to the presence of cancer stem cells (CSCs). This research is focused on studying the interaction between SerpinB3 and junction adhesion molecule A (JAM-A) in GBM CSCs. Previous studies provide evidence that JAM-A has an intrinsic, pro-tumorigenic role in regulating the CSC phenotype. None of these studies, however, focused specifically on JAM-A's intracellular downstream signaling. A pulldown of His-tagged JAM-A was done to identify binding partners and resulted in the identification of the serine protease inhibitor SerpinB3. Endogenous JAMA binding to SerpinB3 was confirmed through immunoprecipitation of SerpinB3. To investigate the CSC-specific role of SerpinB3, SerpinB3 was knocked-down in a human GBM xenograft model (T4121) utilizing 2 non-overlapping short-hairpin RNA constructs. This generated 2 knockdown conditions (each a variation of expressed SerpinB3) and a nontarget control. A CellTiter-Glo® assay was used to measure CSC growth dynamics and a limiting dilution assay was done to determine the stem cell frequency. These in vitro studies demonstrated reduced function of the CSC when SerpinB3 was knocked down. GBM CSCs were orthotopically implanted into NSG mice via an intracranial injection ($n = 30$). Median survival for non-target control mice was 28 days while neither knockdown condition reached median survival at day 50 (log-rank test, $P < 0.001$). This finding suggests that SerpinB3 disrupts the CSC state in GBM.

Poster Board No. 32 - BIOMATERIALS-BASED MODULAR DESIGN OF PLATELET-INSPIRED NANOTECHNOLOGY FOR HEMORRHAGE CONTROL. Kaisal Shah, kshah21@hb.edu, 2939 Glengary Rd, Shaker Heights OH 44120 (Hathaway Brown School). Ujjal Didar Singh Sekhon, uxs39@case.edu, Kelsey Swingle, kls189@case.edu, Aditya Girish, axg664@case.edu, Norman Luc, nfl11@case.edu, Anirban Sen Gupta, axs262@case.edu, Case Western Reserve University, Cleveland OH.

Platelets perform 3 major functions when activated: adhesion and aggregation to form the clot, coagulation amplification by flipping phosphatidylserine (PS) to the outside, and secretion of hemostatic-augmenting granules. Therefore, platelet transfusions are commonly used as the standard of care when a patient is lacking sufficient platelets. However, they present significant problems such as high cost, high infection rate, limited availability, short shelf life, and a need for blood type matching. Nanoscale engineering shows promise for a synthetic version of platelets, named SynthoPlate™, that would perform all 3 functions of platelets to address these problems.

To create the particles, liposomes are modified by surface modification with binding and aggregating peptides, incorporation of PS, plasmin cleavable mask shielding, and loading of the core and delivery of the hemostatic-augmenting agent PolyP. In vitro testing using aggregometry, thrombin and fibrin generation assays, morphology assays, and rotational thromboelastometry demonstrated that the particles are able to co-localize with platelets, enhance secondary hemostatic output, rescue maximum clot firmness, and significantly improve the clotting time and the rate of clot formation when platelet function was lost, improve clot stability, and significantly decrease clot lysis. Compared to platelet-depleted blood, the nanoparticles reduced time to peak thrombin generation from 25 minutes to 18 minutes ($p \leq 0.001$) and increased peak thrombin generation from 115 nM to 240 nM ($p \leq 0.001$). Results demonstrate promise for SynthoPlate to be used as a substitute for platelet transfusions in the future for augmentation of primary and secondary hemostasis to treat platelet-related bleeding complications.

Poster Board No. 33 - DEVELOPMENT OF A MATHEMATICAL MODEL TO PREDICT TECH STOCK TRENDS DURING FINANCIAL CRISES. Elizabeth Sims, esims@laurelschool.org, 17408 Edgewater Dr, Lakewood OH 44107 (Laurel School).

The goal of this project was to create an algebraic mathematical model, accessible to high school students or people with no more math than algebra, that would show a stock's closing price vs. time from June 2008 to June 2009. Due to the fact that they were greatly affected by the 2008 financial crisis, these 5 stocks were specifically chosen: Amazon®, Apple®, Intel®, IBM®, and Microsoft®. The goal was to use the model to predict other technology stock trends during similar financial crises. Starting with a linear model and the closing prices for a year, different degrees of a polynomial were tested (even going beyond 11—the degree used). From these models, it was concluded that these technology stocks do trend with each other. Vernier®, a statistical regression analysis software program readily available to students, was used to determine coefficients of correlation and determination. From these models, it was concluded not only that these technology stock prices move together but also that all are triggered by certain events in the news. The model was then used to search technology stocks with similar motifs under the same economic conditions. Using the models, people with a high school background can foresee a stock's future. Using the model in conjunction with the event, and using the model to understand what happened, shows the relationship between world economic factors and technology stocks.

Poster Board No. 34 - A NOVEL EX VIVO PROCEDURE FOR MONITORING β-HYDROXYBUTYRATE (βOHB) PRODUCTION FROM ISOLATED WHOLE LIVERS. Avinash Singh, avinash.singh9001@yahoo.com, 9001 Cedar Berry Ct, Sylvania OH 43560 (Sylvania Northview High School). Saroj Chakraborty, Blair Mell, Camilla F. Wenceslau, Cameron G. McCarthy, and Bina Joe, Center for Hypertension and Precision Medicine, and Department of Physiology and Pharmacology, University of Toledo, College of Medicine and Life Sciences, Toledo OH.

When glucose is limiting, such as during fasting, the liver synthesizes and secretes ketone bodies into circulation as an alternate fuel source. Previously, it was found that the ketone body beta-hydroxybutyrate (βOHB) is lowered by salt consumption in hypertensive rats. To identify hepatic-specific mechanisms that regulate βOHB in vivo is difficult because extra-hepatic factors impact liver function. The goal of this project was develop an ex vivo procedure to continually monitor hepatic βOHB. D-glucose, but not L-glucose, is a substrate for ATP generation. After examining the differences to simulate non-fasted (D-glucose) and fasted (L-glucose) conditions in vivo, it was hypothesized that livers incubated with L-glucose will generate more βOHB compared to those incubated with D-glucose. Portal veins of 27-week-old Wistar-Kyoto rats (n=3/group) were perfused with either D-glucose or L-glucose in Krebs buffer. Whole livers were excised and incubated with the same buffers as perfusion. Aliquots were collected from 0 to 6 hours for quantitating βOHB. A statistically significant time effect was noted in both buffers, with βOHB continually increasing with time [D-glucose Krebs (mmol/L), 0h: 0.03±0.00 vs. 6h: 0.82±0.02*; L-glucose Krebs (mmol/L), 0h: 0.04±0.00 vs. 6h: 1.16±0.14*, both *$p < 0.05$]. Confirming the sensitivity and validity of our preparation, there was a significant interaction effect: livers incubated for 6 h with L-glucose generated higher levels of βOHB than livers incubated with D-glucose [D-glucose: 0.82±0.02 vs. L-glucose: 1.16±0.14*, *$p < 0.05$]. The novel ex vivo liver preparation simulates fasting and non-fasting conditions in vivo and can be applied to study liver-specific regulation of βOHB independent of extra-hepatic factors.

Poster Board No. 35 - EFFECT OF MICROBIOME ON INTESTINAL STEM CELL ADAPTATION. Ian Swain, iswain21@us.edu, 5080 Boulder Creek Dr, Solon OH 44139 (University School).

Multipotent stem cells in the mammalian intestine are highly proliferative. Because of their potential, it is important to study the changes in adaptation of stem cells in the crypts of the intestine, located at the base of the villi. The intestine is the site of extreme bacterial (microbiome) and ammonia concentrations; therefor, it is useful to understand the mechanisms of intestinal stem cell survival and the adaptations of stems cells in high ammonia states. This is because of the higher risk of cancer associated with proliferation. The goal of this project was to investigate protein/nitrogen metabolism in stem cells, and the physiology of crypts, within mice that had a combination of knockouts of critical genes involved in the urea cycle and Wnt pathway—a determinant of the proliferation of cells. The Berthelot assay was used to measure levels of ammonia in urine and confirm the appropriate presence of the microbiome in mice. Immunohistochemistry was performed to visualize intestinal tissue between control mice and mice under antibiotics (Abx). Olfm4 and BrdU stains were used to mark stem cells and proliferating cells, respectively. In counting crypts, it was found that in both stains the number of positive cells remained the same for both the control and Abx groups. Yet, the average crypt depth of Abx mice was significantly lower than the control ($p < 0.0001$). The increase of depth may suggest that, while the number of proliferating cells and stem cells remained the same, there were other types of cells that were not involved in proliferation.

Poster Board No. 36 - THE CORRELATION BETWEEN HEPATIC VENOUS PRESSURE GRADIENT MEASUREMENTS AND SUCCESS OF THE TRANSJUGULAR LIVER BIOPSY. Isaiah M. Waiters, iwaiters20@us.edu, 1572 Laclede Rd, South Euclid OH 44121 (University School).

Congenital heart disease affects approximately 1% of births per year. The Fontan procedure, used to redirect venous blood from the inferior vena cava and superior vena cava to the pulmonary arteries, is commonly used to fix heart defects at birth. Unfortunately, patients who undergo the Fontan often develop end-stage cirrhosis by their mid-20s. Long-term survival of these patients has improved, but an understanding of liver pathology and why the disease develops the way it does needs further examination. The transjugular liver biopsy (TJLB) has been thought to be the best way of examining or monitoring the progression of cirrhosis in a patient. This procedure can obtain hepatic venous pressure gradient (HVPG) measurements through the hepatic vein. This study examines a potential connection between HVPG

measurements and success (in terms of obtaining liver fragments) of the TJLB at measurements of 14 to 17 mmHg. A chi-square analysis was used. The observed were the number of successful TJLB patients at HVPG measurements between 14 to 17 mmHg. The expected was scaled up to that of a 100-patient data set (in a previous analysis, 100 successful and non-successful TJLB HVPG measurements were obtained). The P value was found to be at 0.01, less than 0.05, which meant that the similarity between general HVPG measurements and HVPG measurements after a successful TJLB cannot be distinguished. Future research will include a larger sample size to help in determining whether HVPG measurements truly play a role in success of the TJLB.

Poster Board No. 37 - NONTHERMAL PLASMA TREATMENT OF POLYMERS REDUCES UNDESIRABLE BIOLOGICAL ATTACHMENTS BUT CAN CAUSE MATERIAL EMBRITTLEMENT. Emily Wilson, emwilson23@hb.edu, 38595 Flanders, Solon OH 44139 (Hathaway Brown School). Greg D. Learn[2], gdl25@case.edu, Horst A. von Recum[2], horst.vonrecum@case.edu, [2]Case Western Reserve University, Department of Biomedical Engineering, Cleveland OH.

The success of surgically-implanted devices is often determined by the nature of biological attachments, made by proteins, cells, or bacteria, to the material. Nonthermal plasma, a partially ionized gas, is often used to chemically modify the surfaces of polymeric implants, so as to enhance biocompatibility and minimize the risk of infection. Although plasma is widely believed to have negligible effects on polymeric materials, no studies have systematically evaluated this with polymeric surgical devices. The goal of this study was to evaluate the time-dependent effects of nonthermal plasma treatment on the surface and bulk mechanical properties of polypropylene (PP) surgical textiles. PP sutures, meshes, and microplates were treated with plasma for selected durations from 0 to 20 minutes. The hypothesis was that plasma treatment would reduce undesired biological attachments, but increasing the duration of exposure would accelerate the mechanical failure of PP surgical devices. Findings suggest that plasma exposure improved resistance to fibrinogen adsorption ($p < 0.001$) and *Escherichia coli* attachment ($p < 0.001$), and promoted mammalian fibroblast attachment ($p < 0.05$). However, there are limits to the benefits of plasma exposure when the mechanical properties of the material must be retained. Longer treatments appeared to be detrimental to the material properties of sutures, as well as the structural characteristics of knitted meshes, with longer exposures resulting in further embrittlement and larger changes in anisotropic qualities. Future studies will be conducted in vivo, in addition to investigating whether the results extend to meshes that exhibit different geometries or polymer compositions.

Poster Board No. 38 - KINETICS OF COLLAGEN SELF-ASSEMBLY FOR SYNTHETIC LIGAMENTS. Angela Yu, ayu21@hb.edu, 29289 Regency Cir, Westlake OH 44145 (Hathaway Brown School). Eloise P. Miller[2], epm43@case.edu, Steven J. Eppell[2], sje@case.edu, [2]Case Western Reserve University, Department of Biomedical Engineering, Cleveland OH.

Collagen molecules self-assemble into fibrils, which make up most ligament tissue in humans. An in-vitro method is being developed to produce physiologically-relevant collagen ligaments attached perpendicularly to a titanium surface, for use in biomimetic orthopedic implants. This ligament synthesis technique uses a unique method of collagen fibrillogenesis to produce parallel, upright-standing, fibrils. To control the process, it is crucial to determine the speed and duration of fibrillogenesis. The present work is focused on measuring the turbidity of a collagen solution because the molecules are self-assembling. A system was designed, built, and tested to use scattering of laser light directed through solutions at varying temperatures and collagen concentrations. A light pipe was used to collect scattered photons and deliver them to a photodetector where they were converted into a voltage. To increase the signal-to-noise, a lock-in amplifier was used. Data were collected with a digitizer integrated with a digital oscilloscope. The collected voltage vs. time curves were analyzed using curve fitting to determine the duration of the lag phase—which is associated with the first step of fibrillogenesis called nucleation. The original conditions used prior to building this setup (37 °C, 200 µg/mL collagen) showed a lag phase of 30 seconds. Reducing the temperature to 27 °C increased the lag phase to 11 minutes. This result changed the standard process for making synthetic fibrils to help in the production of a new product for surgeons to use in treating patients.

Poster Board No. 39 - EVALUATION OF METABOLIC HORMONE THERAPY ON ALZHEIMER'S DISEASE MICE. Ivy Wang, iwang21@hb.edu, 5825 Nicholson Dr, Hudson OH 44236 (Hathaway Brown School). Rachel Corrigan, rcorrig4@kent.edu, Gemma Casadesus, gcasades@kent.edu, Kent State University, Department of Biological Sciences, Kent OH.

Metabolic dysfunctions such as obesity and type II diabetes have been found to be one of the largest risk factors for developing late-onset Alzheimer's disease (AD). Amylin, a hormone co-secreted with insulin, regulates blood glucose levels. Outside of peripheral metabolism regulation, amylin may also have other homeostatic functions in the brain. It has been previously shown that an analog of amylin, pramlintide (PRAM) reduces amyloid-beta plaque burden in the hippocampus and cortex of AD-modeled mice. However, it is largely unknown if the neuroprotective effects of PRAM therapy are due to the activation of CNS receptors (AMYR) or due to metabolic improvement in the periphery. APP/PS1 and WT littermate mice were treated with ±PRAM peripherally and ±AC187 (an AMYR antagonist) centrally. It was hypothesized that mice treated with an AMYR blockade will have a higher alteration of amyloid-beta processing and lower activation of combative oxidative stress mechanisms when compared to controls. Western blotting was performed with hippocampal tissue from these mice to evaluate classical AD markers of pathology. Results thus far show that PRAM treatment might work to increase α-secretase cleavage of amyloid precursor protein to produce higher levels of C-terminal fragment alpha. Additionally observed were increased expression of the amyloid-beta degrading enzyme, neprilysin, compared to saline controls and AC187 treated mice.

Poster Board No. 40 - THIS IS YOUR BRAIN ON MUSIC: AN EXAMINATION OF THE EFFECT OF IONIAN, AEOLIAN, AND LOCRIAN SCALES ON MEMORY RECALL. Toussaint Miller, tmiller21@us.edu, 9601 Shakespeare Parkway, Cleveland OH 44108 (University School).

Research suggests that music found to be pleasing enhances spatial-temporal reasoning, memory recall, and productivity. The objective of this project was to determine which musical scale best aids memory recall in high school (14 to 18 years old; $n = 20$) males. Using sound-washes (arrhythmical musical segments based on tones of 3 musical scales) and a series of memory tasks (word recall and card test), the recall accuracies of each participant—after the presentation of each scale—were compared. To decrease variability, the treatment in which participants started and the card they received were randomly determined prior to the experimentation phase. It was hypothesized that because of its common occurrence in Western music, and overall "happy" tonal quality, the Ionian mode would increase productivity and memory recall ability. On average, participants' scores from the Ionian word-recall test treatment ($x = 0.77$, SE±0.05), were higher than those in the Aeolian word-recall test treatment ($x = 0.73$, SE±0.06). Scores from the Ionian card-test treatment ($x = 0.77$, SE±0.06) were also higher than those in the Aeolian card-test treatment ($x = 0.72$, SE±0.05). In the control word-recall test treatment ($x = 0.69$, SE±0.02), scores were lower

than those from the Locrian word-recall test treatment (x=0.70, SE±0.06). Scores from the control card-test treatment (x=0.88, SE±0.03), were higher than those in the Locrian card test treatment (x=0.82, SE±0.04). The data were further evaluated with a Wilcoxon signed-rank test. Due to time constraints, only 2 scales were compared at a time with limited subject count; therefore, differences were not significant.

Poster Board No. 41 - EFFECT OF DIETARY IRON ON INTESTINAL TUMORIGENESIS. Isaac Jang, isaacjang123asd@gmail.com, 3255 Legends Way, Pepper Pike OH 44124 (Orange High School). Dr. James Swain, Case Western Reserve University, Department of Nutrition, Cleveland OH.

Many studies have linked indiscrete dietary choice with cancer development. Iron is vital for tissue growth and cellular homeostasis, but excess intake may promote tumorigenesis, particularly within the intestinal tract. The goal of this project was to determine the effect of excess dietary iron on intestinal tumorigenesis. Adenomatous polyposis coli (APC) min/+mice, an animal model for human familial adenomatous polyposis (FAP) were used. The mice were divided into 3 different groups based on dietary iron: normal (group 1), moderately high (group 2), and excessively high (group 3). After 10 weeks the mice were sacrificed and intestinal tissues were processed. Using immunohistochemistry (IHC), the processed tissues were analyzed for the quantitative expressions of Ki-67, an intra-cellular marker highly expressed in a tissue containing rapidly proliferating cells such as tumor cells. Morphology of all the groups (n=64) were observed. An increased expression of Ki-67 was observed within the crypts of group 3 compared to group 2 (81.9% vs. 39.9% respectively, $P<0.05$). For crypt to tip, there was an increase in Ki-67 stained cells among group 2 compared to group 1 (19.8% vs. 13.9% respectively, $P<0.05$). Within villi portion, there was no significant difference in the Ki-67 expression among the 3 groups. The findings suggest that even moderately high iron intake could significantly accelerate cellular proliferation within the intestinal tract. This means high iron intake could be associated with an increased risk of tumorigenesis.

Poster Board No. 42 - IMPROVED EFFICACY OF SULFADIMETHOXINE WITH HERBAL SUPPLEMENTS TO INHIBIT THE GROWTH OF *PARAMECIUM AURELIA*. Ryan Ballou, ryan.ballou9@gmail.com, 7800 Verona Rd, Lewisburg OH 45338 (Carroll High School).

Poultry producers have attempted to raise antibiotic-free poultry to meet the ever-growing concerns of consumers. As a result, coccidia has again become prevalent in poultry. Coccidia is treatable with antibiotics, but antibiotic use raises a secondary concern due to continual increase in antibiotic resistance. This experiment tested the improved efficacy of sulfadimethoxine when supplemented with green tea and *Sophora flavescens*, and the effects of these treatments when applied alone. By treating *Paramecium aurelia* with a range of 2.5% to 0.25% concentrations, treatment was most effective at concentrations >1.5% green tea, or 0.25% to 2.5% *Sophora flavescens*. When concentrations of supplements conducive to growth were combined with dosages of sulfadimethoxine that were also conducive to growth, paramecium life was unsustainable. Green tea and sulfadimethoxine contribute to the effectiveness of the other, reducing the needed dosage of sulfadimethoxine when the 2 are used at the same time. All concentrations of *Sophora flavescens* that were tested inhibit the growth of *Paramecium aurelia*, exhibiting antibiotic capabilities by mirroring results found from sulfadimethoxine. By supplementing poultry feed with green tea or *Sophora flavescens*, the required dosage for sulfadimethoxine may be lowered—helping to prevent the development of antibiotic resistance.

Poster Board No. 43 - Unassigned.

College Student and Professional
9:00 – 10:00 AM
and
1:30 – 3:00 PM
SC Room 311 – Ballroom

Note: All posters will be displayed in both morning and afternoon sessions.

Poster Board No. 44 - THROMBOMODULIN EXPRESSION IN MONOCYTES UPON DIFFERENTIATION TO MACROPHAGES. Mallorie Boron, m.l.boron@vikes.csuohio.edu, Xia Liu, Tiffany Hauzer, Xue-Long Sun, x.sun55@csuohio.edu, Cleveland State University, Department of Chemistry, Chemical and Biomedical Engineering, and Center for Gene Regulation in Health and Disease (GRHD), 2121 Euclid Ave, Cleveland OH 44115.

Thrombomodulin (TM) is a transmembrane glycoprotein that is primarily expressed on the surface of endothelial cells. TM serves as a receptor of thrombin for protein C activation, which regulates both coagulation and inflammation via inactivating coagulation proteins Factor Va and Factor VIIIa and preventing pro-inflammatory cytokine release. Recent research has revealed that TM is also expressed in immune cells, including monocytes and macrophages. However, its function in immune cells is still unclear. Profiling of the expression of TM in immune cells is the key initial step for clarifying its function. The goal of this research is to determine TM expression in THP-1 monocytes upon their differentiation to macrophages. The cell surface levels of TM was evaluated by anti-TM antibody combined with confocal microscopy and flow cytometry analysis. It was found that THP-1 macrophages express less TM on their surface immediately after differentiation from monocytes. ELISA and western blot analysis of cell lysates confirmed that THP-1 macrophages expressed less TM than monocytes. TM is a glycoprotein and changes in glycosylation may affect its activity. Endothelial TM is known to contain *N*-glycans and a chondroitin sulfate moiety that serves as a secondary binding site for thrombin to enhance its protein C activation. However, glycosylation of TM in immune cells and its influence on TM activity are unknown. We evaluated chrondroitin sulfate level and sialic acid amounts and linkages on THP-1 monocytes and macrophages by ELISA, mass spectroscopy, and lectin blotting, respectively.

Poster Board No. 45 - INVESTIGATING THE IMPACT OF PLANT AND SEED MORPHOLOGY ON SEED DISPERSAL IN *SOLIDAGO GIGANTEA*. Lizzie Boissoneault, lizzieboissoneault@gmail.com, Emily Rauschert, e.rauschert@csuohio.edu, Cleveland State University, 2121 Euclid Ave, Cleveland OH 44115.

Solidago gigantea, commonly referred to as the giant goldenrod, is native to North America and can inhabit a wide range of environments. This perennial herb is tolerant to a variety of conditions, making it a successful competitor and an invasive species in Europe. In its native range, *S. gigantea* is often found in wet habitats; in its non-native range it is often found in drier areas, forming dense colonial stands. It was hypothesized that morphological characteristics, such as plant height and seed size, will be larger for *S. gigantea* in more productive wet sites and in their non-native ranges. Additionally, dispersal distance is expected to be greater for *S. gigantea* in their non-native range and in dry sites than in their native range and wet sites. To test these hypotheses, large and small inflorescences samples were randomly collected from 10 wet and 10 dry sites in northeast Ohio and Montana, where they are native, and

Hungary, where they are invasive. *S. gigantea* plants collected from dry native sites had a lower plant height (mean) of 112.0 cm compared to 134.5 cm from wetter sites, and this difference was statistically significant ($t=3.25$, $df=39$, $P=0.002$). Preliminary analyses of seed mass indicate that wet and dry sites have different seed masses ($F_{1,372}=12.11$, $P<0.001$) but seed masses are not significantly different in their native and invaded ranges ($F_{1,372}=0.0048$, $P=0.95$). Overall, this study highlights the importance of seed and plant morphology on the dispersal ability of the seeds.

Poster Board No. 46 - UNDERSTANDING BULBIL GERMINATION REQUIREMENTS IN LESSER CELANDINE, *RANUNCULUS FICARIA*. Lauren Egensperger, l.b.egensperger@vikes.csuohio.edu, Emily Rauschert, e.rauschert@csuohio.edu, Cleveland State University, 2121 Euclid Ave, Cleveland OH 44115.

Lesser celandine, *Ranunculus ficaria* , is a spring ephemeral species and herbaceous perennial that inhabits stream banks, river corridors, and floodplains. Originally introduced to the United States as an ornamental plant, it quickly became apparent that *R. ficaria* is capable of overtaking areas rapidly and forming dense monocultures by outcompeting native species for space and resources. One characteristic that likely adds to *R. ficaria*'s success as an invader is the presence of bulbils in the leaf axils, an additional mode of vegetative reproduction. To date, however, the conditions required for bulbils to overcome dormancy and begin germination have not been explored in this species. Therefore, this research aims to determine how cold stratification impacts root emergences in bulbils and seeks to identify optimal germination conditions. In this study, 800 bulbils were exposed to wet warm conditions in a greenhouse for varying lengths of time and then incubated in a refrigerator at 5°C at staggered time intervals. Different combinations of wet storage, which simulates field conditions, and cold storage, which replicates winter conditions, were employed and used to identify circumstances which maximize and minimize germination. The highest germination percentage occurred when bulbils were subjected to 4 weeks in the greenhouse and 10 weeks of cold storage—with 60% displaying root emergence. Additionally, 12.3% of bulbils germinated in the greenhouse without cold stratification. Understanding germination requirements may have implications in management and improving chances of survival for other spring ephemerals and native wildflowers.

Poster Board No. 47 - BIOTIC HOMOGENIZATION: A COMPARISON OF VACANT LOT PLANT COMMUNITIES IN URBAN, SUBURBAN, AND EXURBAN SITES. Megan Herrmann, m.e.herrmann@vikes.csuohio.edu, Caleb Lumsden, c.lumsden57@vikes.csuohio.edu, Emily Rauschert, e.rauschert@csuohio.edu, Cleveland State University, 2121 Euclid Ave, Cleveland OH 44115.

Anthropogenic climate change, land use changes, and global human mediated transport of exotic species is resulting in a few winner species replacing many loser species—a phenomenon known as biotic homogenization. Typically, successful species are widespread generalist species, while species that are lost tend to be endemic specialists. Biotic homogenization contributes to the current biodiversity crisis and reduces complexity and redundancy in ecosystems worldwide, leading to a loss of regional distinctiveness and resilience. Additionally, homogenization of communities can impact ecosystem services provided by these communities and thereby influence ecosystem processes. One potential driver of biotic homogenization is urbanization. Urbanization is associated with increases in disturbance frequency and intensity, habitat fragmentation, and the introduction of non-native species. Plant community abundance and diversity were assessed in vacant lots in northeast Ohio to analyze the effects of urbanization on plant communities. The intensity of urbanization of sites ranged from urban (Cleveland), suburban (Lake County), and exurban (Holden Arboretum). Plant surveys were conducted in the summers of 2016 and 2019, using one-meter quadrats to assess presence and percent cover data of plant species for 35 randomly generated locations within the plot. Taxonomic and functional diversity analyses were performed comparing plant communities both between and within site types. The mean richness was different between sites (ANOVA, $F(2,9)=7.4$, $p=0.013$). Species richness decreased with increasing intensity of urbanization, suggesting a relationship between urbanization and homogenization.

Poster Board No. 48 - PLANT COMMUNITY HOMOGENIZATION ACROSS AN URBANIZATION GRADIENT. Caleb Lumsden, c.lumsden57@vikes.csuohio.edu, Megan Herrmann, m.e.herrmann@vikes.csuohio.edu, Emily Rauschert, e.rauschert@csuohio.edu, Cleveland State University, 2121 Euclid Ave, Cleveland OH 44115.

Biotic homogenization is a global phenomenon in which local specialist species are being replaced by non-native generalist species, reducing regional uniqueness. Urbanization is a major driver of homogenization that not only affects developed areas, but also the proximal natural remnants due to an increase in fragmentation and disturbance. Parklands are often created on previously disturbed areas, and the rate at which they gain native species may be affected by urbanization. Through analysis of data provided and collected by the Cleveland Metroparks®, as part of the Plant Community Assessment Program, it was hypothesized that there would be lower native richness and overall diversity as proximity to the urban core increased. Using data from 2013 and 2018, alpha (site) diversity and beta diversity (species turnover between sites) were quantified—in addition to the change in species richness over time. In analyzing data from exurban, suburban, and urban parkland sites, the mean beta diversity was found to be significantly higher in exurban sites than in urban sites ($F_{2,8}=5.177$, $P=0.0361$). Additionally, the mean change in native richness between the 2 surveys was significantly different as a function of landscape position ($F_{2,8}=5.145$, $P=0.037$). Tukey's test indicated that the mean change in native richness was significantly greater in exurban sites than in suburban sites ($P=0.032$). In conclusion, there is a trend of decreasing native richness and overall beta diversity in urban areas, demonstrating a likely relationship between urbanization and homogenization.

Poster Board No. 49 - THE EFFECTS OF VISUAL STIMULI ON THE ORIENTATION RESPONSE OF AFRICAN CLAWED FROGS (*XENOPUS LAEVIS*). Adam Syed, a.u.syed@vikes.csuohio.edu, Jackson Casteel, j.casteel@vikes.csuohio.edu, Katarina Tomac, k.tomac@vikes.csuohio.edu, Talia Minisall, t.minisall@vikes.csuohio.edu, Tatiana Ally, t.ally@vikes.csuohio.edu, Kristy Tachji, k.tachji@vikes.csuohio.edu, Jeff Dean, j.dean@csuohio.edu, Cleveland State University, 2121 Euclid Ave, Cleveland OH 44115.

The African clawed frog, *Xenopus laevis*, uses 2 mechanisms of prey detection in water: lateral line and visual systems. They utilize characteristics of waves, namely distance from wave source and angle relative to the frog position, created by potential prey to predict the prey's location relative to the frog. The visual system is also used to perceive prey. The hypothesis was that the addition of a visual cue to a lateral line stimulus will enhance the response of the frog in terms of swim distance, turn angle, and response frequency. To test the effect of an added visual stimulus, clear and black-tip rods were hung above a test aquarium and dipped to create waves at different angles and distances relative to the frog. Black rods created visual and wave stimuli while clear rods produced

only waves. Using chi-squared and odds ratio tests of independence for the trials (n=1,119), no significant differences in swim distance (p=0.17) or turn angle (p=0.22) were found between pure lateral line stimuli and lateral line stimuli paired with a visual cue. Frogs were significantly more likely to respond to waves paired with a visual cue (p=0.0025). No preference was shown for either type of stimulus when presented simultaneously (p=0.26). Visual stimuli alone elicited fewer responses. Thus, the results fail to support the hypothesis of response enhancement by visual cue additions in terms of swim distance and turn angle, although support that of increased response frequency.

Poster Board No. 50 - INVESTIGATING THE THEORY OF EMBODIED COGNITION. Anderson Wilder, anderson.wilder@gmail.com, Ernest Oleksy, e.m.oleksy@vikes.csuohio.edu, Andrew Slifkin, a.slifkin@csuohio.edu, Cleveland State University, 2121 Euclid Ave, Cleveland OH 44115.

Psychologists have long studied how the mind processes information. However, recent studies within the field of embodied cognition have shown that cognitive and motor systems interact. As the start of a local research program aimed at investigating relations between motor and language processes, the current study sought to replicate a recent experiment. As in the previous study, the current study examined performance in a modified version of a Stroop task—where the stimulus-words "HAND" and "FOOT" appeared in yellow and blue color. Participants (n=29) were instructed to respond with either the right hand or the right foot depending on the stimulus color. Therefore, a compatible condition was one where the effector indicated by the displayed word ("HAND" or "FOOT") was consonant with the effector response specified by the word color (yellow or blue); if the two were different, then it was an incompatible condition. Longer response times in the incompatible condition would indicate interference between the motor and language systems. Such a result would provide support for embodied cognition theory. According to a two-way repeated-measures ANOVA, there was a significant main effect for effector ($F(1,28)=67.342$, $p<0.001$), and a significant compatibility effect ($F(1,28)=4.750$, $p<0.038$). The results showed shorter response times when the stimulus and the effector response were compatible versus incompatible. These results replicated those previously reported and provide a basis for further local research investigating similar interactions.

Poster Board No. 51 - GENERATION OF NATIVE AND MUTATED pHTC Halo/SOX7 EXPRESSION CONSTRUCTS TO DETERMINE THE IMPACT OF AMINO ACID EXCHANGE ON PROTEIN INTERACTION. Maram Alokaili[1], malokail1@walsh.edu, Jeremy Prokop[2], jprokop54@gmail.com, Alyssa Viscounte[1], aviscoun1@walsh.edu, Lauren Michel[1], lmichel1@walsh.edu, Dinah Qutob[1], dqutob@walsh.edu, Adam Underwood[1], aunderwood@walsh.edu, [1]Walsh University, 2020 East Maple Street NE, North Canton OH 44720, [2]Michigan State University, Grand Rapids Research Center, Grand Rapids MI 49503.

SOX proteins are regulators of transcription that contain a highly conserved High Mobility Group-box (HMG-box) DNA binding domain. While most SOX protein research focuses on the HMG-box, the function of regions outside this DNA binding domain have not been explored. Genomic analysis of all 20 human *SOX* genes has identified multiple conserved areas in these flanking regions as well as potentially impactful sequence variants. One such mutation occurs at the c-terminus of SOX7 that exchanges an alanine (A) for valine (V) at residue 377. Mutation A377V was predicted to modify SOX7 interaction with coregulatory partners. No reports in the primary literature exist regarding A377V. The purpose of this project was to produce native and mutated SOX7 expression constructs to determine if protein-protein interaction is altered. The hypothesis was: SOX7 proteins encoding the A377V mutation exhibit altered protein interaction relative to non-mutated SOX7 expressed in transiently transfected HeLa cells. To test this hypothesis the protein coding regions of human SOX7 and SOX7 A377V were subcloned into pHTCHaloTag® CMV-neo expression vector (Promega®). After sequence confirmation, HeLa cells were transiently transfected with either the native or mutated construct, or control vector in 6 well cassettes. After 24 h, protein was collected under non-denaturing conditions and SOX7 proteins and binding partners were coprecipitated using the HaloTag® Protein Purification System (Promega). Captured proteins were electrophoresed and then stained with Oriole™ florescent stain to visualize differential protein interactions. From these trials, it was determined that A377V deranges protein-protein inactions. Future experiments to identify SOX7 binding partners are underway.

Poster Board No. 52 - COMPARATIVE ANALYSIS OF DIRECT TO CONSUMER GENETIC TESTING KITS. Kristina Amos, kross2@capital.edu, Nate Vance, nvance@capital.edu, Kerry Cheesman, kcheesma@capital.edu, Capital University, Biological Sciences Department, 1 College and Main, Columbus OH 43209.

Direct to consumer (DTC) genetic testing kits are becoming increasingly popular; consequently, concerns about what results mean for consumers are showing up in the media. The purpose of this study was to evaluate DTC genetic testing kits to determine inter-test reliability. The companies of interest included Ancestry.com®, 23andMe®, and MyHeritage®. Twenty-two participants, 12 females and 10 males, representing a variety of ethnic groups, took the 3 independent DTC tests for ancestry lineage. Collection procedures specified by each company were used. Results for each participant were compared across companies, with similarities and discrepancies in identical categories being noted. Of the 22 participants in the study, 21 had a significant discrepancy in at least 1 category and 8 had large discrepancies in 2 or more categories. For example, 23andMe reported 40.4% Native American ancestry for 1 participant while MyHeritage reported 4.2%, for another participant Ancestry.com reported 22.0% Irish/Scottish/Wales ancestry while MyHeritage reported 0.9%. Ancestry.com reported 11.0% European ancestry for a participant while 23andMe reported 63.4%, for another participant Ancestry.com reported 9.0% Nigerian ancestry while MyHeritage reported 46.5%, and 23andMe reported 7.8% Japanese ancestry for a participant while MyHeritage reported 49.4%. These discrepancies point out the unreliability of this consumer science, and can create complications for individuals who assume that the one DTC test they used is an accurate portrayal of their ancestry—and therefore their identity in one or more ethnic groups. Work needs to be done to ensure that consumer DNA reports are indeed accurate reflections of genetic ancestry.

Poster Board No. 53 - DIRECTIONAL CLONING AND EXPRESSION RECOMBINANT OF SOX18 VARIANTS INTO THE PROKARYOTIC EXPRESSION VECTOR pET28a(+). Cassandra Barone[1], cbarone1@walsh.edu, Jeremy Prokop[2], jprokop54@gmail.com, Olivia King[1], king1@walsh.edu, Adam Underwood[1], aunderwood@walsh.edu, Dinah Qutob[1], dqutob@walsh.edu, [1]Walsh University, 2020 East Maple Street NE, North Canton OH 44720, [2]Michigan State University, Grand Rapids Research Center, Grand Rapids MI 49503.

SOX18 is a gene on the chromosome 20 that is linked to endothelial and vascular development. The SOX18 protein contains a High Mobility Group (HMG) box DNA binding

domain that allows this protein to function as a transcription factor. Sequence analysis of the SOX18 gene identified a novel mutation within the human SOX18 HMG-box that replaces glutamic acid (E) for lysine (K) at amino acid 137 (rs201931544). The objective of this project was to insert the native and variant SOX18-E137K gene into the pET-28a(+) (Novagen®) prokaryotic expression plasmid and collect the recombinant protein for use in future SOX18 research. A c-terminal 6x histidine tag encoded by pET-28a(+) allows for one-step purification of the SOX18 protein using HisPur™ Ni-NTA beads (Thermo Scientific®). All SOX18 genes were successfully cloned into pET-28a(+). All constructs were transformed into Mix & Go!™ XJb (DE3) Autolysis™ Competent Cells (Zymo Research) induced for 2 hours with 0.75 mM IPTG at a cell density of 0.8 at OD600. Collection and subsequent analysis of recombinant protein by SDS-PAGE confirmed expression from both SOX18 variants.

Poster Board No. 54 - DETECTION OF NATIVE AND VARIANT NAA10 PROTEINS EXPRESSED IN TRANSIENTLY TRANSFECTED HELA CELLS. Roja Baruwal[1], rbaruwal1@walsh.edu, Jeremy Prokop[2], jprokop54@gmail.com, Morgan Wajda[1], mwajda1@walsh.edu, Maram Alokaili[1], malokail1@walsh.edu, Alyssa Viscounte[1], aviscoun1@walsh.edu, Lauren Michel[1], lmichel1@walsh.edu, Dinah Qutob[1], dqutob@walsh.edu, Adam Underwood[1], aunderwood@walsh.edu, [1]Walsh University, 2020 East Maple Street NE, North Canton OH 44720, [2]Michigan State University, Grand Rapids Research Center, Grand Rapids MI 49503.

N-terminal acetylation, the addition of an acetyl moiety to the N-terminus of a protein, is one of the most common protein modifications to occur in human cells. N-terminal acetylation is catalyzed by N-terminal acetyltransferases (NATs). NAT A is a heterodimeric complex composed of the catalytic NAA10 and NAA15 axillary subunits. NAA10 is linked to functions including post-translational N-terminal acetylation and lysine acetylation. This laboratory has identified a potentially harmful mutation at amino acid 100, where glutamic acid (E) is replaced with a lysine (K), which could interfere with the NAT A complex. The objective of this project was to transfect and express FLAG tagged native and E100K mutated NAA10 into HeLa cells to begin to characterize the functional alteration of the NAA10 E100K variant. The hypothesis was: HeLa cells transfected with native or mutant NAA10 will express FLAG epitope tagged proteins. This project began by seeding 25,000 HeLa cells in each well of a 6 well tissue culture plate. After 24 h incubation, the cells were transfected with codon optimized expression constructs encoding a C-terminal FLAG epitope and either native or mutated NAA10. Proteins were extracted from the cells, electrophoresed using SDS PAGE, and immunoblotted. These assays allowed us to conclude that both native and variant NAA10 proteins can be expressed and detected using a monoclonal anti-FLAG epitope antibodies (Thermo Scientific®). This project confirmed antibody specificity to assess feasibility of projects using this antibody in co-immunoprecipitation experiments using native and variant NAA10 as a bait to capture NAA15 in HeLa cell lysates.

Poster Board No. 55 - JAW KINEMATICS OF RABBITS DURING CHEWING: CONTRIBUTIONS OF JAW YAW TO FOOD BREAKDOWN. Emma Chubb, ec743315@ohio.edu, Rachel Olson, ro603313@ohio.edu, Hannah Curtis, curtish@ohio.edu, Susan Williams, willias7@ohio.edu, Ohio University, 228 Irvine Hall, Department of Biomedical Sciences, Athens OH 45701.

Mammals have a broad variety of feeding habits spanning a continuum from herbivory to carnivory. These varied feeding strategies require different mechanisms of food processing to efficiently extract essential nutrients. Underlying the mechanics of food processing are complex 3D kinematics, or movements, of the jaw relative to the skull. Across mammals a close relationship has been demonstrated between gross jaw movements and dietary habits. The chewing kinematics of omnivores have been well-characterized by studies on pigs, but less is known about how herbivores process tough foods. Here, the kinematics of feeding in a specialized herbivore, rabbits (*Oryctolagus cuniculus*, n=3), were characterized. Marker-based X-ray Reconstruction of Moving Morphology was used to create animations from biplanar fluoroscopy movies, recorded at 250 frames per second, and associated CT scans. This method enabled accurate reproduction of jaw movements that occur in vivo while the rabbits ate hay. High levels of yaw were predicted to indicate strong transverse jaw movements, mostly during slow closing, to increase contact time and mechanical breakdown of tough forage. Rabbits produced 6.09 degrees (SD=1.6) of yaw during the gape cycle, of which 4.6 degrees (SD=2.0) occurred during the slow close phase where tooth-food-tooth contact was observed. Across the phases of the gape cycle, slow close contributed the highest percentage to gape cycle duration (38%, SD=14%). Together these results indicated that the transverse component of jaw movement is critical for processing tough diets in rabbits.

Poster Board No. 56 - AN ASSESSMENT OF HIGH SCHOOL LABORATORY SAFETY IN THE DEFIANCE, OHIO, USA, AREA. Christopher Davis, cdavis003@defiance.edu, Somnath Dutta, PhD, sdutta@defiance.edu, Defiance College, 701 N Clinton Street, Defiance OH 43512.

Laboratory safety is a vital component in teaching and research facilities. In the pre-college education world, educators must be prepared to practice science safely through effective training and the use of safe laboratory practices and guidelines. An anonymous survey (n=5) and on-site visit (n=4) identified, evaluated, and discussed the current state of safety—and areas of potential improvements—for pre-college chemistry educators at the secondary level. Survey data indicate widespread variance in the participation (20% lack training) and the type of training (60% formal, 20% nonformal) that educators receive in areas such as CPR and first aid, and in the storage, handling, and disposal of chemicals. The on-site visit of 1 public distant rural school, 2 public urban (edge of town, distant town) schools, and 1 public suburban large school, found 1 issue at all schools: chemicals were stored above eye level. The survey data suggests that educators may benefit from additional formal training because current educators are learning laboratory safety skills on the job (60%) or through their own research (40%). Other areas of potential improvement include (1) creating systems for chemical waste disposal (60% lack a system) and incident reporting (40% lack a reporting system); (2) increasing the availability of, and training to use, first aid kits (40% lack classroom first aid kits and training to use them); (3) creating grants for schools to purchase equipment (40% lack a fire blanket; student chemical aprons); and (4) better preparing educators to learn science safety through pre-service instruction and continuing professional development.

Poster Board No. 57 - FLAVOR PROFILE OF MOONSHINE HOMEMADE FROM APPLES AND DOUBLE DISTILLED. Andrea Zirkle, a.zirkle1@mail.loraincccc.edu, Mitchell Wooley, Tia Cerrone, Michael Durdak, Louis Bair, Eric Skinner, Mystal Jackson, Clayton Mastorovich, Regan Silvestri, rsilvestri@loraincccc.ed, Lorain County Community College, Department of Chemistry, 1005 N Abbe Rd, Elyria OH 44035.

Homemade moonshine prepared from fermented apples and double distilled was analyzed by gas chromatography-mass spectroscopy (GC-MS). The volatile compounds thus identified serve as a flavor profile of the spirit. As the moonshine has been fermented from apples, it was anticipated a-priori that the flavor profile would contain a wealth of pleasant aroma fruity esters. However, it was

found that the flavor profile of the apple moonshine consists mainly of longer chain alcohols, butanols, pentanols, and hexanols, which serve as off-flavors. Overall, it was found that the flavor of the apple moonshine is dominated by 3-methyl-1-butanol which imparts a fusel, alcoholic, and fermented flavor often described as pungent. It is hypothesized that the fruity ester flavors were unfortunately removed during the double distillation process, which brought the spirit to 170 proof.

Poster Board No. 58 - THE EFFECT OF ALLELES OF *ccr5* ON SURFACE EXPRESSION OF CCR5 AND CXCR4. Sara A. Martin, s.martin29@mail.loraincccc.edu, Raina E. Darr, rainadarr@gmail.com, Kaitlyn F. Armstrong, Cookie326r@gmail.com, Bellamina J. Figueroa, BellaminaFigueroa@gmail.com, Ashley E. Innes, a.innes1@mail.loraincccc.edu, Gary R. Dodson, garydodson84@gmail.com, Sierra N. Avalos, Jasmine R. Shepherd, Harry W. Kestler, PhD, Hkestler@loraincccc.edu, Lorain County Community College, 1005 N Abbe Rd, Elyria OH 44035.

CCR5 is a protein located on normal leukocytes, where it facilitates inflammatory responses. CCR5 is also found in the cytosol where its function is unclear. The cytoplasmic functions of CCR5 are the subjects of this study. A mutation found within the CCR5 gene called *ccr5-Δ32* confers resistance to HIV infectivity. It was determined that 13% of individuals tested in northeast Ohio were heterozygous and 0.67% were homozygous for *ccr5-Δ32*. CD4, an integral membrane protein, paired with other integral membrane proteins CCR5 or CXCR4 can serve as the receptor for HIV. Variations of the HIV envelope genes determine which receptor is used. The protein encoded by this *ccr5-Δ32* gene is purported to down-regulate CCR5 wild-type as well as CXCR4. The *cxcr4* gene has been inserted into the vector pLXSN, this construct can be used to determine the presence of a gene dosage effect in cells co-transfected with various alleles of *ccr5*. Wild-type *ccr5*, *ccr5-Δ32*, and a novel *ccr5* mutation *ccr5-TG5* were inserted to the retroviral expression vector pLenti puro HA-Ubiquitin. *Ccr5-TG5* was found to encode a mutation, changing lysine to arginine at position 314 in the cytoplasmic domain of CCR5, present in an individual exposed to HIV but not infected. Viral particles produced by transfection into the cell line 293FT can be used to infect lymphocytes. Surface expression of the 2 receptors can be determined using fluorescent antibody microscopy. To examine the effect of the complete absence of *ccr5*, a knock-out mutation using the genomic editing tool CRISPR/Cas9 was created.

Poster Board No. 59 - IS WHEAT BREAD A HEALTHIER CHOICE AT SANDWICH SHOPS? Marina Marusic, marina.marusic@ursuline.edu, Lynn Ulatowski, lynn.ulatowski@ursuline.edu, Ursuline College, Biology Department, 2550 Lander Rd, Pepper Pike OH 44124.

Consumers have an array of choices when they eat out, including "healthy" options. However, are the "healthy" options actually healthier? To answer this question, an online nutritional analysis was conducted for wheat and white bread products from 7 different sandwich restaurants. Nutritional websites such as Cronometer (www.cronometer.com) and the restaurant's websites nutrition information were used to collect the data. Specifically, nutritional information compared 1 wheat and 1 white bread product from each restaurant in the following 10 categories: calories, total fat, saturated fat, trans fat, sodium, cholesterol, total carbohydrates, dietary fiber, sugar, and protein. In order to maintain consistency, the data was normalized to weight of the bread product. The results suggest that what is determined a "healthy" choice is dependent on the nutritional characteristics. For instance, white bread consistently showed lower calories, total carbohydrates, added sugars, and sodium—which could be beneficial for individuals watching their weight or someone with high blood pressure. However, the wheat bread had higher protein content and 2 to 3 times the dietary fiber compared to its white counterpart. The amount of fiber is notable because fiber has many exceptional qualities including decreasing LDL cholesterol, increasing satiation, and regulating the digestive system. Future analysis will determine if the differences between the macronutrients, fiber, and micronutrient nutritional composition are nutritionally significant enough to label wheat bread preferable to white bread. What was reinforced, however, was the idea that "healthier" choices may be individualized to each person's needs.

Poster Board No. 60 - EFFECT OF DINITROPARABEN ON APOPTOTIC PARP CLEAVAGE IN HUMAN MELANOMA CELLS. Sarah McNeer, skm003@marietta.edu, Dr. Suzanne Parsons, ksg001@marietta.edu, Marietta College, Department of Chemistry and Biochemistry, 215 5th St, Marietta OH 45750.

Parabens are organic compounds used as antimicrobial agents in cosmetic and food products. Recent studies have shown that some forms of parabens, being used in these products, can accumulate in the body and could cause harm to healthy cells. Parabens, therefor, have the potential to be used to damage and kill cancer cells. In this study, a new paraben was investigated as a potential inducer of apoptosis in melanoma cells. Dinitroparaben, a novel paraben, was synthesized and applied to M624 human melanoma cells to induce cell death. Cell viability was determined through clonogenic assay. The presence of the cleaved form of poly(ADP-ribose) polymerase was detected by western blot. The cleavage of PARP is an indicator of apoptosis. Results show that PARP is cleaved in cells treated with 5.0 mM and 7.5 mM dinitroparaben. In the future, dinitroparaben will be tested with HaCaT healthy human skin cells to determine the specificity of the compound and its viability as an effective cancer treatment.

Poster Board No. 61 - STRIP MINING HISTORY OF THE WILDS BASED ON NDVI ANALYSIS OF LANDSAT DATA. Nathan Paddock, npaddock@muskingum.edu, Stephen Van Horn, svanhorn@muskingum.edu, Muskingum University, 10 College Drive, New Concord OH 43762.

Beginning in the 1940s, and continuing through the mid-1980s, 76% (29.17 km^2 of the total 38.38 km^2) of the land that would be developed as The Wilds biological preserve in Cumberland, Ohio, was strip mined and reclaimed. Prior to 1963, 5.37 km^2 was strip mined. The largest portion, 17.42 km^2, was strip mined prior to 1977. By 1985, an additional 6.36 km^2 was strip mined. The mining moved southeast of The Wilds in 1985. The Wilds visitor center was completed in 1989 and the park opened for public tours in 1994. Using Normalized Difference Vegetation Index (NDVI) analysis of Landsat data, vegetation changes from 1972 to 1995 were documented and used to determine land use changes in the area. Landsat data acquired in the months of June, July, and August that contained less than 20% cloud cover were analyzed. The data was processed using ArcGIS® Pro. NDVI rasters were generated for each year. Consecutive year rasters were subtracted using the raster calculator to create yearly change rasters. The yearly change rasters were reclassified to areas of less vegetation, no change, and more vegetation. During the active mining period, 16.74% of the area showed less vegetation and 21.95% showed more vegetation. During the development of The Wilds, 20.03% of the area showed less vegetation and 26.40% showed more vegetation. After opening for public tours, 5.25% of the area showed less vegetation and 3.60% showed more vegetation. These results appear to be consistent with the strip mining, reclamation, and development of the area prior to opening of The Wilds.

Poster Board No. 62 - CREATION OF A UNIQUE GST-FAK PLASMID FOR PROTEIN EXPRESSION. Alejandro Serna Gomez, alexserna25@gmail.com, Daniel Salmonowicz, danielsalmonowicz@gmail.com, E. Stauble, Jessica Hall, hallj4@ohiodominican.edu, Ohio Dominican University, 1216 Sunbury Rd, Columbus OH 43219.

Focal adhesion kinase (FAK) is a non-receptor tyrosine kinase that is composed of 3 domains: an N-terminal 4.1, Ezrin, Radixin, Moesin (FERM) domain; a kinase domain; and a C-terminal focal adhesion targeting (FAT) domain. The signaling cascade of integrins, which contact the extracellular matrix (ECM), and growth factor receptors activate FAK. This allows FAK to control cell migration, proliferation, and survival through the phosphorylation of—and interaction with—nearby proteins (Src, Cas, Crc, etc.), therefore making FAK a signaling scaffold. Dysfunctional FAK signaling can promote cancerous metastasis. Phosphatidylinositol 4,5-bisphosphate (PIP2), a common lipid found in cell membranes, also serves as an activation factor that changes FAK conformation. FAK is naturally autoinhibited through interaction between its FERM and kinase domains. The mechanism behind FAK activation is still unclear. Current research shows interaction of FERM and kinase domains individually with PIP2, but further research is needed to determine if PIP2 triggers structural changes of the 2 domains simultaneously. To this aim, a unique glutathione-s-transferase (GST) tagged plasmid vector, including only the FERM and kinase domains, was created through polymerase chain reaction (PCR) cloning and site-directed mutagenesis. This process created a unique fusion protein construct, which allows for purification of a FERM-kinase protein segment and research into the activation of autoinhibited FAK by PIP2 binding.

Poster Board No. 63 - RELIABILITY OF LABELED "GLUTEN-FREE" FOOD PRODUCTS IN THE US: A RISK FOR CONTAMINATION. Sydney Skeie, sskeie@capital.edu, Alysa Durbin, Kerry Cheesman, kcheesma@capital.edu, Capital University, Biological and Environmental Sciences Department, Columbus OH 43209.

Gluten is a protein complex that appears in wheat, barely, and rye, and even in foods that do not normally contain these grains. Individuals with celiac disease, and others that are gluten-intolerant, need to avoid gluten in their food. It is necessary for afflicted individuals to know whether advertised "gluten-free" products are indeed free of gluten, and if not, whether it is in high enough concentration to pose a health risk. The current study was designed to determine the reliability of "gluten-free" food labels in the consumer marketplace. Samples of "gluten-free" foods were collected from various locations in central Ohio, including restaurants, grocery stores, and health-food stores. A total of 168 samples were analyzed using a Nima® Gluten Sensor (antibody-based colorimetric assay) to determine if gluten content was <20 ppm, the maximum allowed by US law for a product labeled "gluten-free." Of the samples tested, 71 were certified as "gluten-free" (<10 ppm) by the Gluten-Free Certification Organization (GFCO); only 3 of these (4.2% of samples) were found to exceed 20 ppm of gluten. By comparison, 97 samples were labeled "gluten-free" on the packaging but did not contain certification; of these, 31 (32.0%) were found to contain more gluten than allowed by law. While results reveal that "certified gluten-free" products may be more trusted in their claim of being "gluten-free", contamination may still pose some risk of an inflammatory response in those who are intolerant of gluten.

Poster Board No. 64 - EFFECTS OF THE EMERALD ASH BORER (*AGRILUS PLANIPENNIS*) ON LOWLAND FOREST COMPOSITION ON KELLEYS ISLAND, OHIO, USA. Malia Southard, southard.38@osu.edu, The Ohio State University, 54 W Blake Ave, Columbus OH 43202, Lisa Kutschbach-Brohl, lakbrohl@gmail.com, Put-in-Bay Township Park District, Put-in-Bay, OH.

The emerald ash borer (*Agrilus planipennis*) is a species of wood-boring beetle native to Asia. Since its invasion of North America, the emerald ash borer has decimated populations of native ash species, causing great ecological and economic harm. In order to further understand ash borer induced disturbance, the impacts of green ash (*Fraxinus pennsylvanica*) death due to ash borer damage on forest composition in a lowland forest were investigated on Kelleys Island, Ohio. In June 2019, 2 transects of five 10×10-meter nested quadrats were laid out; all tree species within these quadrats were counted and diameter at breast height (DBH) measured. From this, synthetic importance values were calculated and compared to importance values from past studies in similar lowland locations on Kelleys Island to determine how forest composition has been altered. Overall, importance of roughleaf dogwood (*Cornus drummondii*) increased and importance of green ash decreased. The disappearance of the ash likely also allowed invasive species such as multiflora rose (*Rosa multiflora*) and autumn olive (*Elaeagnus umbellata*) to become more established in canopy gaps. These observed changes strengthen hypotheses that canopy gaps increase abundance of invasive plant species and suggest that the removal of a native species has lasting impacts on the composition of a forest.

Poster Board No. 65 - IMMUNODETECTION OF NAA15 EXPRESSION IN TRANSIENTLY TRANSFECTED HELA CELLS. Morgan Wajda[1], morgan.wajda@gmail.com, Jeremy Prokop[2], jprokop54@gmail.com, Rosa Baruwal[1], rbaruwal1@walsh.edu, Maram Alokaili[1], malokail1@walsh.edu, Alyssa Viscounte[1], aviscoun1@walsh.edu, Lauren Michel[1], lmichel1@walsh.edu, Dinah Qutob[1], dqutob@walsh.edu, Adam Underwood[1], aunderwood@walsh.edu, [1]Walsh University, 2020 East Maple St NE, North Canton OH 44720, [2]Michigan State University, Grand Rapids Research Center, Grand Rapids MI 49503.

The posttranslational addition of an acetyl group to the N-terminus of a protein is one of the most common protein modifications to occur in cells. N-terminal acetylation is typically catalyzed by heterodimeric N-terminal acetyltransferases (NATs). N-alpha-acetyltransferase 15 (NAA15) functions in concert with N-alpha-acetyltransferase 10 (NAA10) to generate the heterodimeric complex amino-terminal acetyltransferase A (NatA). Genomic analysis identified a single nucleotide exchange that would translate to a lysine (K) rather than a glutamic acid (E) at residue 100. Mutation E100K is predicted to modify the complexing of NAA10 with NAA15 of the NatA complex. The objective of this project was to introduce and express Myc epitope tagged NAA15 into HeLa cells as a tool to elucidate the implications of NAA10 E100Ks' ability to heterodimerize with NAA15. The hypothesis is: NAA15 fusion proteins expressing the Myc epitope will be expressed in transiently transfected HeLa cells. To test this hypothesis, the NAA15 expression construct, pCMV6/Naa15 (Myc-DDK-tagged) (OriGene® Technologies Inc.), were transiently transfected into HeLa cultured in glass chamber slides. After 24 hours, cells were fixed in methanol, blocked, and NAA15 fusion proteins were detected using anti-Myc Alexa Fluor® 488 (Thermo Fisher Scientific® Inc.). Micrographs were captured on a BIO-RAD® Laboratories Inc. Zoe™ Fluorescent Cell Imager. Controls showing antibody specificity include HeLa cells transfected with NAA15 incubated with PBS in place of primary antibody. NAA15 protein expression detected using immunocytochemistry was also confirmed by western blots of transfected HeLa cell lysates. Future assays to visualize reduced NAA15/NAA10 E100K colocalization using fluorescence resonance energy transfer are underway.

Poster Board No. 66 - PILOT STUDY: THE EFFECT OF LARGER CONSPECIFICS ON CHINESE MANTID (*TENODERA SINENSIS*) PREDATORY BEHAVIOR. Colton Wilson, cwilson@muskingum.edu, Jamie L. Rafter, jrafter@muskingum.edu, Muskingum University, 10 College Dr, New Concord OH 43762.

Non-consumptive effects reduce prey fitness by altering behavior, including behaviors to avoid cannibalism. This study used Chinese mantids, *Tenodera sinensis*, to determine if larger individuals alter the predatory behavior (attack time) of smaller individuals. Behavioral trials were conducted using an arena with a mesh divider—allowing individuals to see each other while preventing direct interaction. Fourth-instar mantids were randomly assigned to treatments: conspecific-present (n=7) or conspecific-absent (n=7). The time to orient on and attack introduced prey was recorded. Whether or not mantids oriented on each other was noted. Not all individuals oriented on and/or attacked prey. Those that attacked prey, but did not orient on the larger conspecific, were moved to the "absent" treatment since they were not responding to the visual cue (conspecific). Using the times to orient and attack data, the relative difference was calculated to normalize attack time relative to orientation time. The values for mantids in the conspecific present treatment exhibited a bimodal distribution. Therefore, the "absent" treatment group was divided—resulting in 3 treatments: "absent" (n=4), "present-cautious" (n=2), and "present-risky" (n=2). These data were analyzed via one-way ANOVA. There were significant differences between treatment groups ($F=24.85$, $p=0.0025$). Mantids in the present-cautious group had a higher relative difference value, indicating slower attack times after orientation, than that of the present-risky group ($p=0.0081$) and the absent group ($p=0.0023$). Mantids in those groups behaved similarly ($p=0.6544$). These data indicate that mantids may exhibit 1 of 2 behaviors (cautious or risky approach) when attacking prey in the presence of a larger conspecific.

Poster Board No. 67 - REACTION TIMES TO AUDITORY VERSUS VISUAL STIMULI IN STUDENT POPULATIONS. **David Sheridan, dsheridan@otterbein.edu, Beryl Dulo, dulo1@otterbein.edu, Michael Kleman, michael.kleman@otterbein.edu, Otterbein University, Department of Biology and Earth Science, 1 South Grove Street, Westerville OH 43081.**

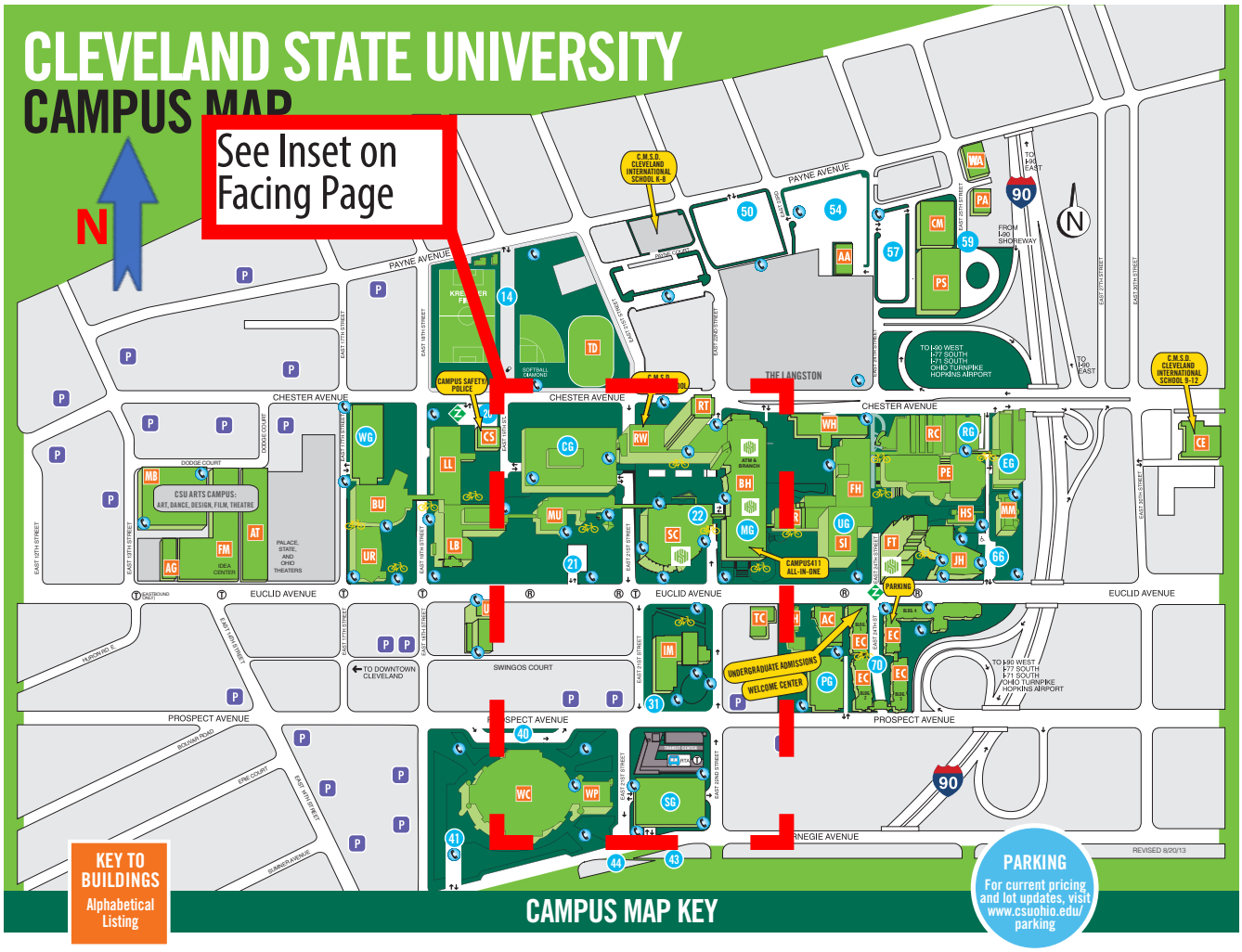
Reaction time (RT) is the interval between the delivery of, and the response to, a stimulus. RT can be affected by age, gender, stimulus modality or presentation, fatigue, and practice. Reacting to auditory and visual stimuli allow humans to navigate through their environment. The goal of this study was to investigate, in a controlled laboratory setting, which reaction time was fastest amongst different student populations. Our overall prediction was that reaction times to visual stimuli would be faster than to auditory stimuli. The experiments were conducted with the BIOPAC® Systems Inc. MP36 experimental module and desktop computer. Subjects pressed a thumb switch as quickly as they could in response to 20 presentations of an auditory "click" or a LED "flash." Contrary to our prediction, auditory reaction times (ART) were significantly faster than visual reaction times (VRT) for both fixed-interval and random-interval stimulus presentation (data presented as mean ± standard deviation): ART fixed=182±30 ms vs. VRT fixed=199±32 ms, paired t-test, $p<0.001$; ART random=230±36 ms vs. VRT random=246±36 ms, paired t-test, $p<0.001$; n=52 subjects. Subpopulations of subjects based on gender identification, video game playing habits, and competitiveness also showed similar differences between ART and VRT. The approximately 20 ms difference in reaction times between the stimuli may be attributed to the time it takes for different types of receptors—auditory hair cells vs. photoreceptors—to transduce stimulus energy into an electrical signal in the central nervous system.

Index to Fields of Interest of Abstracts

Index to First Authors

Index to First Authors (Cont.)

Cleveland State University—Campus Map



AMC Annex ..... AA
Allen Theatre ..... AT
Arts Campus
Berkman Hall (formerly Main Classroom Building MC) ..... BH
The Jack, Joseph, and Morton Mandel Honors College
Bert L. Wolstein Hall ..... LB
Cleveland-Marshall College of Law
Campus Safety ..... CS
University Police
Center for Innovation in Medical Professions ..... IM
NEOMED Campus at CSU, Health /Counseling Services
Cole Center ..... CE
C.M.S.D. Campus International School 9-12
Euclid Commons ..... EC
Welcome Center; Undergraduate, Graduate and International Admissions; Parking & Transportation Services, Residence Life
Fenn Hall ..... FH
Washkewicz College of Engineering
Fenn Tower ..... FT
Health Sciences ..... HS
Julka Hall ..... JH
College of Education and Human Services
School of Nursing
Law Library LL
Library ..... RT
Michael Schwartz Library
MAGNET Building ..... CM
Mather Mansion ..... MM
Maxine Goodman Levin College of Urban Affairs ..... UR
Glickman-Miller Hall
Medical Mutual Tennis Dome and Pavilion ..... TD
Middough Building ..... MB
Arts Campus
Monte Ahuja Hall ..... BU
Monte Ahuja College of Business
Music & Communication ..... MU
Waetjen Auditorium, Drinko Recital Hall
Parker Hannifin Administration Center ..... AC
Parker Hannifin Hall ..... PH
Parking and Transportation Services ..... EC
Physical Education ..... PE
Robert Busbey Natatorium, Woodling Gymnasium
Plant Annex ..... PA
Plant Services ..... PS
Recreation Center ..... RC
Rhodes Tower ..... RT
Rhodes West ..... RW
School of Film & Media Arts ..... FM
Science Building ..... SI
Science & Research Center ..... SR
Student Center ..... SC
Viking Outfitters — CSU Books and Spiritwear
The Galleries at CSU ..... AG
Union Building ..... UN
Wallingford Building ..... WA
Washkewicz Hall ..... WH
Washkewicz College of Engineering
Wolstein Center ..... WO
Bert L. & Iris S. Wolstein Center, Henry A. Goodman Arena
Wolstein Center Pavilion & Banquet Center ..... WP
Gerald H. Gordon Conference Pavilion

Emergency Telephones
Bike Rack Locations
RTA Health Line Stop Locations
Zipcar Location
RTA Trolley Stop Locations
Neighborhood Parking Lots
Huntington Bank ATM

Visitors to Campus may pre-pay for parking by the hour in Lot 21, (Front of MU), Lot 22 (Student Center), Rec Garage (RG), Lot 70 (E. 24th St), Lot 66 (Julka Dr.) and Lot 54. Pay-as-you-exit parking is available in South (SG), Central (CG) and Prospect Garage (PG).

Faculty, Staff and Students may purchase parking permits via CSU GO Online Parking System. Overnight parking is not included. Cash may be accepted in gated facilities during designated special events.

Motorcycle parking is available in designated areas only. Motorcycles are prohibited from parking in vehicle spaces and garages.

State of Ohio Disabled Parking Permit, is required for parking in areas designated for persons with disabilities. Please note that a proper payment is required at all times. Disabled permits can be obtained from the Ohio BMV, http://bmv.ohio.gov/

Parking is offered based upon availability. Parking fees and policies are applicable at all times and facility use parameters are subject to change. The Parking Office is located at E. 24th & Euclid. Check csuohio.edu/parking for updates.

Overnight visitor parking in SG only.

LOT	HANGTAGS	VISITOR PARKING
14	W E N	Hourly coin meter
20	G E N	Prepay using parking app Visitors (hourly rate);
21		Visitors (hourly rate); Paystation*** (pre-pay, exact change required)
22 **		Visitors (hourly rate); Paystation*** (pre-pay, exact change required)
31		Reserved Parking Only
40	G W E N	Visitors (hourly rate); Paystation*** (pre-pay, exact change required)
41	W E N	
43	G W	Lot 43/44 permits
44	G W	Lot 43/44 permits
45	E. 19th St. South of Carnegie	Lot 45 permit only
50	W E N	
54	W E N	Visitors (hourly rate); Paystation*** (pre-pay, exact change required)
57	W E N	
59		Hourly coin meter

LOT	HANGTAGS	VISITOR PARKING
66		Visitors (hourly rate); Paystation (pre-pay, exact change required)
70		Visitors (hourly rate); Paystation (pre-pay, exact change required)
CG*	G E N	Visitors parking from E. 21st St., hourly rate
EG*	G E N	Visitors after 3 pm
MG**	G E N	
PG*	PG	Visitors (hourly rate)
RG**	REC Parking Pass	Visitors (hourly rate); Paystation** (pre-pay, exact change required)
SG*	G W	Visitors (hourly rate)
UG**	G E N	
WG*	G E N	Visitors after 3 pm

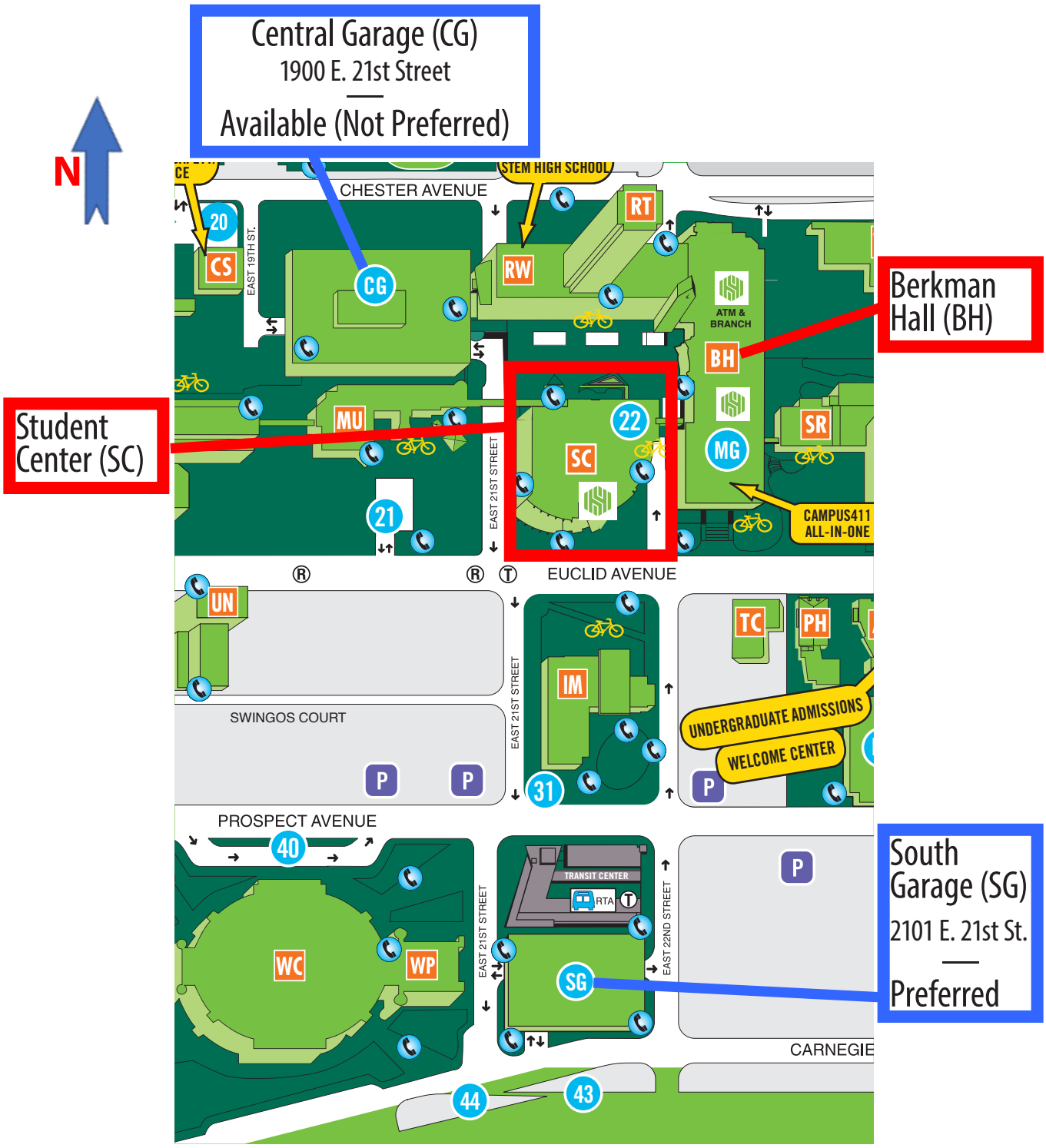
PARKING KEY

Green Hangtag	G	Garage Parking	*
White Hangtag	W	Under the building parking	**
Evening Hangtag	E	Paystation	***
Night Hangtag	N		

Alternatives to CSU Parking:
If you're looking for alternatives to purchasing a prepaid permit, there are several options available.
1) Ride RTA, **2)** Take advantage of metered street parking (Managed by the City of Cleveland),
3) Select a neighborhood parking lot operated by a private parking company or **4)** Borrow a Zipcar on campus 24/7!

Cleveland State University
Map Inset of Central Campus
•• Meeting and Parking Locations ••

Please park in the South Garage (SG, *preferred*) or Central Garage (CG, *available*).



Current Institutional Members

If you see your institution below and would like to learn how to utilize their OAS Membership, please contact us at members@ohiosci.org

CAS
A DIVISION OF THE AMERICAN CHEMICAL SOCIETY

AEP OHIO
An AEP Company
BOUNDLESS ENERGY

Ohio Environmental Protection Agency

THE OHIO STATE UNIVERSITY

Ohio's 529 COLLEGE ADVANTAGE

BATTELLE

charles river

kokosing

BGSU

COLUMBUS STATE COMMUNITY COLLEGE

NORTHERN OHIO NORTHERN UNIVERSITY

UNIVERSITY of MOUNT UNION
Be Exceptional

DEFIANCE COLLEGE
To Know ◆ To Lead ◆ To Serve ◆ To Understand

OTTERBEIN UNIVERSITY

KENT STATE UNIVERSITY

LAKE ERIE COLLEGE

University of CINCINNATI

MUSKINGUM UNIVERSITY

Lorain County Community College

UNIVERSITY OF RIO GRANDE AND RIO GRANDE COMMUNITY COLLEGE
You're one of a kind. So are we.

BioOhio

CLEVELAND STATE UNIVERSITY
engagedlearning

See you next year!

Edison State Community College

April 24, 2021 - Edison State Community College, Piqua, Ohio

***The* Ohio Academy *of* Science**
5930 Wilcox Pl. • Suite F • Dublin OH 43016
Phone 614-389-2182 • Fax 614-389-2470
info@ohiosci.org • https://www.ohiosci.org

Fostering curiosity, discovery and innovation to benefit society.