

THE 56TH ANNUAL OHIO JUNIOR SCIENCE & HUMANITIES SYMPOSIUM



March 13-15, 2019

Bowen-Thompson Student Union
Bowling Green State University

imagine.design.create

www.ojshs.org

Sponsored by the Northwest Ohio Center for Excellence in STEM Education (NWO) and Bowling Green State University

In cooperation with National Science Teachers Association and with the support of the Departments of the Army, Navy, and Air Force



The National Association of Secondary School Principals has placed this program on the NASSP National Advisory List of Student Contests and Activities for 2018-2019

BOWLING GREEN STATE UNIVERSITY

BGSU

2018 OHIO JSHS AWARD WINNERS



Top Row (L to R): Connor Ryan, John-Shaw, Anika Rede, and Maanasa Mendu

Bottom Row (L to R): Arukshita Goel, Suraj Srinivasan, Nora Gera, and Claudia Hamilton

Follow us on Twitter

@NW0stem

#NW0ohioJSHS

Follow us on Facebook

@NWOSTEM

Follow us on Instagram!

@NWOSTEM

TABLE OF CONTENTS

Welcome & History of the Ohio JSHS	2
2019 Ohio JSHS Schedule "At A Glance"	3
2019 Ohio JSHS Schedule for March 13-15, 2019	4-16
Keynote Speaker	17
Poster Presenters	18-19
Judges Score Sheets	
Paper Presenters	20
Poster Presenters	21
2018 Ohio JSHS Awardees	22-23
2019 Ohio JSHS Awards	23-24
Judging Teams	25
Acknowledgments	26
Cumulative Awards	27
Thomas Alva Edison Award	
The Colonel George F. Leist Distinguished Teacher Award	
Ohio JSHS Presenters to the National JSHS	
Ohio JSHS Participant Information	28
Notes	29

1

The Ohio JSHS online evaluation can be found at:

<http://tinyurl.com/yx9qojjg>



Let's get trending!
Include #NWOhioJSHS on all of your posts!



BGSU.



WELCOME TO BOWLING GREEN STATE UNIVERSITY (BGSU)

We are delighted to welcome you to the 56th Annual Ohio Junior Science and Humanities Symposium. The symposium is hosted by the Northwest Ohio Center for Excellence in STEM Education (NWO) and the School of Teaching and Learning at BGSU. The JSHS funding comes from the U.S. Army Research Office, U.S. Office of Naval Research, and U.S. Air Force Research Office. The JSHS program now encompasses forty-eight regional symposia reaching students throughout the United States, Puerto Rico, and DOD Schools in Europe and the Pacific.

This event offers a valuable opportunity for young scientists and scholars to share their impressive achievements with their peers and parents and with professional scientists and scholars. The Ohio JSHS provides public recognition and certificates, honoring achievement and interest in research pursuits. This program also helps students attain a sense of achievement and self-confidence resulting from interaction with students from other schools and regions and with professional researchers and educators.

The JSHS program was started by an Ohio native, Colonel George F. Leist. Following the 1958 launch of the Russian satellite Sputnik, Colonel Leist, then the Commanding Officer of the Office of Ordnance Research in North Carolina, initiated the Junior Science and Humanities Symposium (JSHS) for secondary school science students. The first symposium took place at Duke University in 1958 and spread throughout the United States to many universities during the next four years. In 1962, the National JSHS was created; the Ohio JSHS was initiated the following year in 1963.

Two student finalists and three delegates from each regional JSHS program will be chosen (all expenses paid) to attend the National JSHS that takes place in Albuquerque, NM April 24 – 27, 2019. In recent years, three winners of the Ohio symposium, Suraj Srinivasan (2019), Aaditya Shidham (2008), and Keith Hawkins (2009), have won the top national award. In 2014 the top award winner at the Ohio JSHS, Bluyé DeMessie, also won the 3rd place award in the Environmental Science division at the National JSHS. Clearly Ohio has many high-achieving young people, and we are proud to be able to highlight some of their success with this event.

We are grateful for your participation in this year's event and we hope that you find the 2019 Ohio Junior Science and Humanities Symposium to be a very beneficial and educational experience. Thank you for joining us!

2



Dr. Emilio Duran
Ohio JSHS Director



Dr. W. Robert Midden
NWO Director



Colonel George F. Leist, U. S. Army
Founder, Junior Science & Humanities Symposium

Recognized by The Academy of Applied Science for Pioneering Effects and Vision

SCHEDULE "AT A GLANCE"

Wednesday, March 13

4:00 PM – 6:00 PM	Check In	Hampton Inn, Bowling Green
6:15 PM	Mandatory Meeting for ALL Participants	Great Room, Hampton Inn
7:00 PM – 7:30 PM	Pizza Snack	Great Room, Hampton Inn
7:30 PM	Board Buses to <i>Ice Arena, BGSU</i>	
8:00 PM – 9:20 PM	Ice Skating	<i>Ice Arena, BGSU</i>
9:30 PM	Board Buses to <i>Hampton Inn</i>	
11:00 PM	Students Report to Assigned Rooms	

Thursday, March 14

6:30 AM – 7:45 AM	Breakfast	Great Room, Hampton Inn
7:50 AM	Board Buses to <i>BGSU</i>	
8:30 AM	Opening Session	<i>Bowen Thompson Student Union (BTSU) 228</i>
8:45 AM – 9:45 AM	First Paper Session	<i>BTSU 228</i>
Break (15 minutes)		
10:00 AM – 11:00 AM	Second Paper Session	<i>BTSU 228</i>
10:00 AM – 3:30 PM	Concurrent Poster Judging	<i>BTSU 308</i>
Break (15 minutes)		
11:15 AM – 12:15 PM	Third Paper Session	<i>BTSU 228</i>
12:25 PM – 1:20 PM	Lunch	<i>The Oaks Dining Hall</i>
1:30 PM – 2:30 PM	Fourth Paper Session	<i>BTSU 228</i>
Break (15 minutes)		
2:45 PM – 3:45 PM	Fifth Paper Session	<i>BTSU 228</i>
4:00 PM – 4:45 PM	Laboratory Research Tours	
5:00 PM – 5:45 PM	Special Activity TBD	<i>BTSU 228</i>
6:00 PM – 7:30 PM	Banquet/Keynote Presentation	<i>BTSU Ballroom 202A</i>
7:30 PM	Board Buses to <i>Hampton Inn</i>	
7:45 PM – 11:00 PM	Open Activities	<i>Pool; Great Room, Hampton Inn</i>
8:00 PM – 9:00 PM	Adult Reception	<i>Great Room, Hampton Inn</i>
11:00 PM	Students Report to Assigned Rooms	

Friday, March 15

6:30 AM – 7:45 AM	Breakfast	Great Room, Hampton Inn
8:00 AM	Pack up all items/Board Buses to <i>BGSU</i>	
	Store items	<i>BTSU 227</i>
8:40 AM	Announcements	<i>BTSU 228</i>
8:45 AM – 9:45 AM	Sixth Paper Session	<i>BTSU 228</i>
Break (15 minutes)	Concurrent Poster Viewing	<i>BTSU 308</i>
10:00 AM – 11:00 AM	Seventh Paper Session	<i>BTSU 228</i>
Break (15 minutes)		
11:15 AM – 12:35 PM	Eighth Paper Session	<i>BTSU 228</i>
	Concurrent Poster Viewing	<i>BTSU 308</i>
12:40 PM – 1:40 PM	Lunch	<i>The Oaks Dining Hall</i>
	Judges Meeting/ Luncheon	<i>The Oaks Dining Hall</i>
	Advisory Board Luncheon	<i>The Oaks Dining Hall</i>
	Student Advisory Board Meeting	<i>The Oaks Dining Hall</i>
1:45 PM	Students Dismantle Posters	<i>BTSU 228</i>
2:00 PM	JSHS Evaluation	<i>BTSU 228</i>
2:15 PM	Awards Ceremony	<i>BTSU 228</i>
2:45 PM	Adjournment	

SCHEDULE OF EVENTS

Wednesday, March 13

4:00 PM - 6:00 PM	Check In	<i>Hampton Inn, Bowling Green</i>
6:15 PM	Mandatory Meeting for ALL Participants	<i>Great Room, Hampton Inn</i>
7:00 PM - 7:30 PM	Pizza Snack	<i>Great Room, Hampton Inn</i>
7:30 PM	Board Buses to <i>Ice Arena, BGSU</i>	
8:00 PM - 9:20 PM	Ice Skating	<i>Ice Arena, BGSU</i>
9:30 PM	Board Buses to <i>Hampton Inn</i>	
11:00 PM	Students Report to Assigned Rooms	

Thursday, March 14

6:30 AM - 7:45 AM	Breakfast	<i>Great Room, Hampton Inn</i>
7:50 AM	Board Buses to <i>BTSU</i>	
8:30 AM	Opening Session	<i>BTSU, Room 228</i>

Presentation of Colors: **Pershing Rifles Color Guard, Army ROTC, Bowling Green State University**

Opening Remarks

Dr. Raymond Craig, Dean, *College of Arts and Sciences*, Bowling Green State University

Major Dallen Arny, Department Chair and Professor of Military Science, Bowling Green State University

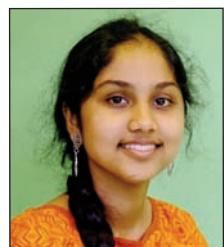
4
8:45 AM - 9:45 AM **First Paper Session** *BTSU, Room 228*

8:45 AM

Maanasa Mendu, William Mason High School

"DeepScin: A multimodal learning based approach to skin disease detection"

Though melanoma accounts for less than 5% of total skin cancer cases, it contributes to more than 75% of skin cancer deaths. The key to reducing skin cancer deaths is through early and accurate detection. However, the visual similarity of skin diseases makes diagnosis a difficult task for both physicians and automated diagnostic tools. Though there are existing machine learning applications, they solely rely on image data for classification, ignoring clinical information such as prior history or age. The goal of the project was to develop a machine learning algorithm that can classify skin diseases with an accuracy of 70%+ under 2 minutes using both image and clinical data. Though real-world skin diagnosis is based on multimodal data, multimodal learning is difficult due to challenges in representation and fusion.



In phase 1, the optimal input data - dermoscopic or macroscopic images - was determined by training 2 convolutional neural networks using transfer learning on Googlenet with 1200+ images. In phase 2, using ccAFuse, a multimodal fusion algorithm, corresponding clinical data and features extracted from the dermoscopic images were fused together to form a new train and test dataset. Later, support vector machines (SVMs), decision trees, and linear regression models were trained on the fused dataset. The DeepScin model trained on the fused clinical information and dermoscopic image dataset achieved the highest overall accuracy of 89.5%, surpassing the initial design criteria and the model trained on dermoscopic images alone. Whether used as a clinical assistant tool for primary care physicians or a method to bridge skin care in the developing world, this DeepScin model can help provide universal access to vital diagnostics.

SCHEDULE OF EVENTS

Thursday, March 14 (Cont.)

9:05 AM

Nitish Dashora, Olentangy Liberty High School

"Segmenting CT Slices: Optimization of Lesion Detection through Mask Region-based Convolutional Neural Networks"

Lesions, or abnormalities in tissue, are common and can be very severe. Before they become lethal, it is imperative that they are properly scanned and detected, so that proper measures can be taken in a timely manner [16]. Current research provides a way to segment lesions autonomously in 16-bit CT scans [25], but our research utilized 8-bit CT scans. The purpose of this project was to determine if deep learning algorithms can be applied on NIH data [2,5] to efficiently segment lesions autonomously using 8-bit CT images. This was done by experimenting with 2D and 3D representations of 8-bit CT scans. It was implemented through the use of a Mask Region-based Convolutional Neural Network [10,11] in tandem with Tensorflow Object Detection API [3,6]. We concluded that segmentation is much more efficient with 3D images, but is overall not efficient enough for professional use. Thus, 8-bit images and 2D imaging should be avoided when autonomously detecting lesions. As a result, CT segmentation would be optimized through use of 3D, 16-bit data.



9:25 AM

Rachel Avina, Sylvania Northview High School

"Determination of Crude (4-Methylcyclohexyl) Methanol (MCHM) Constituents in Environmental Samples By Thin-Film Microextraction"

In 2014, crude 4-methylcyclohexyl methanol (MCHM) leaked from a coal plant into the West Virginia Elk River, contaminating water in nine West Virginia counties. Thin-film microextraction (TFME) uses absorbent properties of solid phase microextraction, but with a membrane to maximize surface area and extraction of analytes. Optimization of the environmentally sustainable TFME for MCHM analysis included varying conditions of desorption, agitation, ionic strength, extraction temperature, and extraction time.



Desorption conditions were analyzed using carryover of analytes on the thin-film after running through the thermal desorption unit; the GCMS examined other conditions. Analysis of peak areas occurred using the Spearman's rank correlation coefficient statistical test. Optimized conditions were observed at 270°C for 2.5 minutes for desorption, 900 rpm for agitation, the ionic strength of twenty percent, and temperature at 55°C. Extraction time reached equilibrium at 60 minutes, but sufficient peaks were concluded and used at 15 minutes. After testing parameters, optimized conditions were tested at concentrations ranging from 0.1 ppb to 500 ppb. Two calibration curves were created based on Toluene D8 and Methyl benzoate D8 with evaluation using standard concentration values of 3.5, 35, and 350 ppb. The new method of TFME was tested using water samples from West Virginia. After no contaminants were identified, the method was tested using ultra-pure water spiked with various concentrations of MCHM; the results obtained compared well to the calibration curve and confirmed validation of this method.

Announcements and Break (15 minutes)

10:00 AM – 11:00 AM

Second Paper Session

BTSU, Room 228

10:00 AM – 3:30 PM

Concurrent Poster Judging

BTSU, Room 308

SCHEDULE OF EVENTS

Thursday, March 14 (Cont.)

10:00 AM

Issac Jang, Orange High School

"Effect of Dietary Iron on the Intestinal Tumorigenesis"

Background: Many research studies have shown a link between diet and cancer development. Iron is vital to tissue growth and cellular homeostasis, but dietary excess may promote tumorigenesis, especially within intestinal tract.

Goal & Purpose: To determine the effect of excess dietary iron on intestinal tumorigenesis, using a murine model.

Materials and Methods: Adenomatous polyposis coli (APC) min/+ mice, an animal model for human familial adenomatous polyposis (FAP) were used. The mice were divided into three different groups based on dietary iron: Normal (group 1), Moderately High (group 2), and Excessively High (group 3). After 10 weeks, mice were sacrificed and intestinal tissues were processed/analyzed using immunohistochemistry (IHC), focusing on quantitative expression of Ki-67, a cellular marker highly expressed in proliferating cells. Ki-67 was used as a target marker because cancer cells divide more rapidly than normal tissue, therefore increased levels of Ki-67 were expected in tumor tissue.



Results: There was an increase in Ki-67 expression within the crypts of the mice groups with increased iron intake. This increase was significant between groups two and three. For crypt to tip, there was a significant increase in Ki-67 stained cells from the group one and group two. Within villi portion, there was no significant difference in the Ki-67 expression among three groups.

Conclusion: Our findings suggest that even moderately high iron intake could significantly accelerate cellular proliferation within intestinal tract. This means high iron intake could be associated with increased risk of tumorigenesis.

6

10:20 AM

Greta Cywińska, Hathaway Brown High School

"Development of an Apparatus for Accurate, Precise Insertion of Intramuscular Electrodes"

Functional neuromuscular stimulation (FNS) is used to improve the lives of people with spinal cord injuries. In motor system neuroprostheses, FNS consists of multiple channels of electrical stimulation on peripheral nerves to produce controlled muscle contractions and generate functional movements of paralyzed limbs. Current FNS systems that enable standing use high levels of constant electrical stimulation, which results in early onset fatigue. Studies to test various methods of reducing fatigue caused by FNS are being conducted in the feline model with nerve cuff electrodes implanted on the sciatic nerve for chronic periods. Simultaneously recording the electromyography (EMG) of specific muscles during stimulation enables investigators to compare EMG signal onset with the time of stimulation and use propagation velocity to determine if the electrode is stimulating motor fibers or if the stimulation of sensory fibers causes a reflexive reaction. Additionally, EMG recordings enable investigators to determine the selectivity of the implanted electrode. An electrode positioning device that allows EMG signals to be taken on separate occasions over chronic periods from different muscles in a manner that eliminates electrode placement and position as a variable was developed to collect accurate and repeatable EMG recordings. To be successful, the electrode positioning system had to have the ability to facilitate insertion of intramuscular electrodes within the same motor unit during every recording session. A device that enables quick and accurate placement of intramuscular electrodes across multiple subjects in repeated trials over longitudinal studies will ultimately allow investigators to better explore different methods of FNS.



SCHEDULE OF EVENTS

Thursday, March 14 (Cont.)

10:40 AM

Jonathan Jang, University School

"The Feasibility of hiPSC-RPE cells and a surrogate for Human RPE"

Vitamin A bound to Retinol Binding Protein 4 (holo-RBP4) circulates in the blood. Cellular uptake of vitamin A is mediated by the Stimulated by Retinoic Acid 6 (STRA6) protein in the retinal pigment epithelium (RPE). Impairment in this process is associated with blinding diseases. We aimed to establish a cell line model which can be used as surrogate for human RPE, using human induced pluripotent stem cells derived retinal pigmented epithelial cells (hiPSC-RPE). hiPSC-RPE cells, genetically modified mouse embryonic fibroblasts (NIH3T3) cells, wild-type NIH3T3 cells, human retina cells, and human RPE cells were recruited to assess the presence of STRA6. In addition, the presence of lecithin retinol acyltransferase (LRAT) gene, which produces the protein responsible for esterification of vitamin A, was also assessed. Western blot, real-time polymerase chain reaction (RT-PCR), immunofluorescence assay, and vitamin A uptake assay were performed. The hiPSC, human RPE and genetically modified NIH3T3 expressed STRA6 protein. No STRA6 could be detected in wild-type NIH3T3 and human retina. RT-PCR revealed the expression of LRAT in hiPSC, human RPE and modified NIH3T3 cells, but not in wild-type NIH3T3 and human retina. Immunofluorescence assays revealed the location of STRA6 in the plasma membrane of hiPSC. The vitamin A uptake assay showed that the hiPSC cells were proficient. We demonstrated the expression of STRA6 protein and LRAT gene in hiPSC-RPE. In addition, STRA6's correct localization in plasma membrane and cellular uptake of vitamin A validated the candidacy of hiPSC as an adequate surrogate for human RPE.



Announcements and Break (15 minutes)

7

11:15 AM – 12:15 PM

Third Paper Session

BTSU, Room 228

11:15 AM

Sahej Bindra, Hathaway Brown High School

"Environmental enrichment improved cognitive performance in mice under normoxia and hypoxia"

The mammalian brain modulates its microvascular network to accommodate tissue energy demand in a process referred to as angioplasticity. There is an aging effect on cognitive function and adaptive responses to hypoxia. Hypoxia-induced angiogenesis is delayed in the aging mouse brain. It has been shown that enrichment provides an environment that fosters increased physical activity and sensory stimulation for mice as compared to standard housing; this increases neuronal activity and oxygen demand. We investigated the effect of environmental enrichment on cognitive performance in young mice (2-4 months; n=18) and the effect of hypoxia in both young (2-4 months; n=6) and aged mice (17-21 months; n=5). Mice were placed in a nonenriched or an enriched environment for 4 weeks under normoxia followed by 3 weeks of hypobaric hypoxia (~0.4 atm). Cognitive function was evaluated using Y-maze and novel object recognition tests in the enriched or non-enriched mice under normoxic or hypoxic conditions. The effect of environmental enrichment on capillary density was determined. Microvascular density (N/mm²) was calculated through GLUT-1 immunohistochemistry in young mice following a 3-week placement in a non-enriched or enriched environment. The young mice showed significantly higher alternation rate (%), 63 ± 7 vs. 48 ± 10, n = 6 young; 5 old) in the YMaze test as compared to the old mice. Under normoxia, the enriched mice showed an improved alternation rate (%), 63 ± 10, n = 10) in Y-Maze test and a higher novel object exploration rate (%), 68 ± 10 vs. 52 ± 10) in the novel object recognition test compared to the non-enriched controls. Similar results were observed following hypoxic exposure. The young mice that underwent environmental enrichment showed significantly higher (~30%) capillary density in cortical brain opposed to the non-enriched mice. Our data suggests that environmental enrichment improved the cognitive performance in mice under normoxic and hypoxic conditions.



SCHEDULE OF EVENTS

Thursday, March 14 (Cont.)

11:35 AM

Claire Gray, Sylvania Northview High School

"Chemical environment controls degradation and photosensitization reactions of blue light excited retinal"



The molecule all *trans* retinal (ATR) is a crucial chromophore involved in the visual cycle. The visual cycle is the biological conversion of a photon into an electrical signal. ATR is usually bound in G-coupled protein receptors called opsins. In recent years it has been found that ATR not bound in the opsins, known as free all *trans* retinal, can cause irreversible damage to cells. Due to our eyes inability to completely filter blue light, the free ATR has the potential to become photoexcited by blue light. The exact subcellular location that allows for free ATR to cause damage is still unknown. The products produced when ATR becomes photoexcited are also unknown. While the molecule ATR is able to become photoexcited, it also degrades at a rapid rate. The cellular location that would allow ATR to become photoexcited and not degrade would have the most potential for damage. In the present study, it was shown that blue light excited ATR degraded at a different rate depending on the solvent being used. In non-polar solvents ATR degraded at a much slower rate, indicating the subcellular location that would chemically support ATR damage to the cell is the hydrophobic plasma membrane. Through the use of anthracene-9,10-dipropionic acid fluorescence as an indicator, it was also shown that one of the products produced of blue light excited retinal is reactive oxygen species.

11:55 AM

Olivia Bibler, Aerospace and Natural Science Academy of Toledo

"A Preliminary Study of Macroinvertebrates as Indicators of Stream Health"



Macroinvertebrates are essential in determining the health of a waterbody because the organisms present provide a long-term perspective of stream health. The objective of this preliminary study was to use macroinvertebrates to indicate whether the water quality of a man-made ditch or a natural river was higher. This objective was achieved by comparing macroinvertebrate samples of a man-made ditch and a natural river. Samples were derived from a kick net sampling method and analyzed using a Pollution Tolerance Index (PTI). In order to create a baseline for each waterbody a Water Quality Index (WQI) was used to evaluate six water quality parameters. Preliminary results concluded from the WQI ranked the river as good and the ditch as fair. These readings are supported by macroinvertebrate data that concluded 77.98% of the total macroinvertebrate collection from the river included extremely pollution intolerant organisms. This is compared to the ditch collection in which 69.33% contained a range of moderately tolerant to moderately intolerant organisms. Overall, preliminary results concluded that the natural river has a higher water quality than the man-made ditch.

12:25 PM– 1:20 PM

Lunch

Oaks Dining Hall

1:30 PM – 2:30 PM

Fourth Paper Session

BTSU, Room 228



SCHEDULE OF EVENTS

Thursday, March 14 (Cont.)

1:30 PM

Virginia Ma, Columbus Academy

"A Novel Design to Investigate Deep Learning Methods for Studying Tumor Microenvironment through Cell-type Deconvolution Enabling Treatment with Precision Medicine"

Precision medicine, or personalized medicine, is the most promising direction for treating complex diseases, such as cancer. The deadliest solid cancer, Pancreatic Ductal Adenocarcinoma (PDAC), has a 5-year survival rate of 4%, and hope for finding viable treatment plans to increase this survival rate lies in precision medicine. The execution of such a treatment plan relies on the knowledge of genetic signatures of the pancreatic tumor cells. However, isolation of these tumor cells is not a simple task: they exist in a complex tumor microenvironment along with many other cell types. Learning the composition of cell types in a tumor sample and the genetic signatures of the individual cell types are crucial. This can be done with deep learning methods, which digitally decompose bulk tumor sample data into cell-type-specific information. Yet, a major issue is the lack of gold standard benchmarking data sets that can be used to evaluate and compare the accuracy of digital decomposition methods. Existing data have limited sample size and between-patient variability, and thus do not truly represent the patient population. This work proposes a novel design to create synthetic data to investigate deep learning cell deconvolution methods so that their accuracy for predicting cell-specific genetic signatures can be evaluated. The design is applied to PDAC with the hope that accurately obtained genetic signatures will enable the initiation of a precision medicine treatment plan for individual patients. This work can also contribute to improved prognosis and treatment of other cancers and complex diseases in general.



Key Words: Complex tumor microenvironment, Pancreatic ductal adenocarcinoma, precision medicine, cellular deconvolution, in silico experimental design

9

1:50 PM

Ainsley Bradbury, Hathaway Brown High School

"Expression and Function of the Transcription Factor HNF4a in Kidney Development"

The kidney is responsible for water homeostasis, solute homeostasis, and waste excretion. However, several aspects of its development remain unknown. The effects of eliminating the genes HNF4a and MafB from *Xenopus* embryos are explored. The embryos lacking HNF4a were hypothesized to have defects in the kidney proximal tubule. *Xenopus* pronephric patterning was labeled by *in situ* hybridization using Pax2 and HNF4a antisense probes. To visualize HNF4a and MafB expression in *Xenopus* pronephros, immunofluorescence was performed on paraplast sections of *Xenopus* embryos using antibodies against HNF4 and MAFB and counterstained with *Lotus tetragonolobus* Lectin (LTL) to visualize proximal tubules. Comparison of frog to mouse immunofluorescence was performed on paraplast sections of day P1 and P10 mouse kidneys stained with antibodies against HNF4a and MAFB and with LTL and Podocin to visualize podocytes. Expression analysis showed that HNF4a is expressed in the proximal tubules and that MAFB is restricted to podocytes. To examine HNF4a and MafB function in pronephric development, *Xenopus* embryos were injected with HNF4a antisense oligonucleotides and MafB antisense oligonucleotides. Three independent biological batches of injected and control embryos were analyzed by immunofluorescence and whole mount *in situ* hybridization. To visualize kidney structure using the 3G8 antibody for proximal tubules and the 4A6 antibody for distal tubules. An *in situ* was preformed to examine kidney patterning and HNF4a expression. Based on these data, HNF4a is expressed in the proximal tubules of both mice and *Xenopus* and is important for establishment of kidney proximal tubules.



SCHEDULE OF EVENTS

Thursday, March 14 (Cont.)

2:10 PM

Jessica McWatters, Pettisville High School

"The Prevalence of Cryptosporidium in Various Ages of Calves"



Cryptosporidiosis is a disease caused by a parasite, Cryptosporidium, often found in neonatal calves. Roughly 57% of scouring in young calves is caused by Cryptosporidium. Currently there is no vaccine or source of treatment to fight the disease. The objective of this experiment was to determine the prevalence of cryptosporidium in various age groups of cattle. The hypothesis was calves three weeks or 21 days old would show the most prevalence of cryptosporidium, because it takes ten days for the calves to experience clinical signs and the calves immune system has not been exposed to Cryptosporidium before. Fecal sample collection was conducted in collaboration with a local veterinarian and a Henry County, Ohio farmer who raises young calves. Standard Animal husbandry practices and biosecurity measures were followed in the care of calves. Forty fecal samples were collected each week for six weeks. Five samples were collected from each age group of calves. Eight age groups tested ranging from one to eight weeks old. The fecal samples were stained using an Acid Fast Stain kit. To identify the Cryptosporidium a pink oocyst was seen under the microscope. Positive and negative results were recorded for each fecal sample. The amount of Cryptosporidium present increased as the age of calves increased through five weeks of age with an exception of week four. After week five the presence of Cryptosporidium decreases. The hypothesis was partially supported.

Announcements and Break (15 minutes)

10

3:00 PM – 4:00 PM

Fifth Paper Session

BTSU, Room 228

2:45 PM

Nicole Szokai, Hathaway Brown High School

"The Role of Filamin – A in the Cross-Communication between the Bradykinin 2 and Angiotensin 1 Receptors"



Thoracic Aortic Aneurysm (TAA) is present when there is a weakened and inflated area of a vessel found in the thorax. Treatment can include monitoring to having a TAA repair surgery, both are extremely dangerous. One of the leading causes of TAA is genetic history and certain genetic variants of Filamin A. Further, Filamin A (FLNA) has been recently linked to cardiovascular disease, TAA, and even neurological disorders. Encoded by the FLNA gene, FLNA is a common protein that is located in aortic endothelial cells, and vascular smooth cells. The Angiotensin 1 (AT1) and Bradykinin 2 (BK2) receptors are common receptors found in vascular smooth muscle cells. Though heterodimeric form of the AT1 and BK2 receptors have been linked to disorders like preeclampsia, the exact mechanism of being linked to each other as well as their form of communication is unknown. This project explored the possibility that FLNA is the link in communication between the AT1 and BK2 receptors. The central hypothesis of this project is: due to activation of either AT1 or BK2 receptor the phosphorylation of FLNA would occur allowing FLNA to bind to both receptors. To test this hypothesis, a series of experiments were run by stimulation of the receptors in order to induce the phosphorylation of FLNA *in vitro*.



SCHEDULE OF EVENTS

Thursday, March 14 (Cont.)

3:05 PM

Prashamsa Koirala, Ottawa Hills High School

"The effects of cadmium telluride thickness on the current and voltage output of thin-film solar cells"

The purpose of this study was to investigate the effects of cadmium telluride thickness on the current and voltage output. Solar cells are devices that convert light energy to electrical energy for humans to use. Electricity is generated through two layers of the cell: the p-type and the n-type. When light hits the cell, electrons and holes are generated. The flow of these electrons is what generates electricity. Cadmium telluride (CdTe) is a p-type material which is mostly responsible for the performance of the cell. Several cells, ranging from 1.27-2.10 μm , were produced and their short circuit current density and open circuit voltage were measured. It was determined that thicker CdTe layers result higher current, voltage, and current x voltage values. These findings can help provide a better understanding of how cadmium telluride affects the performance of the cell, setting a basis for creating more efficient and cost effective solar cells.



3:25 PM

Tejal Pendekanti, Hathaway Brown High School

"Thrombus-Directed Drug Delivery Systems for Targeted Fibrinolysis"

The primary cause of cardiovascular disease, like myocardial infarction and ischemic stroke, is the blockage of blood vessels by blood clots. Treatment requires fibrinolytic agents, like tissue plasminogen activator (tPA), to rapidly remove clots and restore blood flow. Although effective, fibrinolytic drugs pose unwanted side effects like intracranial hemorrhage due to off-target action. Such side effects can be avoided by specifically targeting clots and releasing the drug at the target site through packaging fibrinolytic agents within drug delivery systems (DDS). In this framework, previous studies have shown the benefit of modifying the surface of liposomal nanoparticle-based DDS with ligand motifs that bind to active platelets or fibrin, allowing for clot-relevant binding. Building on this, it was hypothesized that DDS which simultaneously bind to active platelets and fibrin will significantly enhance targeting of clots compared to DDS which bind to platelets or fibrin only. To test this, liposomal DDS surfaces were decorated with platelet integrin GPIIb-IIIa-binding peptide GSSGRGDSPA (IRGD), with fibrin-binding peptide cyclo-AC-Y(DG)I(C(HPr)YGLCYIQGK-Am (FBP) (homomultivalent decorations), or with a combination of both (heteromultivalent decoration). Liposomes bearing various ligand densities and ratios were flowed over human blood clots in microfluidic channels, and liposome binding was analyzed by fluorescence microscopy. Studies showed that heteromultivalent decorations had enhanced binding and reached peak binding with lower ligand density compared to homomultivalent decorations. Future studies will focus on adapting this heteromultivalent targeting strategy on unique DDS that, upon binding to clots, will release fibrinolytic agents via local stimuli.



11

4:00 PM - 4:45 PM	Laboratory Research Tours	
5:45 PM - 5:45 PM	Special Activity TDB	BTSU 228
6:00 PM - 7:30 PM	Banquet/Keynote Presentation	BTSU Ballroom 202A
Keynote Presentation	Jon E. Sprague, R.Ph., Ph.D. Director and BCI Eminent Scholar, Bowling Green State University	
7:30 PM	Board Buses to <i>Hampton Inn</i>	
7:45 PM - 11:00 PM	Open Activities	Pool; Great Room, <i>Hampton Inn</i>
8:00 PM – 9:00 PM	Adult Reception	Great Room, <i>Hampton Inn</i>
11:00 PM	Students Report to Assigned Rooms	

SCHEDULE OF EVENTS

Friday, March 15

6:30 AM – 7:45 AM	Breakfast	
8:00 AM	Pick Up All Items/Board Buses to <i>BTSU</i>	
	Store Items	<i>BTSU, Room 227</i>
8:40 AM	Announcements	<i>BTSU, Room 228</i>
8:45 AM - 9:45 AM	Sixth Paper Session	<i>BTSU, Room 228</i>
8:45 AM – 9:45 AM	Concurrent Poster Viewing	<i>BTSU Room 208</i>
8:45 AM		

Nipun U. Jayatissa, Maumee Valley Country Day School

"Engineering and Evaluation of 3D Printed and Bioprinted Novel Photocuring Polymer Composite Scaffolds for Bone Tissue Regeneration"



The regeneration of bone defects caused by trauma, fracture, and disease is a significant clinical challenge for patients around the world. Annually, the cost for bone fracture repair exceeds \$19 billion. There are several techniques to fabricate polymer or polymer composite scaffolds to use for scaffold guided bone tissue engineering including recent 3D printing. Photocrosslinkable polymer composite (PCPC) gel was developed using simple but effective techniques to repair the bone defects. This PCPC gel was prepared using poly(ethylene glycol) dimethacrylate (PEGDMA), methyl cellulose, photoinitiator and nano-hydroxyapatite (nHA) as the main components. The prepared PCPC gel was cured using a UV/visible light source. The hypothesis of this study is to engineer PCPC porous scaffolds that can mimic porosity, pore morphology, mechanical properties, biocompatibility, and cell attachment and growth similar to human bone. The hardened PCPC scaffolds were characterized for morphology and pore architecture using scanning electron microscopy, structural analysis using Fourier transform infra-red spectroscopy, compressive modulus with a mechanical testing system, and cell viability and cell proliferation with murine pre-osteoblasts. In addition, PCPC scaffolds have shown biocompatibility as determined by in vitro cell culture studies.

9:05 AM

Garrett Blum, University School

"Honeycomb Structures As A Helmet Liner Material: Use of Neural Network Modeling to Predict Helmet Liner Safety for Known and Experimental Helmet Liner Materials"



Despite advancements in helmet technology, traumatic brain injury is still a grave threat to health and safety. Polymer foams, including expanded polystyrene (EPS), are today's common energy absorbers. Honeycomb structures also appear to have the desired properties for an effective helmet liner material. This research intended to quantify the relationship between impact velocity, thickness, density, and industry standard safety criteria (Peak Linear Acceleration (PLA), Head Injury Criterion (HIC), Gadd Severity Index (GSI), and strain) for both materials separately and in layered hybrids. The safety criteria were collected by dynamic drop tests at impact velocities between 0.86 and 7.0m/s for EPS (n=243), ALHC (n=370), and layered hybrid samples (n=663) at varying density and thickness combinations. Neural network models were then trained with these data using GMDH software. Correlations for these models ranged from 0.87 to 0.99 (Rsquared ranged from 0.72 to 0.99). The trends of the models were generally consistent with published literature on the subject: as thickness increases, the helmet liner becomes safer and as the material becomes denser, the helmet liner becomes safer at higher-impact velocities while sacrificing some performance at low-impact velocities. Furthermore, when compared at overlapping densities and thickness, ALHC were able to maintain safer impact criteria than EPS, particularly at higher impact velocities. Hybrids tended to favor one of the materials in regards to thickness combinations, steering away for evenly split thickness combinations. Since ALHC were able to maintain better safety criteria, it is reasonable to conclude that honeycombs could contribute to an improved helmet liner.

SCHEDULE OF EVENTS

Friday, March 15 (Cont.)

9:25 AM

Hannah Grace Dorris, Sylvania Northview High School

"Optimization of the Synthesis of Starting Materials for Claisen Rearrangement"

The creation of carbon-carbon bonds is an essential area of synthetic organic chemistry. One of the most useful methods for creating carbon-carbon bonds is the Claisen rearrangement. However, this method can be troublesome to use due to the limited availability of allyl vinyl ether. There is a need for the development of a more efficient synthetic protocol to gain access to the allyl vinyl ether intermediates since the current methods are time-consuming and inefficient and make the versatile Claisen rearrangement inconvenient to use. Being proposed here is a new approach to the Claisen rearrangement reaction which uses the readily available starting materials alkenes and allylic alcohols.



The halogenation of the alkenes helps the reaction overcomes the mismatch of the polarity of the alkenes and allylic alcohols due to their nucleophilic nature. The halogenation of the alkenes is made possible by having NIS present during the synthesis of the allyl vinyl ether. The presence of a Lewis acid caused the reaction to become more efficient since the Lewis acid behaved as a catalyst to generate more of the electrophilic halogen source. Under the current optimized condition, there has been an encouraging increase in the yield of the Claisen rearranged product, and the reaction will continue to undergo optimization in future work. Future research will also study the generality of this Claisen rearrangement reaction. The generality of this rearrangement will be tested by running reactions with a range of alkene and allylic alcohol substrates.

Announcements and Break (15 minutes)

13

10:00 AM – 11:00 AM

Seventh Paper Session

BTSU, Room 208

10:00 AM

Priya Bhatt, Ottawa Hills High School

"The Wound Healing Project RhoG's Effect On Cellular Migration!"



The RhoG family of proteins affect many aspects of cellular activity such as growth, proliferation, and movement. Specifically, RhoG proteins affect the cell's ability to create cytoskeleton components vital for migration. In turn, this may affect other cellular functions that depend on migration - for example, cells need to migrate towards a wound in order to close it. By exploring RhoG's specific role in this phenomenon, we may better understand the signaling pathways present in cellular lifestyle. In the future, this may aid our approach to treating diseases in which the signaling pathway is disturbed, such as cancer metastasis. In my project, I used the video imaging application ImageJ to analyze the differences in movement towards a wound between a control group of cells and cells that were genetically manipulated to reduce the levels of RhoG (RhoG KD). First, I compared the movement of single cells and found that the control cells were generally able to move farther towards the wound. Next, I compared the velocities of the cells, finding that the RhoG KD cells moved slower than the control cells. Finally, I compared the cells' persistence, which is the ability of cells to move efficiently in a particular direction. My results showed that, despite some individual variability, the median persistence of the control cells was greater and overall, the control cells had greater consistency. Statistically, the difference between the velocities was considered significant whereas the difference between the persistence was not considered statistically significant. In conclusion, in the absence of RhoG, cell migration is significantly impaired, and the cells appear to have a harder time moving towards a given target.

SCHEDULE OF EVENTS

Friday, March 15 (Cont.)

10:20 AM

Katherine Wang, Hathaway Brown High School

"Site-specific role of macrophages in peripheral nerve regeneration and degeneration"



Macrophages infiltrate the dorsal root ganglia (DRG) and the sciatic nerve (SN) distal to the site of injury after peripheral nerve axotomy. Injury induced expression of the chemokine CCL2 in the DRG and SN attracts the macrophages to those sites. Macrophages accumulating in the ganglia and nerve have been shown to be beneficial for axon regeneration. However, the site-specific roles of macrophages have not been clearly determined, since most macrophage inhibition affects the cells at both sites. To inhibit macrophage accumulation at a specific site, the cre-lox system was used to knockout CCL2 in the DRG or SN by mating CCL2-floxed mice (*CCL2fl/fl*) with sensory neuron-expressing cre (Advillin-Cre) or Schwann cell-expressing cre (P0-Cre) mice, respectively. CCL2 mRNA expression was measured in the DRG and SN. Advillin-*CreCCL2 fl/fl* mice showed significantly impaired CCL2 expression in both the DRG and SN, while P0-*CreCCL2 fl/fl* mice displayed impaired CCL2 expression in the SN only, compared to control mice. Macrophage accumulation was measured by labeling with the marker CD68 in DRG and SN 7 days after SN transection injury. Interestingly, Advillin-*CreCCL2 fl/fl* mice showed no change in macrophage accumulation in both the DRG and SN compared to controls, while P0-*CreCCL2 fl/fl* mice displayed impaired macrophage accumulation in the SN only. In an *in vitro* DRG culture measuring axon regeneration, Advillin-*CreCCL2 fl/fl* cultured neurons displayed significantly reduced neurite outgrowth compared to the other genotypes. Using this conditional knockout approach, the contribution of macrophages to the overall regenerative process in the SN and the DRG will be delineated.

14

10:40 AM

Nicole Lim, Ursuline Academy

"Determining if Chitosan nanoparticles aid in treatments for *E. coli*"



Nanoparticle-based drug formulations have recently been developed to treat various diseases. Nanoparticles of 1-100 nanometers in size, made from natural polymers may improve drug-delivery and therapeutic effects. Chitosan is a natural polymer made by treating chitin shells of crustaceans with alkaline substance. This project tested whether Chitosan nanoparticles (CSNP) enhance antimicrobial effects of prescription and natural antibiotics on *Escherichia coli* (*E. coli*). This experiment consisted of two parts. In part one, Bactrim, penicillin, ginger, and wasabi, prepared in three different concentrations, were tested against *E. coli* for seven days using the Kirby-Bauer Disc-Diffusion Method, where zone of inhibition (ZOI) of *E. coli* was measured daily. From part one, the concentration of each treatment yielding the most appropriate ZOI was selected for use in part two. In part two, each treatment was prepared using three different concentrations of CSNP (2.5%, 0.25% and 0.025%), and the respective ZOIs were compared against the controls. Bactrim and penicillin in 0.025% CSNP, as well as ginger and wasabi in 2.5% CSNP were most effective. Although CSNP alone did not appear to have a direct antibacterial effect, when combined with prescription or natural antibiotics at appropriate concentrations, it enhanced their antibacterial effects.

Announcements and Break (15 minutes)



SCHEDULE OF EVENTS

Friday, March 15 (Cont.)

11:15 AM – 12:35 PM

Eighth Paper Session

BTSU, Room 228

11:15 AM

Jennifer Ruijia Wang, Hathaway Brown High School

"Roles for Gasdermin Family Proteins in Neutrophil and Promyelocyte Inflammatory Cell Death Signaling Pathways"

The driving cellular mechanism behind the shift from healthy acute inflammation to uncontrollable and chronic inflammation is a switch from noninflammatory to proinflammatory cell signaling and death. Neutrophils are the most abundant human white blood cells, and neutrophil cell death regulates its tissue resident population, controlling the magnitude and duration of inflammatory responses. Gasdermin E (GSDME) is a pore-forming protein related to the shift from immunologically silent apoptotic to inflammatory pyroptotic cell death in macrophages. Recent studies have proposed that gasdermin D (GSDMD), a protein of the same family, may provide a pathway for activating GSDME in neutrophils by forming pores in neutrophil lysosomes, releasing proteases capable of cleaving GSDME. Here we established an immortalized promyelocyte (neutrophil progenitor) cell line (mPRO), which can be maintained in tissue culture unlike primary neutrophils, to be consistent with the GSDMD pathway. In both primary neutrophils and mPRO, GSDME was found to be expressed and processed. In primary neutrophils, GSDME was cleaved by neutrophil serine-esterase, proteases stored in neutrophil lysosomes. Based on these findings, GSDME can be activated in neutrophils and may play a role in the switch from noninflammatory to inflammatory neutrophil cell death.



11:35 AM

15

Edward Dan, Solon High School

"Designing a New Coating Device and Fabrication Process to Develop Ceramic Microtubes,"

Ceramic microtubes are especially attractive due to their resistance to thermal shock, high temperature, pressure and corrosion, their biological stability and in some cases, thermal or electrical conductivities. A wide variety of applications include liquid and gaseous component separation in chemical, oil/gas, steel, power and electronics, paper and pulp, pharmaceutical, biotechnology, food and beverage, and drinking water. 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 include silk (single and triple strands), cotton thread and angel hair pasta coated with 1, 5, 10, 15, 20 or 25 layers of slurry and fired with a 5-stage heating cycle up to 1100°C/1450°C over a period of 20 hours. Samples were analyzed using a Scanning Electron Microscope (SEM). The 20X and 25X coatings on single silk strand sintered at 1450°C resulted in the strongest and most density-uniform microtubes by decreasing the porosity. The single silk strand with 20X coating under 1450°C firing formed a 25um diameter hole and a 40um outside diameter (OD), while the 20X coating under 1100°C resulted in a 67um OD. The 25X coating resulted in a 50um OD when fired up to 1450°C.



SCHEDULE OF EVENTS

Friday, March 15 (Cont.)

11:55 AM

Sohum Kapadia, University School

"Anatomical Correlation Between Mitral and Tricuspid Valve Dimensions"



The four main components of the mitral valve (MV) and tricuspid valve (TV) - annulus, leaflets, chords, and papillary muscles (PMs) – work together to ensure proper heart pumping and to prevent blood back-flow into the left atrium (MV) and right atrium (TV). It was sought to determine anatomical correlation between the dimensions of these components. Twenty-five sheep hearts were dissected. Circumference of the annulus, length and breadth of the leaflets, and number of chords from the PM to the leaflets was measured. Using Excel and JMP software, all correlations were analyzed via a scatter plot with a regression line. If the correlation coefficient was high and the p-value was below .05, a residual plot was created to see if a linear model was appropriate. The results showed that annular lengths correlated ($r=.87; p= 0.007$) while other components did not. Medically, prediction of annular lengths will give doctors a better estimate to what the replacement ring size should be during surgery, helping prevent patient prosthesis mismatch. Potential future annular rupturing can be predicted if the other valve has unproportionate annular circumference. Economically, department costs will decrease as fewer rings will have to be opened and not used due to them not fitting.

12:40 PM – 1:40 PM

Lunch

Oaks Dining Hall

Oaks Dining Hall

Oaks Dining Hall

Oaks Dining Hall

1:45 PM

Judges Meeting/Luncheon

BTSU, Room 228

2:00 PM

Advisory Board Luncheon

BTSU, Room 228

2:15 PM

Student Advisory Board Meeting

BTSU, Room 228

2:45 PM

Students Dismantle Posters

BTSU, Room 228

JSHS Survey

Adjournment



KEYNOTE SPEAKER



Jon E. Sprague, R.Ph., Ph.D.

Director and BCI Eminent Scholar
Bowling Green State University

Dr. Jon E. Sprague is the Ohio Bureau of Criminal Investigation (BCI) Eminent Scholar and the Director of the Ohio Attorney General's Center for the Future of Forensic Sciences at Bowling Green State University (BGSU). Prior to joining BGSU, Dr. Sprague was the University Director of Academic Research and Head of Pharmaceutical Sciences for the College of Pharmacy at Ferris State University. Before joining Ferris State University, he served as Dean and Professor of Pharmacology at the Raabe College of Pharmacy at Ohio Northern University (ONU). Dr. Sprague has also served as Chair and Professor of Pharmacology at the Virginia College of Osteopathic Medicine, Virginia Tech University. He received his PhD in Pharmacology and Toxicology from Purdue University. He also was on the faculty in the College of Pharmacy at Purdue. His research and teaching interests include the neurobiology of addiction and the pharmacology and toxicology of drugs of abuse. Dr. Sprague has over 100 peer-reviewed publications in these topic areas. Dr. Sprague was also instrumental in writing the synthetic drug laws for the State of Ohio. These laws have focused on the synthetic cathinones, cannabinoids and opioids

17



2019 POSTER PRESENTERS

Abawi, Nadiah, The Bounty Collegium

Liquid Medication Dispenser

Jenin Abuhummos, The Bounty Collegium

The Physiological Calming Effects of Natural Oils

Noor Abukaram, The Bounty Collegium

Camouflage Recognition

SyneneMaria Abukaram, The Bounty Collegium

Inhibition of Staphylococcus aureus by Padding Material

Laalitya Acharya, William Mason High School

Ocula: A Neural Network to Detect the Severity of Diabetic Retinopathy for Early Prognosis of Diabetes

Khalil Al-Rayyes, The Bounty Collegium

Bridging the Gap between Musical Production and Artificial Intelligence

Omar Al-Rayyes, The Bounty Collegium

The Observation of The Digestion of Dogfood and it's Correlation to Bloating

Sagr Alahmar, The Bounty Collegium

Textile Composition of Black Clothing

Emily Banks, Hilltop High School

Gatorade and Powerade Effects on Heart Recovery

Zoi Bauer, Hilltop High School

A Two Year Study of How Diet Affects Salivary pH Levels

Alana Becker & Kezia Lietzau,

Upper Arlington High School

Effects of Stress-Reducing Activities Prior to a Test on High School Students

Abigail Berk, Ottawa Hills High School

Characterizing the Chromosomal Instability Regulator: MAD1

Audrey Berling, Sylvania Northview High School

The Effects of Different Genres of Music On Rats' Intelligence

Hayden Brown, Hilltop High School

How Oxygen Deprivation Masks Affect Running Speed

Ryan Brown, Sylvania Northview High School

The Effects of Bradyrhizobium japonicum on the Growth of Amaranthus palmeri

Sarah Brown, St. Ursula Academy

Dreissena Polymorpha shells' release and retainment of Dissolved Reactive Phosphate

Adam Burnworth, Sylvania Northview High School

Lavender's Repellent Effects on Varroa Mites

Daemien Cunningham-Wagener, Aerospace and Natural Science Academy of Toledo

Urban Structures and their effect on Soil Quality

Hannah Dorris, Sylvania Northview High School

Optimization of the Synthesis of Starting Materials for Claisen Rearrangement

Abdulrahman Elhady, The Bounty Collegium

Novel Recreational Ball Design

Rahaf Elhady, The Bounty Collegium

Hurricane Prevention Plan

Katie Geis, Hilltop High School

Effectiveness of Essential Oils and Traditional Cleaning Products on the Elimination of *E. coli*

Emily Gomez, Aerospace and Natural Science Academy of Toledo

Comparing the Effectiveness of Domestic Dogs and Grey Wolves in Identifying Common Explosives by Scent

Carsyn Hagans, Archbold High School

A Survey of Lichen Diversity in Fulton County OH Cemeteries and Spectrophotometric Analysis for Use As Air Quality Indicators

Shay Jenkins, Aerospace and Natural Science Academy of Toledo

How Urban Area Runoff Affects Water Sources

Soham Joshi, Columbus Academy

Mechanism Leveraging E-Waste to Enhance Water Condensation Through Effective Use of Solid State Magneto-Caloric Thermal Cooling.

Sara Kareem, The Bounty Collegium

Xenon Reflections

Nash Kuney, Hilltop High School

3D Printed Part Strength with Orientation and Layer Height

2019 POSTER PRESENTERS

Sophia Lands, Aerospace and Natural Science Academy of Toledo

Using DNA Analysis to Determine Genetic Health of at Risk Bird Populations

Charla Larcom, Savhanna Noe, & Nathan Tooman, Aerospace and Natural Science Academy of Toledo

How does our energy use relate to surface temperature at our school?

Carson Mahlman, Hilltop High School

Lung Capacity Difference: Athletes and Non-Athletes

Madalyne Marsengill, Sylvania Southview High School

The Effects of Course Load on Sleep

Adley McNeal, Hilltop High School

Engineering A Self-Navigating Robot

Elizabeth Mertens, Sylvania Northview High School

Effects of Art Therapy on General Populations

Rayanne Mustapha, The Bounty Collegium

Novel Solutions to Increase Protection in Contact Sports

Sundus Mustapha, The Bounty Collegium

Determining the Voltage Necessary to Fulfill Oxygen Mask Standards Using Electrolysis

Ateeq Najib, The Bounty Collegium

The Perfect Punch

Morgan Norden, Hilltop High School

Special Needs Children Responses to Sensory Objects Compared to Typical Children

Luca Opperman, Chagrin Falls High School

Indawgyi Lake Fishery: Assessment of environmental impacts using traditional ecological knowledge

Sara Penrod, Olivia Bibler, & LaNaci Sherman, Aerospace and Natural Science Academy of Toledo

Macroinvertebrates as Indicators of Stream Health

Yara Ramadan, The Bounty Collegium

Testing the Accuracy and Efficiency of a Two Probe Taser, Commonly Used in The Police Force

Yazda Ramadan, The Bounty Collegium

VR Medicine

Haylee Sexton, Hilltop High School

The Effects of Surface Temperature on Fingerprint Clarity: A Two Year Study

Madeline Shumaker, Pettisville High School

How the Transparency of Water Affects the Growth of Algae

Katelynn Smith, Hilltop High School

The Effects of Different Teaching Methods in Turn-Taking on Typical vs. Autistic Children

Tenayzah Thurman, Aerospace and Natural Science Academy of Toledo

How do house plants effect air quality

Carter Vair, Aerospace and Natural Science Academy of Toledo

Can Mycelium Sequester Phosphorus

Aditi Vijendra, Sylvania Southview High School

The Relation of Vaspin to Bilirubin

Isaiah Waiters, University School

A Novel Approach to Assessing Cirrhosis Progression in the Liver



JUDGES SCORE SHEETS FOR PAPER PRESENTERS

Name of Student _____

Name of Judge _____

School _____

The Ohio JSHS recognizes students for original research achievements in the sciences, technology, engineering, or mathematics (STEM). The overall requirement for a paper presentation is that students demonstrate valid investigation and experimentation aimed at discovery of knowledge. The judging criteria and scoring for the Ohio JSHS are presented in the following chart. This scale has a total score of 30 points and serves as the basis for discussions among the judging team. The decisions of the judging team are final.

1 = Fair

2 = Satisfactory

3 = Good

4 = Excellent

5 = Superior

Judging Criteria	Suggested Weight
Statement and identification of research problem <ul style="list-style-type: none">• Is the problem clearly stated?• Does the presenter demonstrate understanding of existing knowledge about the research problem?	1 2 3 4 5
Scientific thought, creativity/originality <ul style="list-style-type: none">• Process skills demonstrated by the student in the solution to the research problem and/or the research design• Student demonstrates his or her individual contributions to and understanding of the research problem• Level of effort	1 2 3 4 5
Research design, procedures (materials & methods), results 1. Science <ul style="list-style-type: none">• Appropriateness of research design and procedures• Identification and control of variables• Reproducibility 2. Engineering, computer science, technology <ul style="list-style-type: none">• Workable solution that is acceptable to a potential user• Recognition of economic feasibility of solution• Recognition of relationship between design and end product• Tested for performance under conditions of use• Results offer an improvement over previous alternatives	1 2 3 4 5
Discussion/conclusions <ul style="list-style-type: none">• Clarity in stating conclusion• Logical conclusion that is relevant to the research problem and the results of experimentation or testing• Recognizes limits and significance of results• Evidence of student's understanding of the scientific or technological principles• Theoretical or practical implications recognized• What was learned?	1 2 3 4 5
Skill in communicating research results—oral presentation and written report <ul style="list-style-type: none">• Clarity in communicating research results to non-specialized audience and to judges• Definition of terms as necessary• Appropriate use of audio-visuals• Response to questions from audience and judges	1 2 3 4 5
Acknowledgment of sources and major assistance received	1 2 3 4 5
TOTAL SCORE	

JUDGES SCORE SHEETS FOR POSTER PRESENTERS

Scoring Category	1	2	3	4	Score
	Needs Improvement	Acceptable	Good	Excellent	
Appearance/ Clarity	The poster is difficult to understand, and/or lacks important information or has largely excessive and superfluous information.	Organization and appearance of the poster is adequate but could be improved; some sections are significantly deficient or excessive.	Poster is logically organized; use of headings, fonts, etc. is good; some text is overly lengthy and/or contains errors.	Poster is logically organized; effectively uses headings, fonts, colors and white space; text is concise and error-free.	
Abstract*	Abstract does not represent student's research or is seriously deficient in terms of accuracy, completeness, clarity and conciseness.	Abstract is adequate; but has significant deficiency in accuracy, completeness, clarity, and/or conciseness.	Abstract mostly represents student's research; but is slightly deficient in accuracy, completeness, clarity, or conciseness.	Abstract accurately represents the student's research; clearly and accurately summarizes the project and is complete and concise.	
Research Questions*	Research questions are unclear and not aligned to the purpose of the study.	Research questions are adequately defined but have significant lack of clarity or alignment with the purpose of the study.	Research questions are well defined but have slight lack of clarity or alignment with the purpose of the study.	Research questions are very clearly defined and well aligned with the purpose of the study.	
Significance of the Research	Explanation of the research problem and its connection to broader issues is largely deficient.	Explanation of research problem and its connection to broader issues is significantly deficient but has some good points.	Explanation of research problem and its connection to broader issues has minor deficiencies or is slightly weak.	Student clearly explains the research problem being addressed by the study; clear connections are made to broader issues.	
Research Methods	Methods are not appropriate for the purpose of the study or the description is seriously deficient.	Methods are somewhat appropriate and/or the description has some significant deficiencies.	Methods are largely well chosen and well described but there are some slight deficiencies.	Methods creatively and effectively support the purpose of the study and the description is complete, easy to understand, and concise.	
Conclusions*	Unreasonable conclusions are provided and/or no supporting evidence is provided.	Conclusions are appropriate but there are significant deficiencies in evidence or reasoning.	Conclusions are reasonable and supported by evidence but there are slight deficiencies.	All appropriate conclusions are cited and well justified by evidence, reasoning is sound and complete.	
Limitations	Student identification of limitations is largely lacking or deficient.	Student identification and explanation of limitations has significant deficiencies.	Student identification and explanation of limitations has slight deficiencies.	Student clearly and completely identifies and explains all limitations in the study.	
Graphs and/ or Tables*	Graphs and/or tables are largely deficient with major flaws or omissions.	Graphs and/or tables have significant deficiencies in organization, completeness, or appropriateness.	Graphs and/or tables have slight deficiencies in organization, completeness, accuracy, or appropriateness.	Graphs and/or tables are appropriate, well organized, complete, and accurate.	
Knowledge of Project/Handling of Questions	Student demonstrates little or incorrect knowledge of project when answering questions.	There are some significant deficiencies in the student's knowledge of the project when answering questions.	There are slight deficiencies in the student's knowledge of the project when answering questions.	Student is very knowledgeable about the project; effectively handles difficult questions.	
Presence	Student interacts poorly, unprofessionally, or inappropriately with the judge.	Student speaking and interaction with the judge is adequate but lacks some clarity, confidence, and poise.	Student is professional with only slight deficiency in clarity, confidence, or poise .	Student is professional and displays excellent enthusiasm, confidence, and poise.	
* Score zero if not provided at all					TOTAL SCORE
					of 40

RESEARCH PAPER AWARDEES: 2018

1st Place Winner – Arukshita Goel, Sylvania Southview High School

- \$2,000 College Scholarship sponsored by the United States Army, Navy, and Air Force.
- Presented her research paper at the 2018 National JSHS held in Hunt Valley, MD and competed for a \$12,000, \$8,000, or \$4,000 scholarship.

2nd Place Winner – Suraj Srinivasan, Strongsville High School

- \$1,500 College Scholarship sponsored by the United States Army, Navy, and Air Force.
- Presented his research paper at the 2018 National JSHS held in Hunt Valley, MD and competed for a \$12,000, \$8,000, or \$4,000 scholarship.
- Won 1st Place in the Life Science Oral Competition category at National JSHS, receiving a \$12,000 scholarship.

3rd Place Winner – Nora Gera, Sylvania Northhview High School

- \$1,000 College Scholarship sponsored by the United States Army, Navy, and Air Force

4th Place Winner – Claudia Hamilton, Hawken School

- \$500 Award sponsored by the College of Arts and Sciences, BGSU
- Presented her research poster at the 2018 National JSHS held in Hunt Valley, MD.
- Won 3rd Place in the Environmental Science Poster Competition category at National JSHS.

22

5th Place Winner – Maanasa Mendum, William Mason High School

- \$250 Award sponsored by the Department of Chemistry, BGSU
- Presented her research poster at the 2018 National JSHS held in Hunt Valley, MD.

1st Alternate – Anika Rede, Hathaway Brown High School

- \$150 Award sponsored by College of Education and Human Development, BGSU

2nd Alternate – John-Shaw, University School

- \$100 Award sponsored by the Department of Physics and Astronomy, BGSU

Thomas Alva Edison Award – Connor Ryan, Lincoln High School

- \$250 Award sponsored by the Department of Biological Sciences, BGSU



Connor Ryan, Lincoln High School
Thomas Alva Edison Award Winner

TEACHER AWARDEE: 2018

Colonel George F. Leist Distinguished Teacher Award

– **Sara Laux**, University School

- \$500 School Award sponsored by the United States Army, Navy, and Air Force



Sara Laux, University School

RESEARCH POSTER AWARDEES: 2019

9th – 12th Grade Overall Award

“Best in Show”: \$100 Gift Certificate

23

11th – 12th Grade Awards

1st Place: \$50 Gift Certificate

2nd Place: \$25 Gift Certificate

9th – 10th Grade Awards

1st Place: \$50 Gift Certificate

2nd Place: \$25 Gift Certificate



RESEARCH PAPER AWARDS: 2019

1st Place Winner

\$2,000 College Scholarship sponsored by the United States Army, Navy, and Air Force

- Presents research paper at the 2019 National JSHS in Albuquerque, NM, with expenses paid

2nd Place Winner

\$1,500 College Scholarship sponsored by the United States Army, Navy, and Air Force

- Presents research paper at the 2019 National JSHS in Albuquerque, NM, with expenses paid

The 1st and 2nd place winners have an opportunity to win the following awards at the National JSHS:

- Six \$12,000 undergraduate tuition scholarships, awarded to each of the 1st place finalists in the the National research paper competition
- Six \$8,000 undergraduate tuition scholarships, awarded to each of the 2nd place finalists in the the National research paper competition
- Six \$4,000 undergraduate tuition scholarships, awarded to each of the 3rd place finalists in the the National research paper competition

3rd Place Winner

\$1,000 College Scholarship sponsored by the United States Army, Navy, and Air Force

- Presents poster at the 2019 National JSHS in Albuquerque, NM, with expenses paid

4th Place Winner

\$500 Award sponsored by the College of Arts and Sciences, BGSU

- Presents poster at the 2019 National JSHS in Albuquerque, NM, with expenses paid

5th Place Winner

\$250 Award sponsored by the Department of Chemistry, BGSU

- Presents poster at the 2019 National JSHS in Albuquerque, NM, with expenses paid

1st Alternate

\$150 Award sponsored by the College of Education and Human Development, BGSU

2nd Alternate

\$100 Award sponsored by the Department of Physics and Astronomy, BGSU

Thomas Alva Edison Award

\$250 Award sponsored by the Department of Biological Sciences, BGSU

TEACHER AWARD: 2019

Colonel George F. Leist Distinguished Teacher Award

\$500 Teacher Award for Classroom Materials sponsored by the United States Army, Navy, and Air Force

2019 Ohio Junior Science & Humanities Symposium

Paper Judges

Dr. Anjali Gray	Biology & Health Sciences, Lourdes University
Dr. David Meel	Mathematics and Statistics, BGSU
Dr. Stephania Messersmith	Chemistry Department, BGSU
Mr. Daniel Yaussy	United States Department of Agriculture, Forest Service

Poster Judges

Peggy Adams	Department of Human Services, BGSU
Tim Brackenbury	Department of Communications Sciences & Disorders, BGSU
Yiwei Chen	Psychology Department, BGSU
Steven Chung	Chemistry Department, BGSU
George Clemans	Chemistry Department, BGSU
Ann Darke	Math and Statistics Department, BGSU
Kate Dellenbusch	Department of Physics & Astronomy, BGSU
Colleen Fitzgerald	Department of Communications Sciences & Disorders, BGSU
Yuning Fu	Department of Geology, BGSU
Joseph Furgal	Chemistry Department, BGSU
Enrique Gomezdelcampo	Environmental Science, BGSU
Julia Halo	Biology Department, BGSU
Lynne Hewitt	Department of Communications Sciences & Disorders, BGSU
Sudershan Jetley	College of Technology, BGSU
Resmi KrishnankuttyRema	Department of Engineering Technologies, BGSU
John Laird	Department of Physics & Astronomy, BGSU
Andy Layden	Department of Physics & Astronomy, BGSU
HeeSoon Lee	Department of Human Services, BGSU
Eric Mandell	Department of Physics & Astronomy, BGSU
Gabriel Matney	School of Teaching and Learning, Math Education, BGSU
Kate Mejiritski	Chemistry Department, BGSU
Holly Myers	Environmental Science, BGSU
Kurt Panter	Department of Geology, BGSU
Laura Sanchez	Sociology Department, BGSU
MD Sarder	Department of Engineering Technologies, BGSU
Jerry Schnepp	Department of Engineering Technologies, BGSU
Glenn Tiede	Department of Physics & Astronomy, BGSU
Eileen Underwood	Biology Department, BGSU
Moira van Staaden	Biology Department, BGSU
Haowen Xi	Department of Physics & Astronomy, BGSU
Yu Zhou	Department of Geography, BGSU

ACKNOWLEDGMENTS

2019 Ohio Junior Science & Humanities Symposium

Dr. Emilio Duran, Ohio JSHS Director, School of Teaching and Learning, BGSU

Dr. W. Robert Midden, NWO Director, Department of Chemistry, BGSU

Major Dallen Arny, Department Chair and Professor of Military Science, BGSU

Ms. Susan Stearns, NWO Assistant Director, BGSU

Ms. Lisa Addis, NWO Graphic Designer/Marketing Manager, BGSU

Mrs. Lee Field-Starks, NWO/COSMOS Senior Secretary & Finance Manager, BGSU

Mrs. Jenna Pollock, NWO Education Program Manager, BGSU

Mrs. Beth Ash, NWO Research Program Manager, BGSU

Session Presiders

BGSU Undergraduate Students

Bowling Green State University Laboratory Research Tours

Ms. Rachel Blumer, School of Art, Digital Arts

Ms. Emily Barnes-Hanna, College of Health and Human Services/Medical Laboratory Science

Ms. Jessica Kiss, School of Health and Human Services, Exercise Physiology/Biomechanics

Mr. Bill Mullins, College of Musical Arts-Music Technology

Dr. Matthew Partin, BGSU Department of Biological Sciences, Marine Biology Lab

Dr. Jerry Schnepp, Department of Visual Communication and Technology Education, Collab Lab

Dr. Dale Smith, BGSU Planetarium

Dr. Donna Trautman, Department of Visual Communication and Technology Education

Dr. Eileen Underwood, BGSU Department of Biological Sciences, Herpetarium

Bowling Green State University Sponsors

College of Arts and Sciences

College of Education and Human Development

Department of Biological Sciences

Department of Chemistry

Department of Physics and Astronomy

Northwest Ohio Center for Excellence in STEM Education

School of Teaching and Learning

Special Thanks

Ice Arean, BGSU

The Oaks Dining Hall, BGSU

Hampton Inn, Bowling Green

CUMULATIVE AWARDS

THOMAS ALVA EDISON AWARD

The Thomas Alva Edison Award is presented each year to the student who has independently constructed research equipment and carried out a successful research investigation. The recent history of award winners is listed below; a full list of winners is available at: <http://www.bgsu.edu/nwo/programs/ohio-junior-science-and-humanities-symposium/about-ojshs/thomas-alva-edison-award.html>

Year	Name	School	Year	Name	School
2010	Russell Kittel	Gahanna Lincoln HS	2014	Emily Merickel	Gahanna Lincoln HS
2011	Sulaiman Mustapha	Toledo Islamic Academy	2015	Hannah Meller	Pettisville HS
2012	Chrysta Beck	Pettisville HS	2016	Jordan Skates	Pettisville HS
2012	Bluyé DeMessie	William Mason HS	2017	Mukund Seshadri	Dublin Coffman HS
2013	Mitchell Pallaki	Saint Ignatius HS	2018	Connor Ryan	Lincoln High School

THE COLONEL GEORGE F. LEIST DISTINGUISHED TEACHER AWARD

Each year, an Ohio teacher is selected to receive The Colonel George F. Leist Distinguished Teacher Award. The United States Army, Navy, and Air Force sponsor this award of \$500 to purchase books, supplies, and equipment for the school. The recent history of award winners is listed below; a full list of winners is available at: <http://www.bgsu.edu/nwo/programs/ohio-junior-science-and-humanities-symposium/about-ojshs/the-colonel-george-f--leist-distinguished-teacher-award.html>

Year	Name	School	Year	Name	School
2010	Blythe Tipping	Sylvania Southview HS	2015	Matt Wallschlaeger	Big Walnut HS
2011	Robert Sudomir	Louisville HS	2016	Deborah Bogard	Delaware City Schools
2012	Fred Donelson	Gahanna Lincoln HS	2017	Tyler Bruns	Gahanna Lincoln HS
2013	Abbie Smith	Hilltop Junior HS		Rebekah Rice	Gahanna Lincoln HS
2013	Abbie Smith	Hilltop Junior HS	2018	Sara Laux	University School
2014	Blythe Tipping	Sylvania Southview HS			

CUMULATIVE RECORD OF THE STATE OF OHIO STUDENT PRESENTERS TO THE NATIONAL JSHS

The recent history of award winners is listed below; a full list of winners is available at: <http://www.bgsu.edu/nwo/programs/ohio-junior-science-and-humanities-symposium/about-ojshs/ojshs-presenters-advancing-to-national-jshs-and-liysf.html>

Year	Name	School	Year	Name	School
2011	Austen Mance	Sylvania Southview HS	2015	Pallavi Lanka	Sylvania Southview HS
	Himanshu Savardekar	Dublin Coffman HS		Srinath Seshardi	Village Academy, Powell
2012	Christopher Ellis	Sylvania Southview HS	2016	Graham Lane	University School, Gates Mills
	Brian Haidet	Sylvania Southview HS		Rama Balasubramaniam	Dublin Coffman HS
2013	Bluyé DeMessie	William Mason HS	2017	Arman Serpen	Sylvania Southview HS
	Peeyush Shrivastava	William Mason HS		Srinath Seshardi	Village Academy, Powell
2014	Bluyé DeMessie	William Mason HS	2018	Arukshita Goel	Sylvania Southview HS
	Aditya Jog	William Mason HS		Suraj Srinivasan	Strongsville High School

OHIO JSHS PARTICIPANT INFORMATION

OJSHS INFORMATION DESK & IMPORTANT PHONE NUMBERS

24 Hour Emergency Contact: Susan Stearns (419-704-7458)

An OJSHS staff member is available 24 hours/day during OJSHS. During the OJSHS program, a staff member will be located at the registration/information table located outside Room 228 in the Bowen-Thompson Student Union. Poster Viewing is in Room 308 in the Bowen-Thompson Student Union. While at the hotel, you can contact Susan Stearns, OJSHS Coordinator, by calling or texting her at 419-704-7458.

If you or anyone in your group needs medical attention or have an incident to report, please contact your chaperone. Chaperones must immediately relay any medical emergencies or other incidents to JSHS staff. Chaperones must be able to account for their student/group at all times, in case of emergency. For immediate assistance and in case of life-threatening emergency, dial 911.

MEAL INFORMATION

Wednesday Evening: Pizza snack provided for all students, chaperones, and guests.

28 Thursday and Friday Breakfast and Lunch:

- Breakfast is provided by each hotel for hotel guests only.
- Lunch is provided for all students, teachers, judges, and paid guests and parents at the **Oaks Dining Hall*** (time specific to the OJSHS schedule for each day).

Thursday Evening: A banquet with a buffet meal and keynote speaker is provided for all students, teachers, judges, and paid guests and parents. The banquet will be held in the BTSU Ballroom (student union 202A).

***You must be wearing your OJSHS nametag to receive entry into The Oaks Dining Hall.** The Oaks is an "all you care to eat" buffet. If you leave the dining hall, you are not able to re-enter without paying for another meal at your own expense. Meals are provided for all paid guests of OJSHS.

TRANSPORTATION WHILE AT THE SYMPOSIUM

Buses will be provided to transport guests from the hotels to Bowling Green State University. Please check the schedule in your program for departure times. If you plan to park a personal vehicle at BGSU during the symposium, please contact Susan Stearns at the OJSHS information desk for a parking pass.

SYMPOSIUM EVALUATION

Please remember to complete the online evaluation for the 2019 Ohio JSHS. Your input is highly valued and necessary for the continuing success of the Ohio JSHS. The survey will open on March 15 at 1:00 pm and you will receive an email reminding you to take the survey. You will also receive an email regarding a survey request for the National JSHS program office. Please be sure to complete both the OJSHS evaluation and the National JSHS evaluation. Thank you in advance for your cooperation!

NOTES

Sponsored by:



BGSU

