THE 58TH ANNUAL OHIO JUNIOR SCIENCE & HUMANITIES SYMPOSIUM

March 11-12, 2021

**Held Virtually at
Bowling Green State University**

Sponsored by the Northwest Ohio Center for Excellence in STEM Education (NWO) and College of Education and Human Development (EDHD) at Bowling Green State University (BGSU)

In cooperation with National Science Teaching Association (NSTA) and with the support of the United States Departments of the Army, Navy, and Air Force

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2020 OHIO JSHS AWARD WINNERS

Top Row (L to R) Aditi Kumari, Anya Razmi, Kavita Parikh, and Nathan Mu
Bottom Row (L to R) Shruthi Ravichandran, Sohum Kapadia, and Dawei Liu

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#JSHS Regionals

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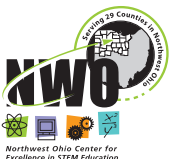
WELCOME TO BOWLING GREEN STATE UNIVERSITY (BGSU)

We are delighted to welcome you to the 58th Annual Ohio Junior Science and Humanities Symposium. The symposium is hosted by the Northwest Ohio Center for Excellence in STEM Education (NWO) and the College of Education and Human Development 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 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 Ordinance 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 the each regional JSHS program will be chosen to attend the National JSHS. The 59th National JSHS will be held April 14-17 2021, as a virtual competition. In recent years, three winners of the Ohio symposium, Suraj Srinivason (2019), Aaditya Shidham (2008), and Keith Hawkins (2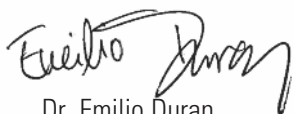009), have won the top national award, and last year, Shruthi Ravichandran placed first in the poster competition of NJSHS. Clearly Ohio has many high-achieving young people, and we are proud to be able to highlight some of their success with this event.

We are grateful for your participation in this year's event and we hope that you find the 2021 Ohio Junior Science and Humanities Symposium to be a very beneficial and educational experience. Now, more than ever, STEM education is critically important to our state, country, and the world. Thank you for joining us!

Dr. Emilio Duran
Ohio JSHS Director
NWO Director

Dr. Dawn Shinew
Dean, College of Education and Human Development

Colonel George F. Leist, U. S. Army
Founder, Junior Science & Humanities Symposium
Recognized by The Academy of Applied Science for Pioneering Effects and Vision

Thursday, March 11

8:15 AM	**Zoom Login Available**	
8:30 AM	Opening Session	*Virtual Color Guard*
	Opening Remarks, Glenn Davis, Vice Provost for Academic Affairs	
8:45 AM – 9:45 AM	**First Paper Session**	
Break (15 minutes)		
10:00 AM – 11:00 AM	**Second Paper Session**	
10:00 AM – 3:00 PM	Poster Judging	
Break (15 minutes)		
11:15 AM – 12:15 PM	**Third Paper Session**	
Break (15 minutes)		
1:30 PM – 2:30 PM	**Fourth Paper Session**	
Break (15 minutes)		
2:45 PM – 3:45 PM	**Fifth Paper Session**	
4:00 PM – 5:00 PM	Laboratory Research Tours	*Admissions office presents*

Friday, March 12

8:30 AM	**Zoom Login Available**	
8:40 AM	Announcements	
8:45 AM – 9:45 AM	**Sixth Paper Session**	
Break (15 minutes)		
10:00 AM – 11:00 AM	**Seventh Paper Session**	
Break (15 minutes)		
11:15 AM – 12:35 PM	**Eighth Paper Session**	
12:40 PM – 1:40 PM	**Keynote Presentation**	
	Judges Meeting	
2:00 PM	JSHS Evaluation - All	
2:15 PM	Closing Remarks/Ceremony	*Virtual Color Guard*
2:45 PM	Adjournment	

Thursday, March 11

8:15 AM	**Zoom Login Available**	
8:30 AM	Opening Session	*Virtual Color Guard*
	Opening Remarks, Glenn Davis, Vice Provost for Academic Affairs	

8:45 AM - 9:45 AM	**First Paper Session**

8:45 AM

Laalitya Acharya, William Mason High School

"Nereid: Using a Convolutional Neural Network (CNN) Approach, an AI Technique, to Rapidly and Accurately Detect Microbial Contamination That May Cause Water-Borne Diseases"

According to WHO, 2.1 billion people lack access to clean-water, and approximately 1 out of 3 drinks from such heavily-contaminated water that they are at high-risk for severe water-borne diseases. The current-methods for microbe-detection time and cost-consuming. This proposal is a novel and interdisciplinary model using a neural network to detect microbial-presence in water. A cohesive-device was created with 3 separate systems. The first was a novel and cost-effective microscope-imaging system which utilized a microscopic lens attachment, a Raspberry Pi Zero and a Raspberry Pi camera. The second was the custom-trained neural network to analyze images of water contamination. This network was trained on 3 microbe types: Lactobacillus, Streptococcus, and Saccharomyces Cerevisiae, using TensorFlow. It used 2-features and the stochastic-gradient-descent algorithm. This training accuracy was consistently above 90%. The validation demonstrated an average accuracy of 98.53% and an F-Score of 95.70%. Lastly the transmission system used Long-Range Radio (LoRA) for communication between the "Water Pipe" and "Water Plant". The end-to-end method is that the microscopic system takes images at regular intervals with a cron-job. These images are sent to the neural network to be analyzed for possible contamination. The network outputs the classification of the contamination, which is sent to the transmission system. If contamination is present, this system will send it to the "Water Plant" from the "Water Pipe" using the LoRA technologies. This solution is scalable and can be trained to detect multiple microbes and other contaminants and can be deployed as a commercial method of detection.

9:05 AM

Anjali Dhanekula, Hataway Brown School

"The Use of Cryoablation as an Alternative Treatment for Rhabdomyosarcoma"

Rhabdomyosarcoma (RMS) is the most common childhood malignant soft tissue cancer with approximately 250 diagnoses in the US each year. RMS is currently treated using surgery, chemotherapy, and radiation therapy. However, these treatments aren't 100% effective. In particular, metastatic RMS continues to have extremely poor outcomes. In efforts to find an alternative treatment, cryoablation, a process which uses ultra-cold temperatures such as liquid nitrogen to freeze and destroy tumor tissue, has been proposed as one option. This process releases molecules from dying tumors that can activate the immune system. Previously, our lab showed that RMS-bearing mice treated by cryoablation showed a regression in tumor growth compared to control RMS-bearing mice. To further test the effectiveness of tumor cryoablation on immune cells, specifically dendritic cells (DCs), we performed an in vitro analysis by co-culturing bone marrow-derived dendritic cells (BMDCs) with cryoablated RMS cells. Using flow cytometry (FACS) and quantitative polymerase chain reactions (qPCR), we showed enhanced induction in DC activation markers following exposure to cryoablated RMS. We also found an upregulation in transcription of proinflammatory cytokines in these DCs. These results support the hypothesis that cryoablation can boost immune cell activation and could be a possible adjuvant to immunotherapy for RMS.

Thursday, March 11 (Cont.)

9:25 AM

Sohum Kapadia, University School

"Morphology and Treatment Implications of the Tricuspid Valve Changes in Patients with Mitral Valve Disease"

Two heart valves are the mitral (MV) and tricuspid valves (TV). Primary (PMR) and secondary mitral regurgitation (SMR) are common diseases, where blood leaks through the MV. In Phase (1) of this study, the purpose was to identify correlations between valvular dimensions and determine TV changes in PMR and SMR. There is limited study of valvular morphology using high-resolution computed tomography (CT) scans, and with the growth of percutaneous surgery, understanding valvular changes is critical due to lack of open-heart visualization. CT dimensions of 125 patients (50 normal, 50 PMR, 25 SMR) were determined. Normal and diseased MV and TV dimensions correlated ($p<0.05$). The TV became larger (SMR>PMR; $p<0.05$) and more circular in disease. In Phase (2), using the Nationwide Inpatient Sample, the prevalence of TV disease (TVD) and TV surgery in patients who underwent MV surgery was studied. 18% had TVD, and 32% had TV surgery. From Phase (1), physicians can correlate dimensions to predict and restore valvular normality. Companies can create an optimal device to repair the TV. Combining phases, physicians know the clinical characteristics for patients whose TV enlargement in PMR/SMR manifests into TVD and TV surgery and can thus take early action to prevent TV damage.

Announcements and Break (15 minutes)

10:00 AM – 11:00 AM	**Second Paper Session**
10:00 AM – 3:00 PM	**Poster Judging**

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10:00 AM

Zuha Jaffar, Hathaway Brown School

"Localized Dual Cancer Drug Delivery from Affinity Based Devices"

Affinity based drug delivery systems utilize interactions between the therapeutic drug and delivery system to manipulate drug loading, control, and extend drug release, improving treatment effectiveness. Broad spectrum chemotherapy, a form of cancer therapy where various chemo agents target different types of cancer cells, is the backbone of cancer treatment. Over time, cancers can develop resistance to a certain drug and utilizing combination therapies is critical to treating cancer. To effectively deliver combination therapies, cyclodextrin (CD), a glucose polymer, has become an increased area of focus for drug delivery due to its affinity for small molecule drugs, or chemotherapy agents, and its ability to increase their solubility and stability. Here, the effectiveness of CD as a drug delivery agent for sorafenib, an agent critical for treatment of hepatocellular carcinoma, was tested.

Disks made of beta cyclodextrin (bCD) and dextran (a non-affinity based polymer) were loaded with sorafenib and inserted in solutions of DMSO (dimethyl sulfoxide) and PBS (Phosphate-buffered saline). Over the course of two months, the amount of sorafenib that leached out these disks was used to identify the maximal loading dose. This process was repeated loading the disks with both sorafenib and doxorubicin to replicate a dual delivery.

An average of 66.4 µg of sorafenib leached out of the bCD disks, and 62.04 µg of sorafenib leached out dextran disks. Of this, 97% of the sorafenib was released in the human body. We show that beta-CD has been identified to be a novel alternative for drug delivery of cancer therapeutics. The high affinity of the drugs with cyclodextrin has been shown along with demonstrating that a significant amount of the drug is able to overcome the affinity and diffuse out of the disks. Finally, using both drugs allowed for more drug to be released. Compared to chemotherapy, where all the cells are affected, affinity based delivery targets only the cancer cells for a longer period of time, avoiding the side effects. Future studies will look to investigate the effectiveness of CD delivery to induce hepatocellular carcinoma cell death. Dual, affinity-based delivery may represent a new form of drug delivery for the treatment of hepatocellular carcinoma and other cancers.

Thursday, March 11 (Cont.)

10:20 AM

Julia Madureira, Hathaway Brown School

"Elucidating the mechanism of PP2A dysregulation by the most recurrent cancer-derived PP2A-A mutant, R183W "

Protein Phosphatase 2A (PP2A) is a family of tumor-suppressing phosphatases that 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 (LCMT-1) and PP2A methyl-esterase 1 (PME-1), that 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 Aα subunit of an arginine at position 183 to a tryptophan (R183W). Through its interference in the recruitment of tumor-suppressing B subunits, the R183W mutation reduces PP2A's tumor-suppressing capabilities. An array of cellular, biochemical, and structural studies were used to investigate how this mutant selectively disrupts PP2A holoenzymes. These results elucidate how the R183W mutant is unable to proceed through the regulatory biogenesis steps required for the recruitment of select B subunits into the active heterotrimer. The R183W mutant demonstrated a 50% decrease in methylation by LCMT-1, an essential regulator of B subunit binding, and a consequent enhanced binding to the PP2A chaperone and inhibitor PME-1 in cellular systems. Biochemical studies further demonstrate that LCMT-1 is unable to methylate the R183W-C dimers in purified systems while there is no change in overall affinity for PME-1. Taken together, these data characterize the molecular details involved in PP2A inactivation and subsequent dysregulation in cancer while providing a framework for the development of cancer-specific therapeutics.

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10:40 AM

Ivy L. Wang, Hathaway Brown School

"Determing Crohn's Disease Treatment Response Using Radiomic and Clinical Features of Patients"

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, helps to 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 Pramlintide (PRAM), an analog of amylin, reduces amyloid-beta (Aβ) plaque pathology 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 amylin receptors (AMYR) or due its benefits on metabolic function in the periphery. To address this, we used Western blotting to determine changes in levels of proteins involved in Aβ regulation in brains of APP/PS1 AD-modeled and WT mice under PRAM-treatment and under PRAM while blocking the AMYR centrally with an inhibitor (AC187). We hypothesized that PRAM would regulate Aβ processing aspects that would be blocked by AMYR inhibition. Results thus far show that PRAM may work centrally to increase α-secretase and lower levels of Aβ. We have also determined that PRAM benefits are unlikely to be related to its ability to regulate degradation of amyloid beta.

Announcements and Break (15 minutes)

Thursday, March 11 (Cont.)

11:15 AM – 12:15 PM   **Third Paper Session**

11:15 AM

Michelle Park, Solon High School

"A Novel Method for Identifying Kepler Exoplanet Habitability Using Python-Based Analysis of Standardized Transit Light Curves and Calculated Parameter Values"

Much of the exoplanet transit data from the Kepler space telescope remains unanalyzed, especially in the search for habitability. To enable the investigation of Kepler exoplanets without the need for time-consuming and difficult visual observations, I developed a novel program using Python to produce global and local view light curve graphs, standardized transit light curve graphs, tables of transit data, the values of three exoplanet parameters (radius, period, and semi-major axis), and the target exoplanet's habitability through parameter relationship graphs. The only input needed is the Kepler ID and an optional search radius as the program solely uses transit data from the Mikulski Archive for Space Telescopes to analyze the target exoplanet(s). I evaluated the accuracy of the program by calculating the percent differences of the three program-generated parameters compared to the confirmed values of these parameters in the NASA Exoplanet Archive for 50 distinct Kepler exoplanets in a sample set. I found the percent differences as 43.02%, 45.23%, and 27.19% for the three parameters respectively. This program will facilitate the search for life in the universe across Kepler exoplanets by efficiently accomplishing the necessary analyses for habitability with only easily accessible transit data.

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11:35 AM

Johan Demessie, William Mason High School

"Removing Chromium (VI) from Contaminated Water using a Low-Cost Chitosan Coated Diatomaceous Earth"

Access to clean water is a major challenge in many developing counties partly due to municipal and industrial pollution. Thus, developing a low-cost technology to provide clean water to the is vital. Hexavalent chromium is a toxic substance that is not biodegradable and has a great effect on ecosystem and human health. In this work, chitosan-coated diatomaceous earth (CCDE) beads were synthesized at 20 w/w% and 30 w% and characterized by Fourier transfer infrared, scanning electron microscopy, and thermogravimetric analysis. CCDE is used for Cr(VI) ion removal from aqueous solution in batch processes. Several parameters have been studied such as solution-pH, initial Cr(VI) ion concentration, the mass of adsorbent, and contact time to investigate the efficiency of Cr(VI) removal. In batch studies. CCDE achieved 99% removal efficiency of Cr(VI) and adsorption capacity was 18.7 mg Cr(VI)/g. The adsorption followed Pseudo-second order and was well fitted to the Langmuir isotherm model, indicating monolayer adsorption behavior. Anions in the solution had an insignificant effect on Cr (VI) ion uptake by CCDE powder. The removal efficiency increased at lower pH and the optimal pH was found to be 4. The adsorption experiments were well described by the Langmuir isotherm model, showing a maximum adsorption capacity of 18.69 mg g–1. Adsorption equilibrium was reached after approximately 60 min, and the adsorption kinetics was well fit by a second-order model for Cr(VI). This study demonstrated that natural-based adsorbents could be employed as a low-cost, sustainable, and excellent alternative material for Cr(VI) ion removal from wastewater.

Thursday, March 11 (Cont.)

11:55 AM

Anish Gupta, Sylvania Northview High School

"In Silico Mapping of 14-3-3ζ and TRAF Protein Interactions"

Recent advances show that the 14-3-3ζ protein participates in several immune regulations and is a unique regulator of IL-17A signal transduction. The IL-17A signal transduction triggers two, 14-3-3ζ-TRAF6 and 14-3-3ζ-TRAF5-dependent intracellular pathways responsible for IL-6/IL-8 and CXCL-1, respectively. Improved IL-17A signaling blockers are desirable in treating inflammatory diseases. Due to its unique role 14-3-3ζ is an attractive target to regulate IL-6 and CXCL-1 levels. The aim of this study is to determine interaction sites between 14-3-3ζ and the TRAF (5 and 6) proteins utilizing bioinformatic analysis. Using ZDOCK, I examined the putative site of the 14-3-3ζ interactions on TRAF (5 and 6) with or without any restrictions. The mapped interacting residues were mutated, and an effect on the interaction with 14-3-3ζ was observed. To further evaluate the interaction quality, Prodigy was utilized to measure binding energy for several possible structures and narrow down the selected interaction sites further. The results indicate that site 479-485 is the putative target of the 14-3-3ζ-TRAF5 complex with ΔG of -17.5 kcal/mol and Kd of 1.60×10^{-13} M. The results for the TRAF6 experiment indicate that residues 483-488 interact with 14-3-3ζ with ΔG of -19.1 kcal/mol and a Kd of 9.50×10^{-15} M. These results identify the binding sites between 14-3-3ζ and TRAF (5 and 6) and provide a rationale to investigate the 14-3-3ζ and TRAF proteins further for the development of a future therapy. This therapy would have applicability to autoimmune disease, chronic inflammatory disease, and Coronavirus Disease 2019.

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1:30 PM – 2:30 PM   **Fourth Paper Session**

1:30 PM

Kaisal Shah, Hathaway Brown School

"Enzyme-responsive Procoagulant Activity by Synthetic Platelets to Treat Bleeding"

Platelets are responsible for promoting clot formation at a bleeding injury site by: adhesion and aggregation to initiate the clot, coagulation amplification by exposing phosphatidylserine (PS), and secretion of hemostasis- augmenting molecules. Therefore, platelet transfusions are routinely used to treat bleeding complications. However, transfusions present significant challenges such as high cost, high infection rate, limited availability and portability, short shelf life, and a need for blood type matching. An alternative strategy is to engineer synthetic platelet particles that mimic platelet mechanisms. Previous research has shown that such synthetic platelet particles can emulate the adhesion and aggregation functions similar to natural platelets. Here, we have built on this with new synthetic platelet designs that also mimic the coagulations amplification function of natural platelets. Thrombin and fibrin generation assays and microscopy and rotational thromboelastometry (ROTEM) based functional assays were used to evaluate the synthetic particles' ability to mimic the coagulation amplification mechanism of natural platelets. The synthetic platelets were able to improve clot formation time, thrombin generation levels, clot firmness, and resist rapid clot lysis. Results demonstrate promise for these artificial platelet systems to be used as a substitute for natural platelet transfusions in the future for the treatment of hemostatic complications.

Thursday, March 11 (Cont.)

1:50 PM

Ellie MacPhail, Hathaway Brown School

"Effect of Physical Activity on Abdominal Adiposity in People living with HIV"

HIV has become a chronic disease as opposed to a fatal one due the treatment becoming more effective. However, now that people are able to live longer lives with HIV, more side effects are occurring. Due to the daily antiretroviral medications (ART) and HIV, metabolic syndrome is becoming common in people living with HIV (PLWHIV). Metabolic syndrome leads to a higher level of visceral fat accumulation, specifically in the abdominal area. Metabolic syndrome has been shown to improve with physical activity. The purpose of this research is to determine the effect gender and age has on physical activity and abdominal adiposity. This study is a secondary study of the PROSPER-HIV study, however, it is only analyzing the data from the 202 PLWHIV in the Northeast Ohio location. Physical activity data was obtained by having participants wear an ActiGraph accelerometer for 7-10 days. Waist circumference and hip circumference was measured. The results showed on average that more males (59%) engaged in over a minute of moderate to vigorous physical activity as compared to females (43%). Males also averaged more steps per day, 13,307 (5,161), than females, 12,249 (5,606). A moderate to significant correlation was found in males between physical activity and abdominal adiposity, however the correlation was not as strong in MVPA per week. Females did not have much, if any correlation between the two, which was not expected, but it is probable that it was due to the lower sample size. In conclusion, we did not find a strong enough confirmation that physical activity and abdominal adiposity are directly correlated. We also did not find a relationship between waist-hip ratio and BMI.

2:10 PM

Carlton Cort, University School

"Developing Electronic Controls for Electromagnetic Levitation Towards Magnetically Deflected Ballistic Mass Technology"

Magnetically deflected ballistic mass (MBDM) describes a system in which a metal rotor, the mass in the system, is suspended (like a maglev train) inside of an evacuated sheath. The metal rotor is sped up by linear induction motors. Because the rotor is in a near frictionless environment, inertia allows storage of energy in the movement of the rotor with minimal energy losses over time. This project is designed to take the first step towards MDBM technology by designing and testing an electronic control system for electromagnets that will be used to levitate a ferromagnetic object. A mild-carbon steel caster ball was selected to be the ferromagnetic object for the system. The electronics that were used to control the electromagnet were an Arduino UNO, L298N motor driver, 24V DC power supply, and two 24V DC Electromagnets. The Arduino UNO and L298N output a maximum 2A and 22V, which is greater than the electromagnets current draw, 0.1875A at a voltage less than the electromagnets', 24V. This control system is able to power the electromagnets at 256 different steps using PWM, allowing for precise control of the electromagnets power at speeds much faster than can be manually achieved. During testing, it was found that at full power it takes 88.25ms on average for the top electromagnet to lift the caster ball, and the inverse exponential function is the best mathematical function for gradual correction.

Announcements and Break (15 minutes)

Thursday, March 11 (Cont.)

2:45 PM – 3:45 PM   **Fifth Paper Session**

2:45 PM

Alexander Devine, University School

"Fruit Dye and Sunscreen to Solar Power: Creating and Testing Titanium Dioxide and Zinc Oxide Solar Cells"

In a previous experiment, a process was explored in which a zinc oxide raspberry dye-sensitized solar cell was made to find a cost-effective alternative to traditional silicon solar cells. This cell produced .1 volts and costed much more per cell than a silicon solar cell. In this experiment, different types of anthocyanin dyes were used, including blackberries and blueberries, as well as raspberry dye to try and find the most effective dye to be used in the solar cell. Titanium dioxide was also used and compared to zinc oxide cells made with the same dyes. The last variable changed was the time that the cell was dyed for, testing increasing increments of 45, 90, and 135 minutes. After making 36 total cells, the cell which produced the most energy was the zinc oxide cell dyed for 135 minutes in blueberry dye. This cell produced .53 volts under the same conditions as the cell which was tested in the previous experiment. The procedure which was used in this experiment also proved to be more effective, as the zinc oxide cell which was dyed for 45 minutes in raspberry dye produced a maximum of .36 volts, with an average of .335 volts, more than three times as much energy produced as the previously made. The cost of the zinc oxide cell is about $2.70 per volt, which is still more than the $2.10 per volt of a silicon solar cell, but proves a promising possibility for dye-sensitized solar cells in the future.

3:05 PM

Shruthi Ravichandran, Hathaway Brown School

"Targeted Delivery of Immune Agonists for Antitumoral Response of the Tumor Microenvironment"

Tumor-mediated immunosuppression allows tumors to hide from the immune system and avoid recognition. To reverse suppression, antigen-presenting cells (APCs) and other immune cells within the tumor can be targeted and activated from their senescent states. Cyclic diguanylate monophosphate (c-di-GMP), a drug that works within the cytosol of immune cells, is used to release inflammatory cytokines like IFN-β to recruit immune cells and initiate anti-tumor responses. However, freely injected c-di-GMP cannot cross cell membranes and is quickly cleared from the body. It is hypothesized that c-di-GMP loaded into a nanoparticle will more effectively deliver drug into immune cells, which are widespread within the tumor, resulting in more potent therapy. To demonstrate the system's therapeutic potential, macrophages were exposed to 30 µg of c-di-GMP loaded into nanoparticles *in vitro*. C-di-GMP nanoparticles boosted cytokine IFN-β production from murine macrophages by 6-fold compared to free c-di-GMP, while unloaded nanoparticles induced low levels of IFN-β secretion comparable to untreated macrophages. This work shows promise in increasing immune agonist efficacy by targeting and reversing immunosuppressive cell subtypes, especially in aggressive cancers, notably breast and brain cancers. Recent advancements support extending this platform to regulate expression of the inhibitory immune-checkpoint protein V-domain Immunoglobulin Suppressor of T-cell Activation (VISTA). Ongoing work utilizes computational methods to synthesize small-interfering RNA (siRNA) for delivery to the tumor site to regulate VISTA expression. Future work includes *in vitro* and *in vivo* studies testing efficacy of synthesized siRNA molecules, optimizing delivery of nanoparticles, and evaluating therapeutic effects on tumor burden and overall survival.

Thursday, March 11 (Cont.)

3:25 PM

Brigette Fuentes, Hathaway Brown School

"Antibiotics and the Gut Microbiome: is there a Role for a Bacillus-Containing Probiotic Supplement?"

Antibiotic therapy is necessary to treat bacterial infections. As broad-spectrum antibiotics, both clindamycin and vancomycin are effective against a wide range of gram-positive bacteria, both pathogenic and the commensal bacteria in the gut. We tested the repercussions of clindamycin and vancomycin treatments in mice at doses similar to those provided in humans, and assessed for changes in gut microbes and differences between markers of intestinal injury and immune responses. We found that both antibiotics depleted gram-positive and expanded gram-negative bacteria in the cecum. These microbial responses were linked with depletion in mRNA expression of anti-inflammatory receptors, GPR81 and GPR109A, and upregulation in the mRNA expression of macrophage inflammatory protein (MIP2) and intracellular adhesion molecule 1 (ICAM1), and fatty acid binding protein 2 (FABP2), in the proximal colon. A spore-forming probiotic supplement was also tested in tandem with the antibiotic therapy to determine whether it would counteract these negative effects of the antibiotics. Here we found that the probiotic supplementation mitigated the expansion of gram-negative bacteria, induced the mRNA expression of GPR81 and GPR109A in comparison to the control and antibiotic-only groups, and decreased the mRNA expression of FABP2, MIP2, and ICAM1. These data suggest a Bacillus-containing probiotic supplement may support gut health during antibiotic therapy, and further studies are warranted.

4:00 PM - 5:00 PM   Laboratory Research Tours   *Admissions office presents*

Friday, March 12

8:30 AM   **Zoom Login Available**

8:40 AM   Announcements

8:45 AM - 9:45 AM   **Sixth Paper Session**

8:45 AM

Megan Chen, Hathaway Brown School

"KLF2 Regulation of Anti-Phospholipid Antibody (APA) Induced Thrombosis"

The Antiphospholipid Syndrome (APS) is characterized by recurrent arterial and venous thrombosis in small and large vessels accompanied by persistently positive antiphospholipid antibody (APLA) tests. We look at the role of transcription factor Krüppel-like Factor 2 (KLF2), which has previously been shown as a potent tonic repressor of myeloid cell activation (notably neutrophils) as well as an essential determinant of both arterial and venous thrombosis, in APS. Mechanistically, using a myeloid cell line, we show that APLA treatment is associated with decrease in KLF2 expression. Additionally, our clinical observations suggest that the proteasome inhibitor Bortezomib confers potent antithrombotic properties, but the molecular basis remains poorly understood. We show that the thrombo-protection generated by Bortezomib is dependent on myeloid KLF2 specifically. Specifically, our study shows that Bortezomib attenuates APLA-mediated thrombosis by increasing the expression of KLF2 levels. Further, pretreatment of myeloid cells with BZ mitigates the decline in KLF2 expression noted with APLA treatment. Collectively, these studies identify a molecular basis for APLA mediated thrombosis and provide a mechanism for targeted therapy.

SCHEDULE OF EVENTS

9:05 AM

Jacob Rintamaki, Westlake High School

"Deep-Learning Analysis of Extreme Climate Events to Predict Future Losses for Wheat in Kansas"

Climate Change is causing extreme weather events, such as drought, to become more frequent and severe, which is causing increasing losses in the Kansas Wheat industry, the #1 grower and #1 exporter of wheat in the US. To predict future losses for wheat in Kansas until 2050, I created a four-step model, comprised of a multilayer perceptron framework with extreme climate variables as inputs and wheat loss as the output, a combination of Exploratory Factor Analysis and linear regression to predict future values for these extreme climate variables, and a final step where these future climate values were plugged back into the original framework to derive the results. The initial results showed that the optimal topology given a bias-variance tradeoff was the normal topology with an MSE of 12.81 (+/- 3.8 million USD). The exploratory factor analysis showed four principal components could explain 63.21% of the model's variability, and this was used to guide predictions for future Extreme Climate Variable values. The final outputs of the model showed that while losses were increasing across the board from 2020 to 2050, they are projected to increase the most in the Spring Season, 70% from 2020 to 2050, led primarily from the Drought, Hail, and Frost Extreme Climate Variables. These three variables pose the largest risks to Kansas agriculture, which lead to recommendations for the implementation of till farming, hail nets, row covers to help reduce the severity of these specific climate risks, among other policy and practical implementations.

9:25 AM

Emily Qian, Hathaway Brown School

"Carbohydrate Biomarkers in Asthma-Induced Lung Inflammation"

Asthma is the most common chronic inflammatory disease, affecting nearly 10% of the population. Hallmarks of asthma include airway hyperresponsiveness, mucus production, airway inflammation, and tissue remodeling, which collectively contribute to difficulty in breathing and limitations to physical activity. 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, 23 fluorescently labeled carbohydrate binding proteins called lectins were used to examine glycan changes associated with inflamed lung tissue using 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 fucosylation have 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 and that similar changes are likely in human lungs. Importantly, the altered glycans will influence immune cell recruitment and the inflammatory cascade. These data suggest that changes in airway glycans in asthma patients could not only serve as a biomarker of disease severity, but also lead to novel therapeutic applications to reduce inflammatory disease burden.

Announcements and Break (15 minutes)

Friday, March 12 (Cont.)

10:00 AM – 11:00 AM   **Seventh Paper Session**

10:00 AM

Carolyn Glasener, Hathaway Brown School

"ECO/miR-200c Nanoparticles Reduce the Invasiveness and Migratory Abilities of Triple Negative Breast Cancer"

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 have been 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 promising results in silencing oncogenes. The tumor suppressor miR-200c has been shown to be down-regulated in paclitaxel-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, a CCK-8 assay was utilized to show that proliferation of paclitaxel-resistant TNBC was impaired upon upregulation of miR-200c. This evidence shows that miR-200c can be utilized to hinder paclitaxel-resistant TNBC aggressiveness.

10:20 AM

Cyril Andrews, University School

"The Utility of Biomarkers in 1p/19q codeleted Fibrillary Astrocytomas"

The distinction between fibrillary astrocytoma (FA) and oligodendroglioma is important for prognosis and treatment. Some FAs demonstrate IDH1 or-2 mutations and can also have deletions on chromosomes 1p or 19q. The World Health Organization (WHO) defines oligodendrogliomas by the presence of 1p/19 q co-deletion as well as an IDH mutation. Only rare cases of FA have shown co-deletions on chromosomes 1p/19q, which could potentially lead to an erroneous classification, especially if an IDH mutation is also evident. This study retrospectively reviewed the molecular pathology of FAs (N=359). 11 patients (6 males, age ranges 37-86 years; 8 WHO grade IV tumors, 2 grade III and I grade II) who had 1p/19q co-deletions were identified. 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 co-deleted 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 co-deletions 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.

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Friday, March 12 (Cont.)

10:40 AM

John Shin, Hawken Upper School

"Developing COVID 19 Diagnostic Programs Using Artificial Intelligence with Chest Xray Data"

The COVID-19 pandemic has impacted society with billions of people quarantined to slow the viral spread, but despite these efforts, over 45 million cases and 1.2 million deaths have been reported as of late October. Two major problems in containing this virus are the lack of resources in many countries and the difficulty in reliably and quickly diagnosing the disease. One effective solution is the use of AI programs to predict the likelihood of COVID infections using CT scans. These however, are expensive, immobile, require a radiologist, and not readily available in poorer countries. An alternative are chest x-rays which are cheaper, mobile, and accessible in every country. In this study, a convolutional neural network capable of recognizing COVID-19 infected lungs was developed and trained on Google Colab using Pytorch with a dataset of 184 COVID positive and 3580 COVID negative chest x-ray images. Additionally, another neural network was created to identify the severity of a COVID-19 infection by analyzing the spread of the disease in a patient's lung. This model was trained on another dataset with 153 COVID-positive images. This study showed the COVID diagnosis model had a sensitivity of 92-99%, specificity of 98-99%, and an F-1 score of 95-99%. Due to the recent outbreak of COVID 19, both programs were limited by the lack of data, which is expected to improve as more chest x-ray data is collected, potentially making this program a viable tool for detection, risk stratification and treatment planning in symptomatic COVID 19 patients.

Announcements and Break (15 minutes)

11:15 AM – 12:35 PM   **Eighth Paper Session**
11:15 AM

Sophia Laye, Hathaway Brown School

"Identification of Selective Inhibitors of Glioblastoma Stem Cells by High-Throughput Screening"

Glioblastomas (GBM) are the most common primary malignant brain tumor in adults and are recognized as one of the deadliest forms of cancer. Despite aggressive therapy consisting of maximal surgical resection followed by concomitant radiation and temozolomide (TMZ) chemotherapy, GBM remains to have a median survival time of ~ 15 months. The presence of neoplastic cells with characteristics of neural stem cells, referred to as glioma stem cells (GSC), has been suggested to be the root cause for tumor initiation and progression. In an effort to identify agents that specifically inhibit GSC growth, a drug screen of over 3700 bioactive small molecules was recently conducted. The potency of these compounds was tested on six GBM patient derived neurosphere lines (HSR029913, HSR040622, HSR040822, CCF3691, CCF3832, and CCF08-387) at different concentrations. Next, the specificity of these compounds in killing GSCs was determined. To this end, the activities of these compounds were tested against immortalized human neural stem cells (v-Myc hNSCs) and normal human astrocytes (NHA). Twelve compounds were identified in the primary screen to be specific in regard to NSCs. Of these, three compounds (AGSC9, AGSC11, AGSC12) showed enhanced specificity in regard to NSCs and NHAs. Future studies will aim to identify molecular pathways targeted by these compounds and determine their effects on tumor progression and animal survival *in vivo*.

Friday, March 12 (Cont.)

11:35 AM

Hannah Ryan, Hathaway Brown School
"TUARGETING TIAM1 BY USING NOVEL DRUG INHIBITORS TO REDUCE CANCER METASTASIS"

There are over 1.7 million new cancer diagnoses and 600,000 deaths per year. Finding new treatments has become urgent. Cancer occurs through mutations that impact proteins that regulate the cell cycle, like T-cell lymphoma invasion and metastasis-1(Tiam1), a protein associated with cancer metastasis and colon cancer. This protein is a guanine nucleotide exchange factor (GEF) meaning it activates a G protein by switching out guanosine diphosphate (GDP) out for guanosine triphosphate (GTP). Tiam1 specifically targets the G protein Rac1 and together they regulate cell migration. Recent studies show that the phosphorylation of an amino acid sequence (TEXXYVXXL) that is located on the surface of the Dbl-homology (DH) activates Tiam1. We believe that targeting the phosphorylation of this sequence would be an effective treatment for colorectal cancer. By preventing the phosphorylation of the TEXXYVXXL sequence, Tiam1 would be left inactive, and therefore unable to carry out harmful products of mutations in its pathways. We tested small-molecules that could target this phosphorylation via wound scratch assays by wounding wells with confluent cells and then adding different compounds into each well. Next, we tested to see if any of the molecules that impacted cell motility were cytotoxic. With these experiments, we found a short list of small-molecules that are definite or potential inhibitors of the phosphorylation of the TEXXYVXXL sequence.

11:55 AM

Aambar Agarwal, Hathaway Brown School
"IDENTIFYING PHRENIC MOTOR NEURON ENRICHED GENES"

Phrenic motor neurons (PMNs), located in the cervical spinal cord, play a critical role in breathing as they provide motor innervation to the diaphragm muscle to control its contractions. The purpose of this project was to identify PMN-enriched transcripts in the *Mus musculus* spinal cord to determine if the corresponding proteins play a role in PMNs. To identify initial candidates, the Allen Spinal Cord database was surveyed for transcripts expressed in the stereotypical position occupied by PMNs in the cervical ventral spinal cord. This approach identified *Chn1, Cpeb1, Cplx1, Hspb8, Lgals1, Lrsam1, Sncg,* and *Timp3*, which were then validated by in-situ hybridization in mouse embryonic spinal cord. In order to detect RNA transcribed from these genes, oligos were designed to amplify cDNA corresponding to a region of these genes, and reverse transcription was used to make RNA probes. Probe concentration was determined by gel electrophoresis. All but Timp3 were enriched in PMNs as shown by in-situ hybridization and immunofluorescence, and Cplx1 and Sncg were highly enriched in the ventral spinal cord. This result suggests that Cplx1 and Sncg may play a more critical role in PMNs and breathing as opposed to the other genes. To determine if the proteins synthesized by these RNA transcripts are essential for breathing, they could be targeted for mouse knockouts. If these mice develop respiratory problems, it would suggest that these proteins are essential for respiratory function and could be targeted in future treatments for breathing disorders.

12:40 PM – 1:40 PM	**Keynote Presentation**	
	Judges Meeting	
2:00 PM	JSHS Evaluation	
2:15 PM	Closing Remarks/Ceremony	*Virtual Color Guard*
	Awards	
2:45 PM	Adjournment	

KEYNOTE SPEAKER

Nathan Yaussy

KIPP Columbus High School Teacher and
Milken Education Award Recipent

Nathan Yaussy is an alumnus of OJSHS, competing from 2002 to 2004. His project, "Road Mortality of Snakes in the Killdeer Plains Wildlife Area", won him trips to Portland, Colorado Springs, San Diego, China, and even Cleveland. Other past research projects include: counting aquatic insects, pulling invasive plants, planting native dune grass on the shores of Lake Superior, and tracking endangered iguanas in the Caribbean.

He earned his bachelor's degree in biology from Hiram College, and obtained a master's degree from Kent State University. After realizing he wanted to be a teacher, he earned a Woodrow Wilson Fellowship to attend John Carroll University for his Master of Education degree.

Nathan is now in his first year of teaching at KIPP Columbus High School. (Knowledge is Power Program). Prior to this he taught seven years at Fairport Harding High School, where he taught a variety of science courses, from 7th grade science to human anatomy, and quite a few things in between.

In November of 2019, he was awarded the Milken Education Award, which is only given to forty teachers throughout the nation each school year.

Mohammad Alshemary, Aerospace and Natural Science Academy of Toledo
Blue-Enriched Light Effects

Emily Angel & Jaylah Jones, Aerospace and Natural Science Academy of Toledo
Temperature's Affect on Aminal Aggression

Roman Azzarello & Neva Hargreaves, Aerospace and Natural Science Academy of Toledo
Soil Infiltration and Flow Rate

Kaitlin Beck, Aerospace and Natural Science Academy of Toledo
Can Rats Be Trained to Steal?

Charaty Belleville, Aerospace and Natural Science Academy of Toledo
Cat Populations Impact on Bird Feeder Density

Lauren Berryman, Ottawa Hills High School
How Does Social Media Affect the Language Barrier Between Generations?

Mashrafi "Ryaan" Bhuiyan & Anthony Packo, Ottawa Hills High School
Which Disinfectants Work Best to Kill Bacteria?

Brooke Billock, Isabella Gilbert, & Bello Vallero, Aerospace and Natural Science Academy of Toledo
What is the difference of aerosol concentration at an aviation site compared to a park site?

Aster Bishop & Nyx Valdez, Aerospace and Natural Science Academy of Toledo
Suicide Awareness

Jade Brown, Jamila Faour, & Destiny Barber, Aerospace and Natural Science Academy of Toledo
Best Methods in Canine Training

Kelsey Burton, Aerospace and Natural Science Academy of Toledo
Does tank temperature affect guppy behavior?

Lailla Burka, Lakota West High School
Easy Water

Neha Chellu, Beachwood High School
Experimental Design of Subcloning and Identification of the IL10 Gene to Determine Its Role as a Disease Marker of Human Heart Failure

Jailyn Clouse & Chandalyn Hill, Aerospace and Natural Science Academy of Toledo
Water Pollution

Alexander Craig & Kevin Greer, Aerospace and Natural Science Academy of Toledo
Scent Detection Dog versus Fox

Joseph Ellis & Cayden Taylor, Aerospace and Natural Science Academy of Toledo
Water Hyacinth and Algae Control

Patricia Erney, Shawn Fox, & Serenity Gilbert, Aerospace and Natural Science Academy of Toledo
How does trash affect the waters PH?

Noah Graf, Aerospace and Natural Science Academy of Toledo
Water Purification

Lareina Hall, Aerospace and Natural Science A cademy of Toledo
A Study Comparing The Accuracy of a Tangent Clinometer VS the NASA Globe Observer App to Measure Native Trees

Rylee Harrington & Savhanna Hass, Aerospace and Natural Science Academy of Toledo
When feeding fingerling Bluegill with an intermittent fasting feed schedule, how much will the weight and length differ?

Alyssa Harvey & Rachel Peacock, Aerospace and Natural Science Academy of Toledo
Positive Reinforcement in Dog Training

Aliyah Holmes, Aerospace and Natural Science Academy of Toledo
Can Toys Decrease Stress in Goats?

Lorelei Huber, Ottawa Hills High School
Studying the Ratio of Phytohormones in Plants that Undergo Fragmentation

Chloe Hughes, Findlay High School
The investigation on the preparation of activated carbon from high density polyethylene through pyrolysis and chemical activation processes

Joshua Jeyandran, Worthington Christian Upper School
Efficacy Comparison in a Variety of Simulated Novel Inoculation Methods in B73 Zea mays

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Gabriella Jones, Aerospace and Natural Science Academy of Toledo
Environments Effect on Guppy Behavior

Sophia Lands, Aerospace and Natural Science Academy of Toledo
What form of genetic analysis will best determine genetic health and diversity in a severely bottlenecked species?

Frank Lee, Sylvania Northview High School
Optimization of a Novel Heck Reaction for the Monoarylation of Terminal Allylamines

Aaliyah Lipkins, Aerospace and Natural Science Academy of Toledo
Where does the surface temperature stay the highest; areas with lots of shade or areas with full sun?

Adan Lopez & Ashlyn Jaqua, Aerospace and Natural Science Academy of Toledo
Does Supplant have a Affect on Quail Behavior?

Haroon Lughmani, Sylvania Northview High School
The Effect of Deferoxamine and Ferrostatin-1 Treatments on Total ROS in HK-2 Cells

Mariana Machado & Rosemarie Swiatecki, Aerospace and Natural Science Academy of Toledo
How can we help slow down someone's heart rate that is scared of snakes?

Isabella Marzano, Ottawa Hills High School
Extending Shelf Life of Strawberries with Botanical Extracts

Ayanna Martin, Aerospace and Natural Science Academy of Toledo
Bullying

Zoe McCarthy, Ottawa Hills High School
The Effect of Music and Physical Activity on the Brain

Grace Metzger, Hannah Taylor, & Jason Tucker, Aerospace and Natural Science Academy of Toledo
Foxes and Fear

Nathan Mu, University School
Utilizing QSAR Models to Predict Biological Molecule and Polymer Interactions

Hari Murali, Sycamore High School
Investigating the Effect of Twisting and Printing Orientation On the Toughness of 3-D Printed Parts

Azzura Opperman, Chagrin Falls High School
Group Interaction On vs. Offline: A Comparative Study of Minigolf Play

Devon Peace, Malaysia Ratcliffe, & Patrick Vaughan, Aerospace and Natural Science Academy of Toledo
How do Rusty Red crayfish affect the environment?

Mackenzie Perry, Sylvania Southview High School
Identifying symptom severity of Post Treatment Lyme disease: A meta-analysis

Ruth Posta, Aerospace and Natural Science Academy of Toledo
Aggression in Male Betta Fish

Brent Perry & Veronica Yager, Aerospace and Natural Science Academy of Toledo
Grafting

Joseph Reamsnyder, Hilltop High School
Engineering a Modified Brewbaker and Kwack Medium for Cucurbita pepo

Catherine Rhegness, Ottawa Hills High School
Grass Growth and Health with Organic Fertilizer, Chemical Fertilizer, and No Fertilizer

Bryann Rogers, Aerospace and Natural Science Academy of Toledo
Depression Levels in Teens Depending on Ownership of an Animal

Annabelle Rose, Aerospace and Natural Science Academy of Toledo
A comparative study of cover crops on their effectiveness of run off into Ohio waterways

Kandra Starks, Aerospace and Natural Science Academy of Toledo
Ground vs. Pavement

Elijah Snyder, Aerospace and Natural Science Academy of Toledo
Equine Medicine

Molly Szurko, Aerospace and Natural Science Academy of Toledo
Human Trafficking

Nathan Tooman, Aerospace and Natural Science Academy of Toledo
Will the presence of Wildfires in the West Coast affect the air quality, temperature, and humidity in the Midwest?

Lalaine Washington, Aerospace and Natural Science Academy of Toledo
Globe Temperature

Rena So, Worthington Christian Upper School
Apoplast Population Dynamics

Darelle Thornton, Firestone CLC
Convolutional Neural Network, QSAR, and the molecular synthesization of Polyphosphate fire retardant in the creation of aluminum hydroxide cellhouse to replace hexylene Ferrocyanide based fire retardants

Allison "Pearl" Thurston, Ottawa Hills High School
Name Brand Clothing vs. Confidence

Savith Vijendra, Ottawa Hills High School
How does humidity affect the amount of spin that a tennis ball has?

Ashley Wang, Ottawa Hills High School
How has Covid-19 affected students' lives and academic performance?

Diniti Welivita, Sylvania Northview High School
Genetic engineering of fluorescently-tagged cell-surface-anchoring optogenetic switch

Jacob Zajkowski, Anthony Wayne High School
Rhizofiltration Potential of Cyanocobalamin in Lactuca Sativa var Capitata to Increase Vitamin B12 Concentration.

Alana Zicarelli
Are Guppies more Depressed or Active in a Gloomy and/or Happy Environment?

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 • 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 • 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** • Appropriateness of research design and procedures • Identification and control of variables • Reproducibility **2. Engineering, computer science, technology** • 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 • 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 • 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 Needs Improvement	2 Acceptable	3 Good	4 Excellent	Score
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: 2020

1st Place Winner – **Aditi Kumari**, Olentangy HS
- $2,000 College Scholarship sponsored by the United States Army, Navy, and Air Force.

2nd Place Winner – **Anya Razmi**, Hathaway Brown
- $1,500 College Scholarship sponsored by the United States Army, Navy, and Air Force.

3rd Place Winner – **Kavita Parikh**, Ottawa Hilll
- $1,000 College Scholarship sponsored by the United States Army, Navy, and Air Force

4th Place Winner – **Nathan Mu**, University School
- $500 Award sponsored by the College of Arts and Sciences, BGSU

5th Place Winner – **Shruthi Ravichandran**, Hathaway Brown
- $250 Award sponsored by the Department of Chemistry, BGSU
- Placed First at the 2020 virtual National Junior Science and Humanities Symposium Poster Presentation

1st Alternate – **Sohum Kapadia**, University School
- $150 Award sponsored by College of Education and Human Development, BGSU

2nd Alternate – **Dawei Liu**, Sylvania Southview
- $100 Award sponsored by the Department of Physics and Astronomy, BGSU

TEACHER AWARDEE: 2020

Colonel George F. Leist Distinguished Teacher Award
- **Jeremy Nixon**, Ottawa Hills High School
  - $500 School Award sponsored by the United States Army, Navy, and Air Force

Jeremy Nixon, Ottawa Hills High School

1st Place Winner

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

- Presents research paper at the 2021 National JSHS held April 14-17 2021, as a virtual competition

2nd Place Winner

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

- Presents research paper at the 2021 National JSHS held April 14-17 2021, as a virtual competition

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 2021 National JSHS held April 14-17 2021, as a virtual competition

4th Place Winner

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

- Presents poster at the 2021 National JSHS held April 14-17 2021, as a virtual competition

5th Place Winner

$250 Award sponsored by the Department of Chemistry, BGSU

- Presents poster at the 2021 National JSHS held April 14-17 2021, as a virtual competition

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: 2021

Colonel George F. Leist Distinguished Teacher Award

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

JUDGING TEAMS

2021 Ohio Junior Science & Humanities Symposium

Paper Judges

Gwynne Rife, Ph.D.	Professor of Biological Science and Education. The University of Findlay
Jeremy Didion, Ph.D.	Department of Biology, Case Western Reserve University
Daniel Yaussy	United States Department of Agriculture, Forest Service
Anjali Gray, Ph.D.	Professor of Biology & Health Sciences, Lourdes University

Poster Judges

Peggy Adams	Department of Social Work, BGSU
Beth Ash	Program Manager, Project IMPACT, BGSU
Colleen Fitzgerald	Communication Sciences and Disorders, BGSU
Joseph Furgal	Chemistry, BGSU
Jodi Haney	College of Education & Human Development, BGSU
Sarah Guensche	Family & Consumer Sciences (College of EDHD), BGSU
Sudershan Jetley	Engineering Technologies, BGSU
Jong Kwan "Jake" Lee	Computer Science , BGSU
Bob Midden	Chemistry, BGSU
Jeffrey Miner	Biological Sciences, BGSU
Tulsi Patel	Air Force Research Laboratory, BGSU
MD Sarder	ngineering Technologies, BGSU
Wan Shen	Public and Allied Health, BGSU
Eileen Underwood	Biological Sciences, BGSU
Margaret Weinberger	Sociology, BGSU
Rick Worch	School of Teaching and Learning, BGSU
Haowen Xi	Physics and Astronomy, BGSU
Jenjira Yahirun	Sociology, BGSU
Yu Zhou	SEES/Geography, BGSU

2021 Ohio Junior Science & Humanities Symposium

Dr. Emilio Duran, NWO Director & Ohio JSHS Director, School of Teaching and Learning, BGSU
Dr. Dawn Shinew, Dean of College of Education and Human Development, BGSU
Susan Stearns, NWO Assistant Director, BGSU
Lisa Addis, NWO Graphic Designer/Marketing Manager, BGSU
Jenna Pollock, NWO Education Program Manager, BGSU

Pre-screening Paper Judges
Jerry Szelagowski, retired teacher
Hans Glandorff, BGHS science teacher
Gabriel Matney, BGSU College of Education faculty

Bowling Green State University Virtual Tours Options:
BGSU virtual site: www.bgsu.edu/virtual
Condensed Campus Tour (a little over 6 mins): https://www.youtube.com/watch?v=5d9fg99HezI&feature=youtu.be
"The Sciences" at BGSU Facebook Live recorded tour: https://fb.watch/3tjFwtlfvl/

Bowling Green State University Sponsors
College of Arts and Sciences
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Department of Biological Sciences
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Department of Sociology

Special Thanks
BGSU Office of Conference & Event Services

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
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
2014	Emily Merickel	Gahanna Lincoln HS	2019	Garret Blum	University 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
2011	Robert Sudomir	Louisville HS	2017	Tyler Bruns	Gahanna Lincoln HS
2012	Fred Donelson	Gahanna Lincoln HS		Rebekah Rice	Gahanna Lincoln HS
2013	Abbie Smith	Hilltop Junior HS	2018	Sara Laux	University School
2014	Blythe Tipping	Sylvania Southview HS	2019	Kathryn Nelson	Sylvania Northview HS
2015	Matt Wallschlaeger	Big Walnut HS	2020	Jeremy Nixon	Ottawa Hills High School
2016	Deborah Bogard	Delaware City Schools			

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
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 HS
2015	Pallavi Lanka	Sylvania Southview HS	2019	Hannah Doris	Sylvania Northview HS
	Srinath Seshardi	Village Academy, Powell		Garret Blum	University School
2016	Graham Lane	Univ. School, Gates Mills	2020	Aditi Kumari	Olentangy HS
	Rama Balasubramaniam	Dublin Coffman HS		Anya Razmi	Hathaway Brown

SYMPOSIUM EVALUATION

Please remember to complete the online evaluation for the 2021 National Junior Science & Humanities Symposium (JSHS). Your input is highly valued and necessary for the continuing success of the Ohio JSHS. The survey will open on March 12 at 1:00 pm and you will receive an email reminding you to take the survey. Thank you in advance for your cooperation!

JSHS Regional Student Survey Link: https://www.cvent.com/d/mjqm05

JSHS Regional Teacher/Mentor Survey Link: https://www.cvent.com/d/njqm0t

If you have any questions about these surveys or your participation in the evaluation study please contact the AEOP Evaluation team at NC State University – Dr. Carla C. Johnson at carlacjohnson@ncsu.edu.

Thank you so much for your participation in the evaluation of JSHS!

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