



**March 19-21**  
**2 0 1 4**

**imagine.design.create**

**The 51<sup>st</sup> Annual Ohio Junior Science & Humanities Symposium**  
**hosted by Bowling Green State University**

Sponsored by

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

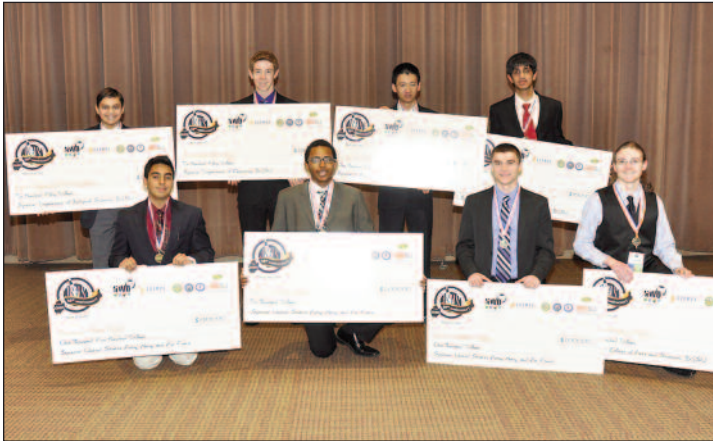
In cooperation with The Academy of Applied Science and with the support  
of the Departments of the Army, Navy, and Air Force



**www.ojshs.org**

The National Association of Secondary School Principals has placed this program on the  
NASSP National Advisory List of Student Contests and Activities for 2013-2014

# 2013 Ohio JSHS Award Winners



**Top Row (L to R)** Mitchell Pallaki, Ryan Richards, David Wang, and Niket Yadav

**Bottom Row (L to R)** Peeyush Shrivastava, Bluyé DeMessie, Evren Gokcen, and Elijah Bedel



2013 Ohio JSHS Participants

# Table of Contents

Welcome .....	2
2014 Ohio JSHS Schedule "At A Glance" .....	3
2014 Ohio JSHS Schedule for March 19-21, 2014 .....	4-17
Keynote Speaker .....	18
Poster Presenters .....	19-20
Judges Score Sheet	
Paper Presenters .....	21
Poster Presenters .....	22
2013 Ohio JSHS Awardees .....	23-24
2014 Ohio JSHS Awards .....	25-26
Judging Teams .....	27
Acknowledgments .....	28
2014 Advisory Board .....	29
History of the Ohio JSHS .....	30
Cumulative Awards	
Thomas Alva Edison Award .....	31
The Colonel George F. Leist Distinguished Teacher Award .....	32
Ohio JSHS Presenters to the National JSHS .....	33



# Welcome

Welcome to Bowling Green State University (BGSU):

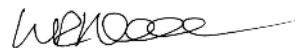
We are delighted to once again welcome you to the 51<sup>st</sup> Annual Ohio Junior Science and Humanities Symposium. The symposium is hosted by the Northwest Ohio Center for Excellence in STEM Education (NWO) and the School of Teaching and Learning at BGSU with the financial support of the U.S. Army Research Office, U.S. Office of Naval Research, and U.S. Air Force Research Office. 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. To quote a former JSHS participant, “[At JSHS] I learned a tremendous amount of science, got to meet other high school students who shared my interests in science, and learned that I could succeed at any program that I chose to pursue.” The Junior Science and Humanities Symposium program also awards thousands of dollars in scholarships to acknowledge the extraordinary levels of achievement of the participants.

Each year, more than 48 regional JSHS symposia are held throughout the United States and in the Department of Defense Schools of Europe and the Pacific. Two student finalists and three delegates from the Ohio JSHS program will be chosen (all expenses paid) to attend the National JSHS that takes place in Washington D.C., April 23 – 27, 2014. The Ohio JSHS first and second place finalists present their research papers at this National Symposium to compete for additional scholarship money and for six opportunities to represent the United States at the London International Youth Science Forum (LIYSF). Since 1966, fifty-seven Ohio JSHS winners have presented papers at the National JSHS. Sixteen of these students have subsequently presented their papers at the LIYSF in London, England. In recent years, two winners of the Ohio symposium, Aaditya Shidham (2008) and Keith Hawkins (2009), have won the top national award. Clearly Ohio has many high-achieving young people. 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 2014 Ohio Junior Science and Humanities Symposium to be a very beneficial and educational experience. Thank you for joining us!



Dr. Emilio Duran  
Ohio JSHS Director



Dr. W. Robert Midden  
NWO Director

# Schedule “At a Glance”

## Wednesday, March 19

4:00 PM – 6:30 PM	Check In	<i>Hampton Inn, Bowling Green</i>
6:45 PM	Mandatory Meeting for ALL Participants	<i>Great Room, Hampton Inn</i>
7:30 PM – 8:00 PM	Pizza Snack	<i>Great Room, Hampton Inn</i>
8:00 PM	Board Buses to <i>Ice Arena, BGSU</i>	
8:30 PM – 9:50 PM	Ice Skating	<i>Ice Arena, BGSU</i>
10:00 PM	Board Buses to <i>Hampton Inn</i>	
11:00 PM	Students Report to Assigned Rooms	

## Thursday, March 20

6:30 AM - 7:45 AM	Breakfast	<i>Great Room, Hampton Inn</i>
7:50 AM	Board Buses to <i>Olscamp Hall, BGSU</i>	
8:30 AM	Opening Session	<i>Olscamp Hall 101B</i>
8:45 AM - 9:45 AM	<b>First Paper Session</b>	<i>Olscamp Hall 101B</i>
<b>Break (15 minutes)</b>		
10:00 AM - 11:00 AM	<b>Second Paper Session</b>	<i>Olscamp Hall 101B</i>
10:00 AM - 3:30 PM	Concurrent Poster Judging	<i>Olscamp Hall 101A</i>
<b>Break (15 minutes)</b>		
11:15 AM - 12:15 PM	<b>Third Paper Session</b>	<i>Olscamp Hall 101B</i>
12:20 PM - 1:20 PM	Lunch	<i>The Oaks Dining Hall</i>
1:30 PM - 2:30 PM	<b>Fourth Paper Session</b>	<i>Olscamp Hall 101B</i>
<b>Break (15 minutes)</b>		
2:00 PM	JH Students to Planetarium	
2:45 PM - 4:05 PM	<b>Fifth Paper Session</b>	<i>Olscamp Hall 101B</i>
4:05 PM - 5:05 PM	BGSU STEM Tours	
5:10 PM	Board Buses to <i>Hampton Inn</i>	
6:10 PM	Board Buses to <i>Olscamp Hall, BGSU</i>	
6:30 PM - 8:45 PM	<b>Banquet/Keynote Presentation</b>	<i>Olscamp Hall 101A/B</i>
9:00 PM	Board Buses to <i>Hampton Inn</i>	
9:00 PM - 11:00 PM	Open Activities/Adult Reception	<i>Pool; Great Room, Hampton Inn</i>
11:00 PM	Students Report to Assigned Rooms	

## Friday, March 21

6:30 AM - 7:45 AM	Room Checkout/Breakfast	<i>Great Room, Hampton Inn</i>
8:00 AM	Board Buses to <i>Olscamp Hall, BGSU</i>	
8:40 AM	Announcements	<i>Olscamp Hall 101B</i>
8:45 AM - 9:45 AM	<b>Sixth Paper Session</b>	<i>Olscamp Hall 101B</i>
	Concurrent Poster Viewing	<i>Olscamp Hall 101A</i>
<b>Break (15 minutes)</b>		
10:00 AM - 12:00 PM	Peer Poster Judging, Junior High Students	<i>Olscamp Hall 101A</i>
10:00 AM - 11:00 AM	<b>Seventh Paper Session</b>	<i>Olscamp Hall 101B</i>
<b>Break (15 minutes)</b>		
11:15 AM - 12:15 PM	<b>Eighth Paper Session</b>	<i>Olscamp Hall 101B</i>
	Concurrent Poster Viewing	<i>Olscamp Hall 101A</i>
12:15 PM - 1:30 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	Group Photograph	<i>Center Stairwell, Student Union</i>
2:00 PM	Students Dismantle Posters	<i>Olscamp Hall 101A</i>
2:30 PM	Awards Ceremony	<i>Olscamp Hall 101B</i>
3:00 PM	Adjournment	

# Schedule of Events

## Wednesday, March 19

4:00 PM - 6:30 PM	Check In	<i>Hampton Inn, Bowling Green</i>
6:45 PM	Mandatory Meeting for ALL Participants	<i>Great Room, Hampton Inn</i>
7:30 PM - 8:00 PM	Pizza Snack	<i>Great Room, Hampton Inn</i>
8:00 PM	Board Buses to <i>Ice Arena, BGSU</i>	
8:30 PM - 9:50 PM	Ice Skating	<i>Ice Arena, BGSU</i>
10:00 PM	Board Buses to <i>Hampton Inn</i>	
11:00 PM	Students Report to Assigned Rooms	

## Thursday, March 20

6:30 AM - 7:45 AM	Breakfast	<i>Great Room, Hampton Inn</i>
7:50 AM	Board Buses to <i>Olscamp Hall, BGSU</i>	
8:30 AM	Opening Session	<i>Olscamp Hall 101B</i>

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

### Opening Remarks

**Robert Midden, Ph.D.**, Northwest Ohio Center for Excellence in STEM Education Director, Associate Professor of Chemistry, Bowling Green State University

**LTC Douglas A. Mohler**, U.S. Army, Commander /Professor, Military Science, Bowling Green State University

**Ms. Blythe Tipping**, Ohio JSHS Assistant Coordinator, Science Teacher, Sylvania Southview High School

8:45 AM - 9:45 AM **First Paper Session** - *Session Presider: Tyler Allen* *Olscamp Hall 101B*  
*Session Moderator: Fred Donelson*

8:45 AM

### **Aditya Jog, William Mason High School**

*"An Investigation of Electrowetting for Variable Focus Liquid Lenses"*

The feasibility of electrowetting for creating variable focus liquid lenses was investigated in this project. It was hypothesized that voltage applied to a conductive drop placed on a dielectric substrate would experience change in shape sufficient to cover the range of focal lengths typically required for vision correction. To test the hypothesis, a small droplet (diameter less than capillary length) was placed on a glass substrate consisting of an Indium-Tin-Oxide conductive layer with 300-nm-thick Parylene-HT dielectric coating. The droplet was photographed at different applied voltages and the contact angle was determined by image processing. The experiment was repeated with an added surfactant and a water droplet immersed in silicone oil. The change in the radius of curvature of the droplet and focal length of the liquid lens was calculated. By changing the applied voltage from 0 to 45 V the contact angle changed from 65° to 48° for water, 35° to 22° with the surfactant, and 109° to 70° with oil. Based on the contact angle measurements, a 25-mm-diameter water-oil lens can cover -4.5 to 4.5 diopters with vertical sides. This range can be expanded to -6.5 to 6.5 diopters by changing side angles by +/- 20 degrees.

# Schedule of Events

## Thursday, March 20 (Cont.)

9:05 AM

### **Mitchell Pallaki, Saint Ignatius High School**

#### “The Optimal Wind Farm Configuration Analysis”

An increasingly used renewable resource is wind power. Wind turbines are effective electricity generators. Wind farm configuration or the positioning of wind turbines is important in optimizing electrical energy production. By analyzing various wind farm configurations, engineers can design the optimal wind farm taking into account wind speed and terrain. This study tested four configurations of wind turbines: Straight Line, Triangle, Inverted Triangle, and Diagonal. Six turbines, 40 cm tall, were tested for energy output at high and low fan wind speeds, 3 and 6 km/hr respectively on a flat and elevated plane. Turbines were placed equidistant from each other and the height was 11.4 cm between elevations. The hypothesis stated that all configurations would generate more electricity on high speed than low speed. The elevated plane configurations were hypothesized to yield more energy than the flat terrain regardless of speed. The flat terrain, inverted triangle configuration and elevated terrain triangle configuration were hypothesized to produce the most energy. This is based on the movement and speed of wind at different altitudes. There were N=320 total trials, 20 trials for the four configurations, on two terrains, and at two wind speeds. The configurations production from greatest to least: Elevated plane: inverted triangle (1,759 mV), triangle (1,577mV), horizontal (1,566 mV), and diagonal (779 mV). The total average energy was 710 mV. Flat plane: diagonal (1,461mV), inverted triangle (1,362 mV), horizontal (1298 mV), and triangle (1,069 mV). The total average energy was 649 mV. Of all the energy produced in all configurations and elevations, 62% of it came from the high speed compared to 38% for the low speed. The diagonal contributed 7% of total energy produced compared to approximately 15% contribution from the others. All configurations yielded more electrical energy on high versus low speed. Every configuration yielded more electrical energy on the elevated plane except the diagonal. Based on this study, the inverted triangle on an elevated plane and the diagonal on a flat plane yield the most energy.

9:25 AM

### **Disha Shidham, Upper Arlington High School**

#### “Analysis of Cell-Secreted Microvesicles Related to Cancer Diagnosis”

Cell-secreted microvesicles (MVs) have been observed to play essential roles in cell-to-cell communication. MVs secreted from cancer cells, in particular, can deliver microRNA to cells in the surrounding tissue create a tumor microenvironment that promotes angiogenesis and releases metalloproteases. The goal of this study is to identify membrane proteins on the surface of MVs secreted from the MEC1 chronic lymphocytic leukemia cells using cryogenic transmission electron microscopy (cryo-TEM) and antibodies specific for the membrane proteins that are attached to gold nanoparticles. A preliminary determination of MEC1 MV morphologies was first completed using cryo-TEM imaging and Image-J software. In this analysis 403 MVs were characterized based on MV shape, bilayer structure, diameter, size distribution, and bilayer thickness. The MEC1 MVs were found to be spherical in shape with a single bilayer encapsulating electron dense material. MV diameters ranged from 23 nm to 475 nm with the mean being  $83 \pm 26$  nm. Average bilayer thickness for the larger MVs (diameters  $>150$  nm) is  $6 \pm 1$  nm. The average bilayer thickness for the smallest MVs (diameters  $\sim 50$  nm) is essentially the same:  $6 \pm 1$  nm. The second step of this investigation is to establish an experimental protocol for labeling MVs with gold nanoparticles and imaging the labeled MVs using cryo-TEM. To this end, synthetic liposomes with streptavidin (SA) conjugated to lipids on the outer membranes were produced to which gold nanoparticle-labeled, anti-SA antibodies could be bound. Four different preparations of the SA-conjugated liposomes were formulated: (1) 1:2 molar ratio of SA to biotin-PE with a 0.5% (by weight) biotinylated PE in the liposome formulation, (2) 1:2 molar ratio of SA to biotin-PE with a 1% (by weight) biotinylated PE, (3) 1:4 molar ratio of SA to biotin-PE with a 0.5% (by weight) biotinylated PE, and (4) 1:4 molar ratio of SA to biotin-PE with a 1%

# Schedule of Events

## Thursday, March 20 (Cont.)

(by weight) biotinylated PE in the formulation. Each solution was incubated with gold nanoparticle-labeled anti-SA antibodies and imaged using cryo-TEM to visualize binding of the labeled antibodies to the liposomes. Initial results show binding was inhibited by liposome concentrations that were too high, in addition to possible aggregation of liposomes as a result of cross-linking by multivalent SA.

### Announcements and Break (15 minutes)

10:00 AM - 3:30 PM **Concurrent Poster Judging** *Olscamp Hall 101A*  
10:00 AM - 11:00 AM **Second Paper Session** - *Session Presider: Coti Puhl* *Olscamp Hall 101B*  
*Session Moderator: Robert Sudomir*

10:00 AM

#### **Hannah Meller, Pettisville Local Schools**

*"The Effect of Various Barley Straw Applications on the Growth of *Chlorophyta*"*

The objective was the effect of various barley straw applications on the growth of *Chlorophyta*. The hypothesis was algae treated with chlorine, and then barley straw would be more affective, because treatment with chlorine would kill the algae and the addition of barley straw would prohibit new algae growth. Algae were started under 100watt grow lights with two gallons of distilled water, 1.6L of algae water, and 30 drops of fertilizer to each bucket. Six one gram barley straw pouches were made. Once algae bloomed, chlorine and barley straw pouches were added to assigned sets of three buckets. One set of buckets had no additional treatment. 345µL chlorine was added to a second set of buckets. Barley straw pouches were added to a third set, and the fourth set of buckets 345µL chlorine was added and 24 hours later a barley straw pouch was added. Water was tested with the spectrophotometer and turbidity probe to measure algae present. pH and temperature were taken. The data collected was inconclusive, and the experimental design needs to be evaluated along with further testing. The data for turbidity indicates chlorine has the least amount of particles suspended with the other three groups vary in a similar pattern and with a slight increase. pH and temperature was consist through the various groups. Chlorine samples had the most absorbance, and chlorine with barley straw application had the second most absorbance. Barley straw had the third greatest absorbance, and the algae had the least amount of absorbance.

10:20 AM

#### **Ragavi Lanka, Sylvania Southview High School**

*"The Synthesis of 6-deoxy Gual Derivatives for the Stereoselective Synthesis of S-linked Digitoxin"*

Heart diseases are the leading cause of death in the United States of America; however, the number of cases has declined significantly due to pharmacological advancements in the study of cardiac glycosides, therapeutic agents derived from naturally occurring materials. The most commonly used cardiac glycoside is digitoxin, which is utilized to treat cardiac arrhythmia. Despite its usage as a treatment, digitoxin has various negative side effects that have led to renal kidney failure. In order to remove these symptoms, digitoxin has been formed through the synthesis of analogs, synthetic molecules; however, most of these analogs continue to have detrimental effect on certain human cell lines. It was, therefore, hypothesized that S-Linked digitoxin, an analogue of digitoxin, can be prepared by glycosylating a simple thiol acceptor with 6-deoxy gual donor through the catalysis of metals such as Tin to form thioglycosidic linkage. The formation of gual occurred through a six-step reaction using galactose pentaacetate as the starting material, and three trials were completed, resulting with 92 percent yield. This process included various reaction methods such as reduction, thioglycosylation, deacetylation, and Ferric rearrangement. Thus, this implies that 6-deoxy gual can be used to form the thioglycosidic linkages in S-linked digitoxin.



# Schedule of Events

## Thursday, March 20 (Cont.)

10:40 AM

### **Michaela Dean, Rutherford B. Hayes High School**

“Food to Energy: Energy Production in Bio-Hybrid Dye-Sensitized Solar Cells”

Alternative energy has a long way to go before it can handle the growing energy needs of the world. By using plants as the main component in a solar cell, it might be possible to use what nature has already perfected to increase the efficiency and decrease the cost of solar energy. The goal of this project was to find the best plant dye to use in a dye-sensitized solar cell and compare the performance to a typical silicon one. Raspberry, blueberry, spinach, and soy dyes were used. The results showed that the silicon cells produced over 400 millivolts less electricity than all of the dye-sensitized cells; soy and raspberry produced the most electricity. The standard deviations between soy and raspberry overlapped, making them statistically equal. Soy only overlapped with raspberry; raspberry overlapped with all of the other dye types. Silicon cells were projected to produce the most electricity followed by spinach, then raspberry, blueberry, and soy. Silicon has already been commercially perfected; spinach is used by most researchers in bio-hybrid cells; the cell design used was created for anthocyanin; and soy was used because of the commercial importance of soy products. The most likely explanation for the result was the intensity of color of the dye on the cells. Raspberry and blueberry were very dark; spinach was extremely light, and soy was in the middle. Continuations of this project could work to perfect this design, create arrays, make the cells bigger, and use different designs with the same dyes.

Announcements and Break (15 minutes)

11:15 AM - 12:15 PM    **Third Paper Session** - *Session Presider: Chris Kerney*                      *Olscamp Hall 101B*  
*Session Moderator: Cristin Hagans*

11:15 AM

### **Eric Zhu, Sylvania Southview High School**

“Examining Stress Reduction on *mua-6* and *ifb-1* Intermediate Filament Weak Points in *C. elegans*”

An essential element of the cytoskeleton is intermediate filaments (IFs). A ubiquitous set of proteins, they serve the purpose of structural support to the various components of the cell and are critical to the absorbance of mechanical stress. More importantly, a loss of function in these IFs has been shown to lead to a variety of conditions, for instance desmin-related myopathy. Thus, given that the functions of IFs are linked to structural support, it was hypothesized that reducing stress on an area where IFs had been weakened would lead to a decrease in the symptoms that the defect may bring. *Caenorhabditis elegans*, a commonly used nematode, was the model organism in this project. To study the effects of stress reduction on IF defects, the *mua-6* and *ifb-1* mutations were observed, which create structural defects in the IFs IFA-2 and IFB-1, respectively. Both mutations were placed under two methods of stress reduction; immersing the nematodes in a soft agar environment, where movement would create less stress, and introducing a separate mutation that would restrict their movement. After a constant growth period, the phenotypic expressions of both mutations in both conditions were observed and compared to their respective controls. Overall, the results supported the initial hypothesis, and both methods of stress reduction significantly reduced the expression of the genetic defect ( $p < 0.0001$ ).

# Schedule of Events

## Thursday, March 20 (Cont.)

11:35 AM

### **Lauren Jenkins, Ottawa Hills High School**

“Comparison of Horse Shoe Wear on Dirt and Synthetic Racetrack Surfaces”

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

11:55 AM

### **Emily Merickel, Gahanna Lincoln High School**

“The Development and Testing of a Prototype for an Enclosed Autonomous Oxygen-Regenerating Environment”

The purpose of this project was to develop a prototype for an enclosed autonomous oxygen-regenerating environment. Oxygen regeneration was chosen for study in consideration of the advancing field of space exploration, long term space travel, and space colonization. An oxygen-regenerating environment could allow for humans to live for indefinite lengths of time in hostile environments, such as in space or even underwater. A NXT brick was programmed to regulate carbon dioxide and oxygen in the prototype environmental chamber, along with a carbon dioxide scrubber that counterbalanced oxidation with the photosynthesis of algae, and a humidity scrubber that removed humidity from the air utilizing calcium chloride. Primary testing consisted of several phases. In the first phase, carbon dioxide, oxygen, relative humidity, and temperature sensors were inserted into the prototype environment and used to chart data. During the second phase, carbon dioxide scrubbers were assessed for their capabilities to produce oxygen and remove carbon dioxide. Next, several mice were individually placed into standardized sealed chambers with sensors to determine average amounts of oxygen and carbon dioxide exchanged. Finally, the newly constructed prototype chamber was tested with a candle without using the algae scrubber chambers to confirm that the environment was adequately sealed. Initial results proved encouraging. Though the carbon dioxide scrubbers did not generate enough oxygen to counterbalance the oxidation of three mice, they were able to counterbalance two mice for several hours. Work continues on controlling humidity and using feedback loops with sensors to enable this system to be essentially autonomous.

12:20 PM - 1:20 PM

**Lunch**

*The Oaks Dining Hall*

1:30 PM - 2:30 PM

**Fourth Paper Session** - *Session Presider: Matthew Seljan Olscamp Hall 101B*  
*Session Moderator: Matt Wallschlaeger*

# Schedule of Events

## Thursday, March 20 (Cont.)

1:30 PM

### **Chrysta Beck, Pettisville Local Schools**

“The Effects of *Allium sativum* on the Development and Meat Quality of *Gallus domesticus*”

The problem studied the effects of *Allium sativum* on the development and meat quality of *Gallus domesticus*. The discovery of natural coccidiostats is a step towards reductions in the amount of chemical products applied to poultry. The hypotheses were the broilers treated with garlic solution on wire flooring will grow the largest efficiently (H1), the broilers treated with garlic solution will have the most desirable meat quality (H2), and garlic will prevent the development of coccidia in broiler flocks (H3). The procedure included collecting data on food consumption, body mass, and water consumption over 6 weeks. Data on moisture retention and coccidian prevention were tested on meat and viscera. Broilers grown on wire flooring/ no garlic grew the largest (average of 2.348 kg). Broilers on wire floors/ garlic solution grew the least (average of 2.144 kg). An ANOVA statistical analysis revealed that there was a difference in growth between broilers, but the difference was marginally significant ( $F=2.617$ ,  $p=0.067$ ). Broilers on wire flooring/ no garlic had largest average food consumption but had the least efficient food consumption to body mass ratio. The broilers grown on wire flooring/ garlic had the least moisture loss (0.020 kg). Fecal flotations showed that broilers treated with garlic had 0-1 coccidian/ high power lens sweep. Broilers with no garlic had 12-15 coccidian/ high power lens sweep. H1 was not supported, H2 was supported, and H3 was supported.

1:50 PM

### **Laura Stegner, Gahanna Lincoln High School**

“Developing a Biodegradable Polymer from Soy Protein Isolate for Use in Three-dimensional Printing”

The purpose of this project was to explore the development of a soy-based biodegradable polymer that would be suitable for use in three dimensional [3D] printing. Soy protein isolate [SPI] was selected as the base of this plastic due to its numerous economic and environmental benefits. SPI failed to properly plasticize with the given chemical formula, leading to the integration of cornstarch into the base mixture. Concentrations with a base of 0%, 20%, 25%, 30%, and 35% SPI, with the remaining percentage being cornstarch, were tested. The plastic was tested for its tensile strength, elongation, water absorption, rate of degradation, and ability to melt and reform. Test strips were created using a custommade stainless steel mold to fit American Society for Testing Materials [ASTM] standards of testing. The tensile strength test yielded results that suggest that the 0% SPI plastic produced significantly stronger plastic than any mixed concentration [ $p<0.015$ ]. The elongation test was unable to be completed due to warped, brittle test strips that proved unusable. Water absorption test results proved inconclusive, with further testing recommended. The degradation test suggests that certain concentrations of SPI plastic degrade at a significantly faster rate than other concentrations. The plastic did not show any signs of being able to melt or reform, making it a thermoset. Although biodegradable, results suggest this plastic does not show promise for the purpose of 3D printing. A new approach using algal waste as the main biodegradable component is being explored.

# Schedule of Events

## Thursday, March 20 (Cont.)

2:10 PM

### Allison Clausius, Sylvania Southview High School

“Environmental Impact Comparison between Various Photovoltaic Modules”

Research on photovoltaic (PV) cells has been on the rise as a promising energy alternative. New PV types have been recently developed, such as CZTS. Though studies have shown CZTS to be promising, there has been little to no research on its environmental impacts. In this study, GaBi 6.0 software was used to formulate a life cycle assessment (LCA) model for CZTS. LCA models were also created for amorphous silicon (a:Si), mono-crystalline silicon (mono-Si), poly-crystalline silicon (poly-Si), copper indium gallium diselenide (CIGS), and cadmium telluride (CdTe). After creating the models, the Tool for the Reduction and Assessment of Chemical and other environmental Impacts (TRACI) was used to calculate the total global warming potential and ecotoxicity potential for each PV type. Water use was calculated using GaBi. The PV module types were compared using these categories. Prior work suggests that CZTS has the lowest environmental impacts in the three categories listed above; however, our model shows that CZTS is the highest emitter of green house gases (GHG) and has the highest water use of the materials analyzed. CZTS did have a low ecotoxicity potential. Through further research on CZTS, high module efficiencies may be achieved, making it beneficial to pursue more research on environmentally safe production methods for this technology to lower the GHG emissions and water usage.

Announcements and Break (15 minutes)

2:00 PM

### Junior High Students to Planetarium

2:45 PM - 4:05 PM

### Fifth Paper Session - Session President: Nicole Kiefer

Olscamp Hall 101B

Session Moderator: Cristin Hagans

2:45 PM

### Christian Grimme, Gahanna Lincoln High School

“Development of a Virtually Controlled Robotic Hand”

The purpose of this project was to make an economic version of NASA's robotic hand from Robonaut 2. Robonaut 2 has distinct features such as remote control from a different location, direct human control of robotic hands, and the ability to move about in a wide variety of environments. Three distinct features from Robonaut 2 were replicated: remote control, direct manipulation of the robot via a virtual control, and mobility while adding the simplicity of a single control hand. For the first challenge, remote control, the project used Bluetooth. By controlling the robotic hand via Bluetooth, it is a simple process to change to radio signals that could travel long distances in outer space. The second challenge of direct manipulation of the robot was tackled by a precise combination of d-Flex sensors, gyroscopes, and accelerometers. All of these inexpensive control and spatial sensors are easily obtainable from various resources. The third and final challenge of movement is complex and this study went through two options. One of the options had to be abandoned due to time constraints, limited component availability, and overall project complexity. The study finally settled on Robonaut 2's Remote Operational Vehicle [ROV] form, Centaur 2, and used it as an alternate model to accomplish the challenge of mobility. The replica hand of Robonaut 2 was able to tackle all of its challenges with success. Each finger and thumb were mathematically modeled for time versus ability to lift mass and each showed good fits for exponential relationships ( $R^2 = .81-.97$ ). Gripping strength varied from 6 - 10 Newtons. As the payload increases, so does the time needed to move the motors that control the hand. The hand's ROV system was also able to move faster in reverse than forwards, and the programming will need modifications to address this problem. The simplistic idea in which the replica was created and its success in completing all challenges with promising results encourages one to continue further research and modification to the prototype.

# Schedule of Events

## Thursday, March 20 (Cont.)

3:05 PM

### **Megan Zhao, Brecksville-Broadview Heights High School**

“Exploration of Potential Thermoelectric Material by the Synthesis of Different Samples of Kesterite”

Kesterite, a quaternary semiconductor, is a compound that possesses optical properties. Optical compounds enable higher efficiency in energy transfer and have suitable band gap energies which have many applications in materials science. In the process of synthesizing kesterite  $[(\text{Cu}-2\text{Sn})\text{xZn}_{3(1-\text{x})}\text{S}_3]$ , a potential material for future technological advancements such as in thin film solar cells and thermoelectric devices, different methods were experimented with in order to create an optical compound. In one way of varying the procedure, different values of x were substituted into the empirical formula of the compound- starting as low as 0.10 and as high as 0.80, thus producing compounds with unique stoichiometry. Yet another variable that changed throughout the synthesis of  $[(\text{Cu}-2\text{Sn})\text{xZn}_{3(1-\text{x})}\text{S}_3]$ , was to use different sources of sulfur such as through elemental sulfur and thiourea. The samples of kesterite made from thiourea rather than elemental sulfur had a much simpler procedure that required lower temperatures and was formed more quickly. After the samples were washed of excess solvent, they were run through various machines such as elemental dispersive x-ray machine and x-ray diffraction in order to analyze the resolution of the elements in the samples and to confirm the identity of the samples as kesterite, respectively. The study found that the optimal value of x was at the 0.45 stoichiometric results and that the use of elemental sulfur as the component of sulfur for synthesis produced better samples of kesterite than using thiourea.

3:25 PM

### **Dhweeja Dasarathy, Hawken Upper School**

“Alteration in androgen receptor expression by the 3’ untranslated region”

Prostate cancer is the 2nd most common cancer in men that affects nearly 240,000 males with about 29,700 deaths annually. Androgen blocking is the mainstay of therapy but resistance to treatment is common. Understanding the molecular mechanisms of regulation of androgen receptor (AR) will permit the development of novel, molecular targeted therapies. It was hypothesized that the 3’UTR transcriptionally regulates the expression of AR. Studies were performed in PC-3 cells grown to differentiation. Amplification of constructs was done using PCR, protein assays using immunoblots, and cloning using appropriate restriction enzymes and transfection using a lipofectamine protocol. Transcriptional regulation of AR was examined by expression of a plasmid containing AR gene with and without the 3’UTR into PC-3 cells. AR 3’ UTR constructs were amplified, sequence confirmed and cloned between SpeI and SacI sites in pMIR-REPORT luciferase vector using the cloning protocol. The expression of the AR protein at different conditions was quantified by immunoblotting. Transfection of the 3’UTR decreases AR gene expression confirming that 3’UTR poses a regulatory effect on AR gene. An *in-vitro* model for determining the mechanisms of AR regulation in prostate cancer was established and showed that full length 3’UTR is necessary for transcriptional regulation of AR.

# Schedule of Events

3:45 PM

## Jesse Rines, Big Walnut High School

“Grätzel Cells: Optimizing the Future of Energy”

This comprehensive study consists of two experiments to determine the optimal concentrations of titanium dioxide ( $\text{TiO}_2$ ) and iodide electrolyte in Dye-Sensitized Solar Cells, or Grätzel cells. Each of these chemicals is crucial to the effectiveness of the cells, which operate by the combination of anthocyanin dye to stimulate electrons in  $\text{TiO}_2$ , creating a current transported through the iodide electrolyte when, of course, activated by the sun's energy. Through variance of the concentrations of  $\text{TiO}_2$  and iodide electrolyte, these experiments demonstrated a logistic relationship in each chemical as concentrations increased. This is significant because logistic relationships have horizontal asymptotes; at a certain concentration, no matter how much more the concentration is increased, the cell itself will not become more effective in generating voltage. From the perspective of a company attempting to sell Grätzel cells as a cheap, practical alternative to traditional, expensive silicon solar panels, it would not make logical sense to spend money to attain the same productivity. Thus, optimizing concentrations also optimizes a corporation's profit margins. These experiments determined the optimal concentration of  $\text{TiO}_2$  to be 4.3M to 4.5M, and the optimum concentration of iodide electrolyte solution to be  $4.974\text{E-}3 \text{ M I}_2$  with  $4.9697\text{E-}2 \text{ M KI}$  dissolved in ethylene glycol ( $\text{C}_2\text{H}_6\text{O}_2$ ). Refining this technology is essential to sustainability; solar energy is the key to unlocking a renewable resource that will last the span of human existence. It will lower human dependence on non-renewable resources and create a sustainable solution to an emerging problem.

4:05 PM - 5:05 PM

BGSU STEM Tours

5:10 PM

Board Buses to *Hampton Inn*

6:10 PM

Board Buses to *Olscamp Hall, BGSU*

6:30 PM - 8:45 PM

Banquet/Keynote Presentation

*Olscamp Hall 101A/B*

### Keynote Presentation

### Roots to STEM

**Dr. Jodi Haney**, Professor, School of Teaching and Learning, College Education and Human Development & Department of Environment and Substantiality, College of Arts and Sciences

9:00 PM

Board Buses to *Hampton Inn*

9:00 PM - 11:00 PM

Open Activities/Adult Reception

*Pool; Great Room, Hampton Inn*

11:00 PM

Students Report to Assigned Rooms

## Friday, March 21

6:30 AM - 7:45 AM

Room Checkout/Breakfast

*Great Room, Hampton Inn*

8:00 AM

Board Buses to *Olscamp Hall, BGSU*

8:40 AM

Announcements

*Olscamp Hall 101B*

8:45 AM - 9:45 AM

### Concurrent Poster Viewing

*Olscamp Hall 101A*

### Sixth Paper Session - Session Presider: Allison Rees

*Olscamp Hall 101B*

Session Moderator: Matt Wallschlaeger

# Schedule of Events

## Friday, March 21 (Cont.)

8:45 AM

### **Bluyé DeMessie, William Mason High School**

“Developing a Sustainable Water Filtration System for Use in Low Income Countries”

The objective of this study is to develop a novel and sustainable filtration device based on sand, clay, and banana peels (that were sun-dried, ground and pyrolyzed at 500°C) to remove heavy metal ions from an aqueous solution. The filter bed's surface physical and chemical properties were determined using a variety of methods including thermo-gravimetric analysis (TGA), Fourier transfer infrared spectroscopy (FT-IR), pH electrophoresis, BET surface area analysis, SEM imaging, and X-Ray diffraction (XRD) analysis. It was determined that the pyrolysis of dried banana peels formed a porous, large surface area adsorbent with strongly negative surface charges. Batch adsorption studies were conducted to compare the adsorbent's equilibrium capacity with that of commercially available activated carbon, Calgon F400. The Langmuir and Freundlich isotherms were linearly fitted to the equilibrium adsorption data. The Freundlich's model fit the equilibrium data better and showed the degree of favorability of adsorption of Pb(II) and Cu (II) ions with pyrolyzed banana peel were 0.51 and 1.34 respectively. Fixed-bed column studies were undertaken to evaluate the performance of the filter bed in removing Cu(II) and Pb(II) under varying operating conditions. The effluent stream's concentration, conductivity, pH, and total organic carbon content were measured. It was determined that the adsorption of heavy metals onto the filter bed is irreversible. The dynamics of the adsorption process were evaluated using the Thomas model and the Yoon–Nelson model. These revealed parameters that are useful for process design, such as adsorption rate and capacity. The adsorption capacity of 287.2 mg Cu(II)/g was achieved at 10 mg/L of initial concentration, bed height of 1 cm, and flow rate of 15mL/min. Competitive adsorption against naturally occurring ions was determined to have little effect on the removal of heavy metals from the water. As the influent stream's concentration increases the time of breakthrough decreases and the breakthrough curves become steeper. Extracting Cu(II) and Pb(II) from contaminated water using this filtration system is a low cost, efficient, and sustainable approach.

9:05 AM

### **Shaleen Goel, Sylvania Southview High School**

“The Effects of Alkylation and Poly-ADP Ribose Polymerase (PARP) Inhibition on the Survivability of Human Glioblastoma Cells”

Glioblastoma patients have less than a 3% five-year survival rate. Current treatments include using alkylation through temozolomide (TMZ), to which the cancer eventually becomes resistant. The alkylation initially kills cancerous cells because it initiates a pathway, mismatch repair (MMR), causing apoptosis. It does not kill human cells because they have MGMT, which repairs the alkylation. The way glioblastoma cells become resistant is by “losing” MMR, and thus not having apoptosis following alkylations. PARP is a protein integral to the DNA repair pathway of base excision repair (BER). BER is a repair pathway, which also repairs DNA alkylations. The purpose was to find out if a synthetic lethal approach using alkylation and PARP inhibition combined will kill glioblastoma cells both short and long term. The rationale was that the extreme volume of mutations in the TMZ resistant glioblastoma cells would cause cell death. The results showed that the synthetic lethal approach worked to cause cell death in TMZ resistant glioblastoma cells both short and long term. There was only a .5% cell survival for the synthetic lethal approach, over five times less than using an alkylating agent. Theoretically, this provides a new approach to treat glioblastoma tumors in human patients, but future studies are required to extrapolate the results to living organisms.

# Schedule of Events

## Friday, March 21 (Cont.)

9:25 AM

### Mathew Zianni, Gahanna Lincoln High School

"An Investigation of the Effects of Glutaraldehyde the Growth and Nodulation of *Sinorhizobium meliloti*"

The purpose of this project was to investigate the effects of glutaraldehyde, a chemical commonly used in hydraulic fracturing to kill bacteria, on the growth of *Sinorhizobium meliloti*, and its ability to nodulate *Trifoli* sp. Hydraulic fracturing is becoming increasingly common, and the symbiotic relationship between nitrogen-fixing bacteria and leguminous plants is an important source of nitrogen in most terrestrial ecosystems. Two separate experiments were run to fully explore the potential environmental impacts of glutaraldehyde. In the first experiment, *S. meliloti* from a commercial inoculum was grown on a plate of yeast mannitol agar with Congo red inhibitor. After initial plate growth to ensure no contamination from other bacteria, the *S. meliloti* colonies were transferred to 20 plates of the agar. Each plate had three filter paper punches placed in it, with five plates each having the filter paper soaked in either distilled water, which served as the control, 10 ppm glutaraldehyde, 100 ppm glutaraldehyde, or 1000 ppm glutaraldehyde. The radius of inhibition from each filter paper was measured. In the second experiment, *T. sp.* seeds were submerged completely in a mixture of inoculum and distilled water. Six seeds were then paced at the top of a paper towel in a transparent Kapak bag. 15 mL of nitrogen free nutrient solution was poured in each of the bags, with 10 bags getting only the solution and serving as a control, 10 receiving the solution with 10ppm glutaraldehyde, 10 receiving 100 ppm glutaraldehyde, and 10 receiving 1000 ppm glutaraldehyde. The rate of visible nodulation of *T. sp.* was measured. In the first experiment, the average radius of inhibition was 0 cm, 0 cm ( $p$ =perfect line) for the 10 ppm group, 0.375 mm ( $p$ =0.0945) for the 100 ppm group, and 1.331 mm ( $p$ =0.0002) for the 1000 ppm group. In the second experiment, the nodulation rates were 47.8% for the control, 48% ( $p$ =0.9904) for the 10 ppm group, 18.2% ( $p$ =0.0961) for the 100 ppm group, and 0% ( $p$ =.0074) for the 1000 ppm group. At 10 ppm, the glutaraldehyde had a statistically insignificant benefit to nodulation and no effect on growth. At 100 ppm, the concentration commonly used in hydraulic fracturing, the glutaraldehyde had harms to growth and nodulation that approached statistical significance. At 1000 ppm, the glutaraldehyde had statistically significant harms on growth and nodulation. Further research with more plants and bacterial plates is suggested.

### Announcements and Break (15 minutes)

10:00 AM - 12:00 PM	Peer Poster Judging, Junior High Students	<i>Olscamp Hall 101A</i>
10:00 AM - 11:00 AM	<b>Seventh Paper Session</b> - Session Presider: Lee Ruhe	<i>Olscamp Hall 101B</i>
	Session Moderator: Fred Donelson	

10:00 AM

### David Wang, William Mason High School

"Characterization of E2A and HEB Complex Formation with ETO via Data-Driven Biomolecular Docking"

E2A is an E-protein class transcription factor. When merged via chromosomal translocation to form E2A-Pbx1 fusion protein, E2A activates genes that induce acute lymphoblastic leukemia despite the presence of natural corepressors like ETO which normally repress E2A function. Unlike previously assumed, however, the PCET binding site of the AD1 domain of E2A weakly binds to ETO in comparison to the PCET binding site of HEB thereby allowing E2A-Pbx1 to induce cell transformation. Thus this project centers on examining why the AD1 domain of E2A protein binds more weakly to ETO than the AD1 domain of HEB. The cause of E2A's weak binding was identified by using the HADDOCK



# Schedule of Events

## Friday, March 21 (Cont.)

server to dock the two proteins. It was found that the serine 19 residue of HEB can form an extra hydrogen bond using its side chain with ETO which causes stabilization in the structure of HEB. In contrast, E2A possesses a proline residue which can't form hydrogen bonds due to its torsion angle restrictions. The proposed model of E2A and HEB binding was then confirmed by a series of mutagenesis experiments. The model suggests how E2A can avoid ETO repression to induce acute lymphoblastic leukemia as well as a way to treat acute lymphoblastic leukemia by targeting E2A residues in the PCET motif to enhance E2A-ETO repression.

10:20 AM

### **Timothy Lee, Sylvania Southview High School**

#### **"Prosocial Responses to Ostracism in Adolescents with Different Self-Construals"**

This study looked at the relationship between culture, ostracism, and prosocial responses in adolescents. Because ostracism affects groups differently, research must be done on specific groups. Therefore, this experiment hoped to find: (a) non-ostracized adolescents are more likely to demonstrate greater prosocial behavior than ostracized people, (b) those with interdependent self-construals are more likely to demonstrate greater prosocial behavior than those with independent self-construals, and (c) both self-construal and level of ostracism produce a joint effect on prosocial behavior. Participants from a local high school (N = 60) were asked to complete a questionnaire that measured general prosocial behavior score and self-construal. After ostracism through the Twenge, Baumeister, Tice, and Stucke (2001) "being-alone" ostracism paradigm, an additional hypothetical situation measured allocation that demonstrated prosocial behavior. Data analysis showed that hypothesis A was mostly supported, hypothesis B was fully supported, and hypothesis C was partially supported. Those with interdependent self-construals demonstrated the greatest prosocial behavior. Also, ostracism may be universal, but much also depends on the experimental threat of priorities in the experiment because different age groups have different priorities. Understanding adolescents' responses to ostracism can play a significant role in preventing school problems and antisocial behavior from occurring.

10:40 AM

### **Kyle Davis, Big Walnut High School**

#### **"Feather Microbiota in Tree Swallow (*Tachycineta bicolor*) Nests"**

The microbiology of avian plumage has been studied in adults (Burt, J. Avian Biol. 40:349-351. 2009, Burt and Ichida. Auk 116:364-372. 1999, Gunderson Auk 125:972-979. 2008.), but the microbiota of feathers used to line the nests of birds has not been described. I collected feathers from the nests of Tree Swallows (*Tachycineta bicolor*) from five different stages in the swallow nesting cycle beginning when the swallows first added feathers to their nest, when they laid their first eggs, when incubation started, when the first chick hatched, and when the nestlings fledged. Two feathers were collected from each nest at each stage, 96 feathers in total. The bacteria were removed from the feathers in nutrient broth and samples of the broth were cultured on selective media. The colonies of bacteria were then identified by colony morphology and the media on which they grew. Microbial diversity and abundance were greater in the later stages of the nesting cycle than in the earlier stages, as expected. This is shown through the four bar graphs generated from the recorded data.

Announcements and Break (15 minutes)

# Schedule of Events

## Friday, March 21 (Cont.)

11:15 AM - 12:15 PM **Concurrent Viewing** *Olscamp Hall 101A*  
**Eighth Paper Session** - *Session President: Nicholas Ziverts Olscamp Hall 101B*  
*Session Moderator: Abbie Smith*

11:15 AM

### **Aman Kumar, William Mason High School**

“Development of a Protocol for Measuring rt-PA Activity of t-ELIP Using a Spectrophotometric Method”

Stroke is the fourth leading cause of death in the U.S. and the leading cause of severe, long-term disability. Almost 88% of all strokes are ischemic strokes, caused by thrombosis or embolism in the brain. Recombinant tissue plasminogen activator (rt-PA) is the only FDA-approved thrombolytic agent administered in a certain number of ischemic stroke cases. The effectiveness of rt-PA in breaking up clots in ischemic stroke patients, if administered within three hours of stroke onset, improves neurological deficits (Smith et al., 2008). Recently, ultrasound-enhanced thrombolysis has been explored to treat ischemic stroke in combination with an ultrasound contrast agent and the thrombolytic drug rt-PA. One ultrasound contrast agent under development is echogenic liposomes (ELIP). ELIP are phospholipid vesicles with a broad size distribution (approximately 100 nm – 10  $\mu$ m) that contain gas and fluid. With rt-PA, these liposomes can be used as a novel targeted UCA to deliver the drug and release it via the administration of ultrasound and cavitation activity. A means to quantify the activity of rt-PA t-ELIP is essential during the development of this novel therapy. Such a methodology could test if ultrasound exposure triggers rt-PA release in t-ELIP, and provide information of the batch-to-batch variability of the ELIP. A spectrophotometric method has been successfully developed to determine method to compare the relative change in activity of t-ELIP. Using the spectrophotometric method to create a quality control model to estimate certain concentration at given absorbencies is a reliable method at lower concentrations. At higher concentrations variability increases and reliability decreases; however, strong R<sup>2</sup> values showed linearity within the data set. Temperature cycling the t-ELIP resulted in a lower activity than non-temperature cycled t-ELIP indicating that either the current method of temperature cycling is not valid or that temperature cycling leads to a lower rt-PA activity in general.

11:35 AM

### **Athulya Murali, Sycamore High School**

“A Process Parametric Study on the Effectiveness of Origami Based Design for Oil Spill Clean Up”

Oil spills in the ocean are harmful to the environment. The hypothesis of this study is that cleaning up oil spills will be more effective if origami based designs are used. In this research project, the performance of polypropylene as sheets was compared to that of an origami based, “magic ball” design. Oil spill was simulated by including 60 grams of petroleum distillates in 40 liters of water. Using 20 X 20 cm polypropylene sheets, the “effectiveness” of the designs was determined based on the total amount of oil absorbed, and the time taken by the designs to drift to the periphery of the tub. The static test results showed that the flat sheet absorbed about 60% more oil. The dynamic test, in which the “ocean wind” was simulated using a fan, revealed that magic ball reached the shore in 31 seconds, whereas the flat sheet never reached the shoreline. Moreover, the magic ball absorbed 116% more oil while travelling. The results proved that the origami based design was “more effective” and supports the hypothesis that cleaning up oil spills in the ocean will be more effective if origami based designs are used.

# Schedule of Events

## Friday, March 21 (Cont.)

11:55 AM

### Ya'el Courtney, Mount Carmel School

“Improving Weight-Length Relationships in Fish to Provide More Accurate Bioindicators of Ecosystem Condition”

Bioindicators are effective tools for evaluating ecosystem condition. Weight-length models are essential to using fish as bioindicators, providing expected weights for healthy fish of given lengths. The traditional model,  $W(L) = aL^b$ , is widely used and fits many fish taxa, but is error-prone and has undesirably large uncertainties. This study evaluated a proposed improvement, replacing  $a$  with scaling parameter  $L1$ :  $W(L) = 1000(L/L1)^b$ . The primary hypothesis was that the improved model would have lower mean parameter uncertainties than the traditional model and smaller uncertainties in most data sets, yielding more accurate bioindicators. The models were compared for 160 data sets including 94 taxa containing 14,102 data points. Each set was fit to the traditional model and the proposed improvement with appropriate regression techniques. The improved model yielded lower uncertainties for  $L1$  but similar uncertainties to the traditional model for  $b$ . Lower  $L1$  uncertainties propagate to more sensitive bioindicators. The secondary hypothesis was supported:  $L1$  shows promise as a new bioindicator because its value increases when fish are stressed by suboptimal conditions including the Deepwater Horizon oil spill, oyster reef destruction, and overpopulation of invasive species.  $L1$  is sensitive, accurate, and valuable in conjunction with condition factor to diagnose environmental well-being.

12:15 PM - 1:30 PM

### Lunch

Judges Meeting/Luncheon  
Advisory Board Luncheon  
Student Advisory Board Meeting

*The Oaks Dining Hall*  
*The Oaks Dining Hall*  
*The Oaks Dining Hall*  
*The Oaks Dining Hall*

1:45 PM

Group Photograph

*Center Stairwell, Student Union*

2:00 PM

Students Dismantle Posters

*Olscamp Hall 101A*

2:30 PM

Awards Ceremony

*Olscamp Hall 101B*

3:00 PM

Adjournment



# Keynote Speaker



## **Dr. Jodi J. Haney**

**Professor**  
**School of Teaching and Learning, College Education**  
**and Human Development**  
**Department of Environment and Substantiality,**  
**College of Arts and Sciences**

## ***Roots to STEM***

After teaching middle and high school science in the public schools for eight years, Jodi Haney has spent the last twenty years on faculty at Bowling Green State University. Before arriving at BGSU, Jodi earned her Ph.D. in Curriculum and Instruction from The University of Toledo with focused study in science and middle childhood education and educational psychology. Haney now holds a professorship with a joint appointment in the College of Education and Human Development and in the College of Arts and Sciences. She teaches undergraduate science education courses, graduate curriculum courses, and both undergraduate and graduate courses in environmental sustainability. A productive grant writer, Jodi has earned over 20 million dollars in local, state, and federal funding to support her science and environmental education programs at BGSU. Dr. Haney has authored over 30 peer-reviewed publications, made over 50 scholarly presentation, and has served as a consultant to roughly 100 Ohio schools. Haney believes that teaching is the essence of her identity and is passionate about her role to inspire the love of learning through active, engaged, and authentic experiences both within the classroom and the local community.

# 2014 Poster Presenters

**Madison Aleshire, Big Walnut High School**

"Enzymatic Reactions with Lactase"

**Emily Armbruster, Hilltop High School**

"The Effects of Alcohol Concentrations on Brine Shrimp"

**Brooke Ashbaugh, Hilltop High School**

"Sterility of Multipurpose Contact Solution and Contact Lens Cases"

**Samar Ayoub, Sylvania Southview High School**

"Stress' Impact upon Decision-making"

**Justin Bacon, Buckeye Valley Middle School**

"The Effects of Soil pH on Earthworms"

**Gillian Baker, William V. Fisher Catholic High School**

"Scent and Sales II: The Effect of Scent on Consumers' Product Perceptions"

**Jacob Beneke, Buckeye Valley Middle School**

"Store Bought Attractants versus Vegetables"

**Cohen Boyer, Buckeye Valley Middle School**

"Recycled Energy"

**Landrey Brown, Hilltop Junior High School**

"Can You Determine Someone's Athletic Ability Just by Looking at Their Hands?"

**Nathan Brown, Buckeye Valley Middle School**

"Is More Wastewater Produced Over the Weekend?"

**Michael Burchfield, Sylvania Southview High School**

"The Effects of Table Tennis Ball Diameter on Rally Length"

**Robert Candor, Gahanna Lincoln High School**

"The Design, Production, and Testing of a Prototype Cognitive-Based Human Exoskeleton"

**Alexander Cline, Gahanna Lincoln High School**

"Developing an Algae Based Biofuel for Use in Passenger Automobiles"

**Melanie Conley, Buckeye Valley Middle School**

"Fingerprint Quality"

**Andrew Coy, Buckeye Valley Middle School**

"The Battle of the Laundry Detergents"

**Jacob Dennis, Pettisville Local Schools**

"The Effect of Seed Treatment on *Glycine* max Yields"

**Bhakti Dixit, Sylvania Southview High School**

"The Comparative Study of the Knee Flexion Angle in Male and Female Soccer and Basketball Athletes"

**Anjali Dubbaka, Olentangy Liberty High School**

"PRMT5 Regulation in the Cell Cycle"

**Shivatej Dubbaka, Olentangy Liberty Middle School**

"Rotting Teeth: Is it Preventable?"

**Ismael Gad, Sylvania Southview High School**

"The Effect of Body Mass Index on Osteoporosis"

**Teryn Ganster, Hilltop Junior High School**

"Which Toothpaste Works the Best?"

**Bradley Grimm, Hilltop High School**

"Relation between Color Paper and Math Test Scores"

**Tanner Hogg, Buckeye Valley Middle School**

"Does the Temperature of a Hockey Puck Affect How Far It Will Slide on Ice?"

**Jacob Honick, Gahanna Lincoln High School**

"The Preservation of Traditional Longboarding Mechanics Enhanced by Means of Electric Motor Accompanied by an Efficient Regenerative Braking System"

**Zach Horn, Gahanna Lincoln High School**

"Experimental Design of A Low Cost and Practical Acoustic Telemetry System"

**Katie Hsieh, Sylvania Southview High School**

"Psychological Effects of Aromatherapy"

**Joshua Hubbs, Buckeye Valley Middle School**

"Ultra Sonic Laser"

**Analise Lajeunesse, Buckeye Valley Middle School**

"Counting Calories"

**Pallavi Lanka, Sylvania Southview High School**

"A Comparison of the Effect of *Azadirachta indica* oil and Ciprofloxacin on *E. coli*"

**Hannah Lawson, Buckeye Valley Middle School**

"It's All In The Flour"

**Gretchen Lee, Pettisville Local Schools**

"The Effects of Rabbit Manure on the Speed of Decomposition of Compost"

**Dominique Legg, Buckeye Valley Middle School**

"Beat of the Heart"

**Sarah Lehner, Buckeye Valley Middle School**

"Cover Crops: Does Height Matter?"

**Melissa Liang, Sylvania Southview High School**

"The Effects of Alphabet Math on Neuroplasticity in High School Students"

**Julian Liber, Sylvania Southview High School**

"The Relative Persistence of Allelochemicals compared to Synthetic Herbicides in Soil"

**Cate Longmore-Micham, Bowling Green Senior High School**

"Viscosity and Water Movement: The influence of Temperature on Swim Speed"

**Emily Maneval, Hilltop High School**

"Antibiotics: Natural vs. Pharmaceutical"

# 2014 Poster Presenters

**Will McKinney, Hilltop High School**

"The Effectiveness of an Eco-Friendly Fishing Net Compared to a Regular Fishing Net"

**Becca Miller, Hilltop Junior High School**

"Rate of Gain, 16% vs. 18% Protein in Rabbit Feed"

**Caitlyn Miller, Columbia High School**

"The Power of Suggestion: Memory Manipulation"

**Anne Miner, Bowling Green Senior High School**

"Testing the Effects of Water Salinity on Plant Growth"

**Amy Mirecki, Columbia High School**

"The Ability of Cinnamon and Turmeric to Inhibit the Growth of *Escherichia coli*"

**Jordan Mitchell, St. John's Jesuit High School**

"Development of Biomimetic Nanofiltration Membranes"

**Francis Mok, Sylvania Southview High School**

"The Gramme Dynamo and its Efficiency"

**Jayrid Mosher, Buckeye Valley Middle School**

"The Effect on Humans While Playing an Intense Video Game"

**Shilpa Murthy, Olentangy Liberty High School**

"The Effects of Alginate Encapsulation on Seed Germination"

**Abigail L. Myers, Big Walnut High School**

"Arctic Oil Spill Clean-up"

**Faith C. Myers, Big Walnut Middle School**

"Flame Temperatures in Wood Burning Fires: Hardwood versus Softwood"

**Andrea Oprandi, Louisville High School**

"The Detection of the NOS Terminator, the Camv 355 Promoter, and/or the Plant Chloroplast Gene in the Tissue of *Drosophila Melanogaster* Fed Genetically Modified Fruit Product Using Electrophoresis and the Evaluation of the Resulting Physical Characteristics"

**Grace Palaparty, Kings High School**

"Bacteriophage Efficiency"

**Sara Pharazyn, Buckeye Valley High School**

"Climate Conditions and Bone Density"

**Vineet Prasad, Mason High School**

"TAS2R38 Genotype/PTC or PROP Phenotype: Relationship with Dietary Fat Preference and Body Mass Index (BMI)"

**Brooklyn Pugh, Louisville High School**

"The Effects of Feed Type and Growth Implants on the Average Daily Gain in Feeder Calves"

**Lindsey Pugh, Louisville High School**

"The Effect of Strongyle Parasites on the Blood PCV Count in Boer Goats"

**Gavin Riegsecker, Pettisville Local Schools**

"Does Height Affect Running Time in Trained Runners?"

**Grant Rospert, Buckeye Valley Middle School**

"Blood Spatter"

**Johnnie Roth, Hilltop Junior High School**

"How Foot Position Affects Your Foul Shot"

**Ben Routhier, Hilltop Junior High School**

"Fingerprinting with Different Powders on Different Surfaces"

**Madeleine Routhier, Hilltop High School**

"What Pain Reliever Dissolves the Quickest in Hydrochloric Acid?"

**Zach Schneider, Buckeye Valley Middle School**

"Tape Adhesive"

**Sibi Sengottuvel, Gahanna Lincoln High School**

"Development of an Accelerometer Based Wheelchair Control System"

**Sumiran Shah, Sylvania Southview High School**

"A Down Syndrome Interaction Comparison"

**Shival Sinha, Sylvania Southview High School**

"The Effect of Cycloheximide (CHX) on *Saccharomyces cerevisiae*"

**Rocco Spino, Sylvania Southview High School**

"Secondary Circuit Configuration Comparison"

**Douglas Synowka, Louisville High School**

"A Correlation of Neurological Conditions and Food Allergies"

**Camron Taylor, Buckeye Valley Middle School**

"Is an Arrow's Speed Affected by the Arrow's Tip?"

**Morgan Tigges, Buckeye Valley Middle School**

"Color Equals Memory"

**Fiona Tseng, Buckeye Valley Middle School**

"Electromagnetic Danger to Plants"

**Selena Turner, National Inventors Hall of Fame Science, Technology, Engineering and Mathematics High School**

"LIFE SAVER: A Prototype Crib Alarm to Prevent Infant Death"

**Teren Wycoff, Buckeye Valley Middle School**

"Identifying the Processes that Formed the Glacial Till Deposit at the National Lime and Stone Quarry"

**Lily Yan, Sylvania Southview High School**

"The Synthesis of CZTS Thin Films for Solar Cell Application"

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

# Judges Score Sheet for Poster Presenters

Scoring Category	1	2	3	4	Score
	Needs Improvement	Acceptable	Good	Excellent	
<b>Appearance/ Clarity</b>	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	
<b>Abstract*</b>	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.	
<b>Research Questions*</b>	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	
<b>Significance of the Research</b>	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	
<b>Research Methods</b>	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	
<b>Conclusions*</b>	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	
<b>Limitations</b>	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	
<b>Graphs and/or Tables*</b>	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	
<b>Knowledge of Project/Handling of Questions</b>	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	
<b>Presence</b>	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**



# Research Paper Awardees: 2013

## **1st Place Winner – Bluyé DeMessie**, William Mason High School

- \$2,000 College Scholarship sponsored by the United States Army, Navy, and Air Force
- Presented his research paper at the 2013 National JSHS held in Dayton, Ohio, with expenses paid
- Competed for a \$12,000, \$8,000, or \$4,000 scholarship plus an expenses-paid trip to the London International Youth Science Forum (LIYSF)

## **2nd Place Winner – Peeyush Shrivastava**, William Mason High School

- \$1,500 College Scholarship sponsored by the United States Army, Navy, and Air Force
- Presented his research paper at the 2013 National JSHS held in Dayton, Ohio, with expenses paid
- Competed for a \$12,000, \$8,000, or \$4,000 scholarship plus an expenses-paid trip to the London International Youth Science Forum (LIYSF)

## **3rd Place Winner – Evren Gokcen**, Gahanna Lincoln High School

- \$1,000 College Scholarship sponsored by the United States Army, Navy, and Air Force
- Presented his research paper in the Poster Session at the 2013 National JSHS held in Dayton, Ohio, with expenses paid

## **4th Place Winner – Elijah Bedel**, West Union High School

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

## **5th Place Winner – Ryan Richards**, Gahanna Lincoln High School

- \$250 Award sponsored by the Chemistry Department, BGSU
- Attended the 2013 National JSHS held in Dayton, Ohio, with expenses paid

## **1st Alternate – David Wang**, William Mason High School

- \$150 Award sponsored by the College of Education and Human Development, BGSU
- Attended the 2013 National JSHS held in Dayton, Ohio, with expenses paid

## **2nd Alternate – Niket Yadav**, Lakota West High School

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

## **Thomas Alva Edison Award – Mitchell Pallaki**, Saint Ignatius High School

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

**Mitchell Pallaki**, Saint Ignatius High School  
Thomas Alva Edison Award Winner



# Research Poster Awardees: 2013

## High School Division

### 9th – 12th Grade Overall Award

**“Best in Show” Award:** Aric Floyd, Hawken Upper School

### 11th – 12th Grade Awards

**1st Place:** Mallory Rowan, Gahanna Lincoln High School

**2nd Place:** Rona Jiang, Sylvania Southview High School

**Honorable Mention:** (In Alphabetical Order)

Catherine Dong, Sylvania Southview High School

Lance Lu, Sylvania Southview High School

Deborah Okeke, Sylvania Southview High School

### 9th – 10th Grade Awards

**1st Place:** Mohamed Meziane-Tani, Sylvania Southview High School

**2nd Place:** Lauren Jenkins, Ottawa Hills High School

**Honorable Mention:** (In Alphabetical Order)

Shaleen Goel, Sylvania Southview High School

Hannah Meller, Pettisville Local Schools

Shival Sinha, Sylvania Southview High School

Eric Zhu, Sylvania Southview High School

## Junior High School Division

**“Best in Show” Award:** Jacob Dennis, Pettisville Local Schools

**People’s Choice Award:** Gabriel Beck, Pettisville Local Schools

# Teacher Awardee: 2013

## Colonel George F. Leist Distinguished Teacher Award

– **Abbie Smith**, Hilltop Junior High School

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

**Abbie Smith**, Hilltop Junior High School



# Research Paper Awards: 2014

## 1st Place Winner

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

- Presents research paper at the 2014 National JSHS in Washington D.C., with expenses paid
- Chance to compete for an expenses-paid trip to the London International Youth Science Forum (LIYSF)

## 2nd Place Winner

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

- Presents research paper at the 2014 National JSHS in Washington D.C., with expenses paid
- Chance to compete for an expenses-paid trip to the London International Youth Science Forum (LIYSF)

***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
- An expenses-paid trip to the London International Youth Science Forum, an exchange program bringing together over 400 participants from 60 nations. The London trip is awarded to each of the 1st place National JSHS finalists; the runner-ups are alternate winners.

## 3rd Place Winner

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

- Presents poster at the at the 2014 National JSHS in Washington D.C., with expenses paid

## 4th Place Winner

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

- Expenses paid trip to the 2014 National JSHS in Washington D.C.

## 5th Place Winner

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

- Expenses paid trip to the 2014 National JSHS in Washington D.C.

## 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**

# Research Poster Awards: 2014

## High School Division

### 9th – 12th Grade Overall Award

“Best in Show”: \$100 Gift Certificate

### 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



## Junior High School Division

“Best in Show” Award

People’s Choice Award

# Teacher Awardee: 2014

## 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

## 2014 Ohio Junior Science & Humanities Symposium

### Paper Judges

Dr. Anjali Gray	Biology & Health Sciences, Lourdes University
Dr. Jon Bjorkman	Physics & Astronomy, The University of Toledo
Dr. David Meel	Mathematics & Statistics, Bowling Green State University
Dr. Stephania Messersmith	Chemistry, Bowling Green State University
Dr. Joanne Rebbeck	United States Department of Agriculture, Forest Service
Mr. Daniel Yaussy	United States Department of Agriculture, Forest Service

### Poster Judges

Dr. Jonathan Bostic	School of Teaching and Learning, BGSU
Dr. Daniel Brahier	School of Teaching and Learning, BGSU
Mr. Jake Burgoon	NWO, BGSU
Dr. Steven Chung	Department of Chemistry, BGSU
Dr. Kate Dellenbusch	Department of Physics and Astronomy, BGSU
Dr. Fei Gao	Department of Visual Communication Technology, BGSU
Dr. Sudershan Jetley	Department of Engineering Technologies, BGSU
Dr. John Laird	Department of Physics and Astronomy, BGSU
Dr. Raymond Larson	Department of Biological Sciences, BGSU
Dr. Andrew Layden	Department of Physics and Astronomy, BGSU
Dr. Gabriel Matney	School of Teaching and Learning, BGSU
Dr. Bob Midden	Department of Chemistry, BGSU
Dr. Cordula Mora	Department of Psychology, BGSU
Dr. Holly Myers	Department of Environment and Sustainability, BGSU
Dr. Kurt Panter	Department of Geology, BGSU
Dr. William Scovell	Emeritus Professor, BGSU
Dr. Glenn Tiede	Department of Physics and Astronomy, BGSU
Dr. Andrew Torelli	Department of Chemistry, BGSU
Dr. Eileen Underwood	Department of Biological Sciences, BGSU
Dr. Rick Worch	School of Teaching and Learning, BGSU



# Acknowledgments

## 2014 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

**LTC Douglas A. Mohler**, U.S. Army, Commander/Professor, Military Science, BGSU

**Ms. Jessica Belcher**, Ohio JSHS Coordinator, NWO Assistant Director, BGSU

**Mr. Hans Glandorff**, Ohio JSHS Assistant Coordinator, Science Teacher, Bowling Green High School

**Ms. Donna Meller**, Ohio JSHS Assistant Coordinator, Science Teacher, Pettisville Local Schools

**Ms. Blythe Tipping**, Ohio JSHS Assistant Coordinator, Science Teacher, Sylvania Southview High School

### Session Moderators

Fred Donelson Gahanna Lincoln High School, Teacher

Abbie Smith Hilltop Junior High School, Teacher

Matt Wallschlaeger Big Walnut High School, Teacher

Cristin Hagans Hilltop High School, Teacher

Robert Sudomir Louisville High School, Teacher

### Support Staff

Lisa Addis NWO, Graphic Design/Web Support

Joetta Kynard NWO, Organizational Support

Jacob Burgoon NWO, Evaluation

Susan Stearns NWO, Organizational Support

### Session Presiders

BGSU Undergraduate Students

#### Thursday:

Session 1: Tyler Allen

Session 2: Coti Puhl

Session 3: Chris Kerney

Session 4: Matthew Seljan

Session 5: Nicole Kiefer

#### Friday

Session 6: Allison Rees

Session 7: Lee Ruhe

Session 8: Nicholas Ziverts

### Bowling Green State University Laboratory Research Tours

Dr. Matthew Laurent, School of Human Movement, Sport, and Leisure Studies

Dr. Matthew Partin, Marine Biology Lab

Jodi Schroeder, Wolfe Center

Ben Spence, Stroh Center

Dr. Eileen Underwood, Herpetology Lab

### 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

### Community Sponsors

Always Promoting, Maumee

### Special Thanks

Ice Arena, BGSU

The Oaks Dining Hall, BGSU

Hampton Inn, Bowling Green

# Advisory Board

## 2014 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

**Ms. Jessica Belcher**  
NWO, BGSU

**Mr. Hans Glandorff**  
Bowling Green High School

**Ms. Donna Meller**  
Pettisville High School  
Ohio JSHS Assistant Coordinator

**Ms. Blythe Tipping**  
Sylvania Southview High School  
Ohio JSHS Assistant Coordinator

**Ms. Lisa Addis**  
NWO, BGSU

**Mr. Jacob Burgoon**  
NWO, BGSU

**Ms. Ann Burkam**  
Buckeye Valley Middle School

**Mr. Fred Donelson**  
Gahanna Lincoln High School

**Dr. Lena Ballone Duran**  
School of Teaching and Learning, BGSU

**Ms. Cristin Hagans**  
Hilltop High School

**Ms. Joetta Kynard**  
NWO, BGSU

**Ms. Linda Lower**  
Perstorp Polyols, Inc.

**Ms. Rebekah Rice**  
Gahanna Lincoln High School

**Ms. Abbie Smith**  
Millcreek-West Unity School

**Ms. Susan Stearns**  
NWO, BGSU

**Mr. Robert Sudomir**  
Louisville High School

**Ms. Iris Szelagowski**  
Former Ohio JSHS Coordinator  
Retired Teacher

**Mr. Daniel Yaussy**  
Ohio State University

**Ms. Leslie Yaussy, RN, BSN**  
Public Health Nurse, Adv. Professional, Delaware



# History of the Junior Science & Humanities Symposium

In 1958, Colonel George F. Leist, a native Toledo resident, together with the U.S. Army Research Office, initiated the Junior Science & Humanities Symposium (JSHS) for secondary school science students throughout the United States. The JSHS Program has been sponsored by the United States Department of the Army since its inception. The Departments of the Navy and Air Force joined this initiative after 1995 to increase and encourage student interest in science, engineering, and mathematics. Resulting from this sponsorship and the cooperative efforts of universities throughout the nation, the JSHS program encompasses forty-eight regional symposia reaching high schools throughout the United States, Puerto Rico, and in cooperation with the Department of Defense Schools of Europe and the Pacific.

In 2012, Bowling Green State University and the School of Teaching and Learning at BGSU with the support of The Northwest Ohio Center of Excellence in STEM Education (NWO) will host the 49th Ohio JSHS for the fifth year. At the symposium, first and second place finalists will be chosen to present their research papers at the National JSHS to be held in Bethesda, Maryland, on May 2 to May 6, 2012. These two paper presenter finalists will compete at the National JSHS for a \$12,000 scholarship and one of six opportunities to represent the United States at the London International Youth Science Forum (LIYSF) during the summer of 2012. The LIYSF is an exchange program that brings together over 400 participants from 60 nations.

In addition, the third, fourth, and fifth place Paper Presenters will be awarded an all expenses paid trip to the National JSHS. These five Ohio JSHS awardees will have the opportunity to interact with over 400 participants in a program of networking and scientific exchange. Since 1966, fifty-two Ohio JSHS winners have presented papers at the National JSHS. Having earned a first place award, sixteen of these students have subsequently presented their papers at the LIYSF in London, England.

## **WHY PARTICIPATE?**

Former JSHS participants confirm that the significance and results of JSHS extend beyond scholarships and recognition. At regional and national symposia students and their teachers have the opportunity to:

- Participate in a forum honoring exceptional work and encouraging personal and academic growth.
- Interact with practicing researchers who offer a look beyond high school to opportunities in post secondary education and to academic and career development in the sciences, engineering, and mathematics.
- Develop higher-order thinking skills and integrated learning across disciplines through the process of scientific inquiry, writing a scientific paper, and developing a presentation – all skills that will benefit future postsecondary and graduate pursuits.
- Participate in a scientific conference, take field trips, and have their work published.
- Gain self-confidence not only through the experience of the research investigation, but also through networking among participants of similar interests.



# 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 following students are past winners of this award:

<u>Year</u>	<u>Name</u>	<u>School</u>
1978	Robert Pearsall	Patrick Henry High School, Hamler
1979	Diana Lauck	Ravenna High School, Ravenna
1981	James Kasner	West Holmes High School, Millersburg
1982	Cindy Raymond	Roosevelt High School, Kent
1983	Eric Wertz	Lakeview High School, Stow
1984	Lyle Reusser	West Holmes High School, Millersburg
1985	David Roberts	Westerville North High School
1986	Eric Germann	Lincolnview High School, Van Wert Co.
1987	Rodney Hartman	Bloom-Carroll High School, Carroll
1988	Matthew Fuerst	Wickliffe Senior High School
1989	Michael McGrath	Ashland City High School
1990	Mathew Heston	Carrollton High School
1991	Michael Ruthemeyer	St. Xavier High School, Cincinnati
1992	Gregory Lohman	Highland High School, Medina
1993	Aimee Springowski	Brookside High School, Sheffield Lake
1994	Jeff Smith	Sylvania Southview High School
1995	Stephan M. Gogola	Theodore Roosevelt High School, Kent
1996	Adreanna Decker	Barnesville High School
1997	Lev Horodyskyj	Padua Franciscan High School, North Royalton
1998	Lev Horodyskyj	Padua Franciscan High School, North Royalton
1999	Andrew Sauer	St. Xavier High School, Cincinnati
2000	Margaret Engoren	Sylvania Southview High School
2001	Lindsey Heine	Sylvania Southview High School
2002	James Ristow	Theodore Roosevelt High School, Kent
2003	Jared Steed	Buckeye Valley High School, Delaware
2004	Jared Steed	Buckeye Valley High School, Delaware
2005	Robbie Christian	Hoover High School, North Canton
2006	Alex Liber	Sylvania Southview High School
2007	Ruth Chang	Sylvania Southview High School
	Victoria Ellis	Sylvania Southview High School
2008	Elizabeth Engoren	Sylvania Southview High School
2009	Abigail Styron	Hilltop High School, Alvordton
2010	Russell Kittel	Gahanna Lincoln High School
2011	Sulaiman Mustapha	Toledo Islamic Academy
2012	Chrysta Beck	Pettisville High School
2012	Bluyé DeMessie	William Mason High School
2013	Mitchell Pallaki	Saint Ignatius 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 following teachers have been honored as past winners of the Colonel George F. Leist Distinguished Teacher Award:

<u>Year</u>	<u>Name</u>	<u>School</u>
1978	Father Charles S. Sweeney	St. John's High School, Toledo
1979	Father James Lotze	St. John's High School, Toledo
1980	Earl Shafer	Bowling Green High School
1981	Jerry Jividen	Hudson High School
1982	Jon Secaur	Roosevelt High School, Kent
1983	Sister Mary Blandina	Cardinal Stritch High School, Toledo
1984	Rebecca Stricklin	Oak Hills High School, Cincinnati
1985	Kay Ballantine	Sheridan High School, Thornville
1986	Iris Szelagowski	Woodward High School, Toledo
1987	Diane Gabriel	Bloom-Carroll High School, Carroll
1988	Spencer E. Reams	Benjamin Logan High School, Zanesfield
1989	Father Charles S. Sweeney	St. John's High School, Toledo
1990	Jon Secaur	Roosevelt High School, Kent
1991	John A. Blakeman	Perkins High School, Sandusky
1992	Penny Karabedian Cobau	Sylvania Southview High School
1993	Vaughn D. Leigh	Hudson High School
1994	Penny Karabedian Cobau	Sylvania Southview High School
1995	Kathleen Keller	Carroll High School, Dayton
1996	John Jameson	Cincinnati Country Day
1997	Evelyn Davidson	Ursuline Academy, Cincinnati
1998	Paula Butler	Cincinnati Country Day
1999	Barbara Kraemer	Padua Franciscan High School, North Royalton
2000	Susan Sanders	Padua Franciscan High School, North Royalton
2001	Tim Giulivg	Padua Franciscan High School, North Royalton
2002	Darla Warnecke	Miller City High School
2003	Peggy Sheets	Upper Arlington High School
2004	Connie Hubbard	Hoover High School, North Canton
2005	Ann Burkam	Buckeye Valley Middle School, Delaware
2006	Hans Glandorff	Bowling Green High School
2007	Connie Hubbard	Hoover High School, North Canton
2008	Donna Meller	Pettisville Local Schools, Wauseon
2009	Cristin Hagans	Hilltop High School, West Unity
2010	Blythe Tipping	Sylvania Southview High School
2011	Robert Sudomir	Louisville High School
2012	Fred Donelson	Gahanna Lincoln High School
2013	Abbie Smith	Hilltop Junior High School

# Cumulative Record of the State of Ohio Student

## Presenters to the National JSHS

<u>Year</u>	<u>Name</u>	<u>School</u>	<u>Year</u>	<u>Name</u>	<u>School</u>
1966-L	Patricia Fraser	Regina HS, Mayfield Heights	1995	Amy Caudy	Big Walnut HS, Sunbury
1967-L	Mark Meuty	Woodward HS, Toledo	1996	Paul Gemin	Carroll HS, Dayton
1968-L	Katharine Lowenhaupt	Walnut Hills HS, Cincinnati	1997	Smita Dé	Cincinnati Country Day School
1969-L	Susan Krueger	Magnificant HS, North Olmsted	1998	Stephanie Meyers	Ursuline Academy, Cincinnati
1970-L	Bruce Arthur	Westerville HS	1999	Jason Lee Douglas	Cincinnati Country Day School
1971-L	Robert Butcher	Wapakoneta HS	2000-L	Ulyana Horodyskyj	Padua Franciscan HS, North Royalton
1972-L	Jon Alexander	St. John's HS, Maumee	2001	Ulyana Horodyskyj	Padua Franciscan HS, North Royalton
1973-L	William Steers	St. John's HS, Toledo	2002	Ulyana Horodyskyj	Padua Franciscan HS, North Royalton
1974-L	Francis Sydnor	St. John's HS, Toledo	2003-L	James Zhou	Upper Arlington HS
1975-L	Jane Stoffregen	St. Ursula Academy, Toledo	2004	Paul Hoffman	Upper Arlington HS
1976	Harlan Krumholz	Meadowdale HS, Dayton	2005	Paul Scheid	Gilmour Academy, Gates Mills
1977	Paul Cahill	East HS, Akron		Laura Johnson	Upper Arlington HS
1978	Kevin Anderson	St. John's HS, Toledo	2006	Daniel Litt	Orange HS, Pepper Pike
1979-L	Eric Evans	Stow HS		Madhav Chopra	Hoover HS, North Canton
1980	Carl Von Patterson	Ravenna HS	2007	Jyotiraditya Sinha	Hoover HS, North Canton
1981	Kelly McAleese	Black River HS, Medina		Saumitra Thakur	Sylvania Southview HS
1982	Robert Sturgill	St. John's HS Toledo	2008-L	Aaditya Shidham	Upper Arlington HS
1983	Shirley Bodi	Cardinal Stritch HS, Toledo		David Litt	Orange HS, Pepper Pike
1984	Douglas Gorman	Oak Hills HS, Cincinnati	2009-L	Keith Hawkins	GlenOak HS, Canton
1985	Robert Freeman	Sheridan HS, Thornville		Kevin Hawkins	GlenOak HS, Canton
1986	Jill Thomley	Woodward HS, Toledo	2010	Karen Kruzer	West Geauga HS, Chesterland
1987	Kenneth Clubok	Athens HS		Dennis Tseng	William Mason HS, Mason
1988	Ron Birnbaum	Maumee Valley Country Day School, Toledo	2011	Austen Mance	Sylvania Southview HS
1989	Aaron P. Garcia	St. John's HS, Toledo		Himanshu Savardekar	Dublin Coffman HS
1990	Simon Solotko	Roosevelt HS, Kent	2012	Christopher Ellis	Sylvania Southview HS
1991	Joann Elizabeth Roy	Perkins HS, Sandusky		Brian Haidet	Sylvania Southview HS
1992	Andrew Gano	Sylvania Southview HS	2013	Bluyé DeMessie	William Mason HS, Mason
1993	Daniel Stevenson	Hudson HS		Peeyush Shrivastava	William Mason HS, Mason
1994-L	Scott Damrauer	Sylvania Southview HS			

L = Winners of National JSHS who presented papers at the London International Youth Science Forum (LIYSF).



# The 51<sup>st</sup> Annual Ohio Junior Science & Humanities Symposium

*March 19-21, 2014*



*Sponsored by:*

