

Wisconsin-Upper Peninsula of Michigan Junior Science and Humanities Symposium

2020 JSHS PARTICIPANT LIST

Appleton North High School
Appleton, WI
Ahmad Abdel-Azim**
Sahar Sherif – Guest

Big Foot High School
Walworth, WI
Hailey Bauman
Sydney Bender**
Jacob Curtis*
Angela Gulotta – Teacher
Kitana Gulotta

Ethan Jackowski
Molly Knoll
Henry Koerner
Lisa Konkell – Teacher
Melissa Konkell**
Ryan Loudonbeck
Sebastian Rodriguez Moreno
Kastyn Sherman*

Cashton High School
Cashton, WI
Katherine Alderson
Hailey Brownell
Aiden Cook**
Austin Culpitt
Megan Culpitt**
Jack Kleba
Jacob Lemke – Teacher
Julie Lundeen – Teacher
Naomi Mason
Zackry Mlsna
Colin O’Neil
Madison Schendel
Emma Schlesner**
Faith Valentine – Teacher
Nicholas Wall – Teacher

Central High School
La Crosse, WI
Andrew Winga
Eden Winga**
Libby Winga - Guest
Taryn Winga

Lake Linden-Hubbell High School
Lake Linden, MI
Siona Beaudoin**
Gretchen Hein – Teacher

Living Word Lutheran High School
Jackson, WI
Joshua Hua
Margaret Hua

Onalaska High School
Onalaska, WI
Vikram Ailiani**
Raju Ailiani – Guest
Aditya Ailiani – Guest

University School of Milwaukee
Milwaukee, WI
Rohan Anne
Vijay Anne
Neil Dogra**
Sumita Dogra
Zadan Mason**
Azita Hamedani

Verona High School
Verona, WI
Jessica Ayite-Atayi*
Kaela Bahr*
Madeleine Barger*
Madeline Bonifas*
Ella Chorlton
Arhat Dwa*
Kendall Hazen*
Elizabeth Larson*
Josephine McCartney*
Hope Mikkelsen – Teacher

Wisconsin Lutheran High School
Milwaukee, WI
Alyssa Ebling
Daniel Ebeling – Teacher
Qiusu Miao**

University of Wisconsin-La Crosse
Basudeb Bhattacharyya, Ph.D.,
Biochemistry Educator
Megan Litster, Ph.D.,
Biology Educator
Jenni McCool, Ph.D.,
Math Educator
Lisa Pitot, Ph.D.,
Science Educator

JSHS SUPPORT STAFF
Heidi Masters, Ph.D.,
Regional Director
Adam Masters,
Regional Assistant

JSHS OBJECTIVES

- To Promote**
research and experimentation in the sciences, humanities, mathematics, and engineering at the high school level.
- To Recognize**
the significance of research in human affairs, and the importance of humane and ethical principles in the application of research results.
- To Search Out**
talented youth and their teachers, recognize their accomplishments at symposia, and encourage their continued interest and participation in the sciences, humanities, mathematics, and engineering.
- To Expand**
the horizons of research-oriented students by exposing them to opportunities in the academic, industrial, and governmental communities.
- To Increase**
the number of future adults capable of conducting research and development.

The Wisconsin-Upper Michigan Junior Science and Humanities Symposium is presented annually by the University of Wisconsin-La Crosse School of Education and Department of Military Science in cooperation with the National Science Teachers Association and the United States Army Research Office, Office of Naval Research and Air Office of Scientific Research.

The Symposium is one of 48 similar regional programs conducted by the National Science Teachers Association.

Outstanding students from regional symposia will be chosen to participate in the 58th National Symposium to be held in Norfolk, Virginia, April 15-18, 2020.

Wisconsin-Upper Peninsula of Michigan Junior Science and Humanities Symposium

January 25–26, 2020 | Treehaven in Tomahawk, Wis.



SYMPOSIUM AGENDA

Saturday, January 25

10–11 a.m.	Arrival/Registration Upload presentation to computer Board Games/Pool/Foosball/Gift Shop
11 a.m.–Noon	Welcome to Treehaven & JSHS Team Building Activities
Noon–12:45 p.m.	Lunch
1–1:45 p.m.	Practice Presentations Student Observers Learn about JSHS
2–6 p.m.	Oral Research Presentations
6–6:45 p.m.	Dinner
7–7:30 p.m.	Poster Presentations
7:30–9:30 p.m.	Night Hike/Activities/Snacks
8–8:30 p.m.	Teacher/Mentor Meeting
10 p.m.	Quiet Time

Sunday, January 26

8–8:55 a.m.	Breakfast/ Turn in Keys
9–9:45 a.m.	Military STEM Presentation
10 a.m.–11 a.m.	Group 1: Hike Group 2: Science Stations
11 a.m.–Noon.	Group 1: Science Stations Group 2: Hike
Noon–1 p.m.	Lunch
1–1:20 p.m.	JSHS Survey
1:20–1:40 p.m.	Awards Ceremony
2 p.m.	Head Home

*PosterPresenter
** OralPresenter

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UNIVERSITY of WISCONSIN
LA CROSSE

Wisconsin-Upper Michigan Symposium Late January or Early February, 2021

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Co-sponsored by the University of Wisconsin-La Crosse



Poster Presentations

JESSICA AYITE-ATAYI Verona High School

The Quality of Sleep

Sleep is essential to everyday life, and the goal of this experiment is to decrease the use of blue light before bed, improving sleep quality. The purpose of this experiment is to test how sleep quality differs from the use of blue light. The experimental design is just a control group in this experiment, and participants are aware of what the experiment consists of and what they are doing. The setting takes place in the home of the subjects, and is going to be ran by the use of two sleeping apps. First week, participants will go about their schedules as usual, but only tracking their sleep. The app, 'Sleep cycle', is a microphone sensitive app that tracks your breathing and sleeping throughout the night. For the second week, participants will again go about their usual schedules, as the underlying factor is substituting the use of any type of blue light an hour before their bedtime. They will be using the app, 'SleepTracker' to track their sleep for the second week. The importance of this experiment is to better sleep quality in humans. Playing a vital role in good health, protecting both your mental and physical, as well as your brain functions. My results will consist of comparison graphs of sleep quality between the first week and second week.

MADELEINE BARGER Verona High School

Targeting Oxidative Phosphorylation to Explore a Potential Treatment For High Grade Serous Ovarian Cancer

High grade serous ovarian cancer is the most common as well as most lethal subtype of ovarian cancer, accounting for about 70% of cases. Currently, there are no known treatments that are effective in both killing the cancer and preventing the recurrence of this subtype of ovarian cancer. Oxidative phosphorylation is a metabolic pathway in which ATP is efficiently synthesized due to the transfer of electrons from NADH and FADH₂ to O₂. Oxidative phosphorylation contributes to the survival of these cancer cells, as they rely on this pathway for an energy source. Therefore, an approach that can be taken to successfully restrict tumor growth is to inhibit oxidative phosphorylation. The purpose of this research is to identify molecules that can interfere with oxidative phosphorylation, with an end goal of creating a drug that cures high grade serous ovarian cancer.

MADELINE BONIFAS Verona High School

Information Technology (IT) Supporting the Accurate Collection of Data and Protocol in Medical Case Studies

The psychological and biological makeup of a criminal is a complex subject neuroscientists and forensic psychologists have tried to determine for many years. Genes MAO-A, FOX-2, CDH-13, fos-2 have been found to be a common malfunction in criminals. The orbital frontal lobe, hypothalamus, amygdala and the anterior cingulate cortex have been found to have different type of activity and even structure when compared to a normal, healthy brain. Environments and childhood trauma can also play a role in the development of a criminal career. Are criminals man made or born? To help support these details, psychopaths (born) and sociopaths (made) are introduced to show each of the factors in singular human subjects. By investigation famous criminals and the reports forensic psychologists give, helps to determine some pieces of this big puzzling mystery. Using Robert Hare's list and James Fallon's data, this paper is able to point out important information and go deep in ways that hasn't been thought of; empathy for these criminals. Studying these individuals can be the sole key to finding the root of the criminal behavior and effective ways to not only treat it, but prevent it.

KAELA BAHR Verona High School

Bang Energy Drink's Impact on Heart Rate in Female Adolescents

The purpose of this experiment was to see the effect the Bang energy drink had on female adolescents heart rate. In this experiment, I used the apple watch to monitor subjects heart rate over the course of a full day. It was hypothesized that the intake of caffeine in Bang energy drinks would increase the heart rate to almost double the resting heart rate throughout the whole day. It was also hypothesized that drinking a full Bang energy drink would increase the heart rate even higher. The experiment continued over three days, the first being the control day with just the subjects baseline heart rate, the second being a 50/50 drink of the Bang energy drink mixed with water, and the third being a full 15oz Bang energy drink. The results of the study showed that we could support the null hypothesis because all of the results were over the α -level of .05, showing to be not statistically significant.

Poster Presentations

JACOB CURTIS Big Foot High School

Decision Making Translation AI Response Time

One of the big problems and nuisances of being multilingual and having to frequently switch between languages is communication over mobile messaging because of the need to switch their keyboard language to message specific people. In response to this I have started on the development of a messaging app that will allow a user to set specific individuals to receive messages in specific languages and let the user consistently type in one language which will get translated automatically to the desired language. This app, if fully programmed would need to work at the fastest possible rate it can. To determine what the fastest way is, I conducted an experiment testing the response time between three loop methods. After conducting the experiment, I was able to determine the DO WHILE loop was the slowest at average response times of 9, 18.334, and 24 milliseconds. When looking at the fastest loop method of the three, the data was inconclusive do to the fact that the FOR loop was significantly faster than the WHILE loop for the 50th position with times of 16 and 18.667 milliseconds, but slower in the 100th position with times of 22 and 20.667 milliseconds.

ARHAT DWA Verona High School

Self-reported Therapy Adherence for Treatment of Type 2 Diabetes Mellitus

Insulin therapy is the most common treatment prescribed for type 2 diabetes mellitus (T2DM) patients. Although it is prescribed to almost 50% of T2DM patients, many patients do not use the insulin injection as recommended. The objective of this experiment is to find out the reason of non-adherence in T2DM patients in insulin therapy. Based off of prior research, we predict that women with clinical depression will less commonly adhere to insulin therapy. After comparing the number of diabetic patients to insurance rates, unemployment rates, and access to a primary care physician, we found a positive association with diabetic patients and unemployment rates and insurance rates. As expected, there was a negative trend with diabetic patients and primary care physician access. With positive trends in diabetes patients to unemployment rates and insurance rates, we conclude that their unemployment and insurance has a positive correlation with the diagnosis of diabetes within our experiment (Wisconsin counties). We also conclude that having less primary care physicians has a positive association with diagnosis of diabetes within our experiment. In 2020, part 1 of the experiment will be conducted and part 2 will be part of the background of that experiment.

ELIZABETH LARSON Verona High School

Everything You Need to Know about Tearing your ACL

I started this project in hopes to help other people's recovery go a little bit easier than how mine went. I used my past experiences and the lessons that I have learned to create this project, which will hopefully be used to guide others through their own injury. I am a very charismatic individual, who always wants to help others through their difficulties, so by expressing the hardships that I have had to overcome, I hope to make a connection and comfort those who are struggling with this injury. I have included the things that I had to do on a daily basis, and some of the most important exercises that I had to do on a daily basis to recover. Although your physical health is you number one focus on this journey, you can't forget about your mental health either. You need to focus on the little things, and congratulate yourself for the tiny milestones because this is a very long road to recovery. Taking a step back and just breathing, wiping your mind of everything, is what helped my mental health the most. This is a very difficult injury, and you do not want to go through it alone, which is why I have created this resource. I hope I have helped someone out there who is struggling with this, and I hope that they will soon overcome this long journey.

KENDALL HAZEN Verona High School

Gluten's Effect on Mood and Energy Levels in Adolescents

Gluten's effect on mood and energy levels is a widely speculated topic that does not have much research to support many of the claims that are being circulated throughout society. I completed a week-long experiment of 22 high school students. The students tracked all the food they consumed for a week and then completed a 7 question survey regarding mood and energy levels throughout the week. The students were then split into groups of high-gluten diets, medium-gluten diets, and low-gluten diets and the survey results were statistically analyzed for the mean and standard deviation. The experiment showed that there was little to no difference between the 3 groups of students. Since the students were completing the survey based on their average diet, the hypothesis cannot be supported or rejected, so further research will have to be completed. In the next phase of the experiment the subjects will be asked to minimize gluten from their diet for a week and take the survey again at the end of it and analyze the results with the previous week.

JOSEPHINE MCCARTNEY Verona High School

The Effect of Pre-Workout Supplements on Athletic Performance

Pre-workout supplement use is becoming more mainstream among amateur and professional athletes alike. However, the effect on sprint swimming performance is largely untested. A randomized, double-blind study was conducted to test the effect of pre-workout supplements on athletic performance. Subjects in the experiment swam two 50 meter freestyle, one before and one after a taking a blinded treatment. The subject's pulse rate, blood pressure, general symptoms, and 50 freestyle time were recorded after each swim. The average 50 freestyle time difference (post-pre) for the placebo group was 1.17 seconds and the average 50 freestyle time difference (post-pre) for the supplement group was 0.21 seconds. The subjects who used the pre-workout supplement showed greater time improvements and no indication of increased pulse rate over the subjects who did not use the pre-workout supplement.

KASTYN SHERMAN Big Foot High School

Shapes of Sorbents in Motor Oil

A sorbent is a substance that has the properties of collecting molecules and other substances. There are three main shapes of sorbents used in the process of collecting oil from ocean spills, pom poms, pads, and rolls. Each of their surface areas will be different. In theory, the shape that has the most surface area will be able to hold the most oil. The way I tested this was by simulating an oil spill in the ocean with a ripple tank. I hypothesized that the shape of the pom poms would cause it to be the most effective sorbent when collecting motor oil because they seemed to have the greatest surface area between the three sorbents. Through my experiment, I found data that refutes my hypothesis, the roll shape collected the most motor oil. The roll collected 823.35 grams of oil with a 31.75 grams beginning weight while, the pom poms collected 401.68 grams with a 31.84 grams of beginning weight and the pads collected 154.34 grams with a 15.48 grams of beginning weight.

Oral Presentations

AHMAD ABDEL-AZIM Appleton North High School Using Single-Cell RNA Sequencing Data to Study Plastid Differentiation Dynamics with Nucleus-Encoded Plastid Gene Expression in*Arabidopsis thaliana*

Plastids are organelles that are unique to plant cells and that synthesize and store critical chemical compounds and pigments. All plastids develop from undifferentiated proplastids in meristematic tissue; however, it is unknown how plastid development progresses relative to plant cell development, namely the extent to which plastid state is coupled with cell state. This coupling was explored via single-cell RNA sequencing of the root of *Arabidopsis thaliana*. Cells were clustered independently using nucleus-encoded plastid genes and non-plastid-related genes; this enabled independent assignment of plastid and cell type. A machine learning model was developed to classify cell types based solely on plastid gene expression profiles. The high accuracy of this model (>96%) suggests that most cells of a given type house the same unique plastid types. A trajectory inference model was used to create a pseudotime axis between undifferentiated meristematic cells and mature endodermal cells, enabling the study of synchronicity between cell and plastid development. Along this pseudotime axis, proplastid gene expression was found to significantly decrease as endodermal proplastid gene expression significantly increased, indicating that plastid state is coupled with cell state. Our finding of such coupling leads to advances in plastid engineering and may enable future biotechnological applications.

VIKRAMAILIANI Onalaska High School X-ray Crystallography and Biochemical Analysis of Fumarase C Variant H129N

Crystallographic studies of the structures of proteins help explain how those proteins function as enzymes. The field of crystallography has advanced in the past decade, mainly in terms of the energy that can be achieved by a beam in X-ray crystallography. However, current crystallography data on the structure of the H129N mutated variant of the enzyme fumarase has a significantly lower resolution than modern structures of the regular wild type. In this study, we used purification techniques such as Ni2+metal-chelate chromatography to create crystals of the H129N variant with hanging drop vapor diffusion so we could solve its structure with X-ray crystallography, eventually obtaining a resolution of approximately 1.41 angstroms, near that of modern structures for the wild type. We also began experiments with circular dichroism and Michaelis-Menten kinetics to determine thermodynamic quantities for folding in wild type fumarase C and the H129N variant as well as kinetic quantities for the catalysis of both enzymes in the dehydration of S-malate to fumarate, with the goal of understanding how the solved structure affects the function of the variant.

SIONA BEAUDOIN Lake Linden-Hubbell High School Public Perceptions of Wild Berry Crops and an Invasive Species Pest Threat in Rural Michigan

The Upper Peninsula of Michigan (UP) is a region heavily dependent upon agritourism. The population has a high percentage of Native Americans and Finnish Americans, and a median household income that is below the Michigan average. During the summer of 2019, a study was conducted in the western UP concerning local knowledge of berries a new invasive fruit fly, Spotted Wing *Drosophila* (SWD, *Drosophila suzukii*). SWD infests fruit before it is ripe, meaning that it is already inside the berries when they are harvested, and can make it ripen faster. Sampled berries from the UP contained SWD larvae. A demographic survey was used to determine public knowledge of SWD and local berry practices. Out of 45 completed surveys, only one reported that they did not pick berries. Over 75% of respondents began picking berries in their youth and have continued throughout their life. This shows that berries are ingrained into the local culture. Furthermore, the surveys confirmed that many people pick berries as a cost saving way to obtain healthy food.

SYDNEY BENDER Big Foot High School Determining the Effects of Antibiotic Resistance in Soil From Local Farmland

Four local farms were chosen based on the type of manure being sprayed on their fields, Davis, Loudenbeck and Vanderstappen used animal fertilizer and Pearce farms used a non-animal fertilizer.. From these farms five soil samples are taken from each, using a sound and respected method creating randomized samples. The samples were mixed with water and filtered to create a soil mixture and the mixture was spread over an agar plate, resulting in a bacteria lawn. Antibiotic solutions of ampicillin, tetracycline, penicillin, and streptomycin were made. In a sterile environment, one sterile disc of paper was rinsed in a corresponding antibiotic and placed in quarter section of the bacteria lawn. Kill zones were recorded and analyzed. From the results obtained from this research, it can be concluded that antibiotic resistant soil occurs in farms that use animal manure as a fertilizer in crop fields. With 100% of samples taken from Loudenbeck, Vanderstappen and Davis farms showing no kill zones for the four antibiotics. Testing soil samples that come from local farm lands will enable farmers from communities to better their methods of antibiotic use and understanding the effects it has on the crops they are producing.

AIDEN COOK Cashton High School Evaluating a Non-Lethal Screening Technique for the Detection of the Spring Viremia of Carp

Common carp, although an invasive and pervasive species in nearly all reaches of the Mississippi River, are an important commercial fish world-wide and in the United States. Spring Viremia of Carp Virus (SVCV), listed as a notifiable disease under the World Organisation for Animal Health, is a major threat to carp species, especially farmed fish (including ornamental koi). This exotic virus was first discovered in the United States in 2002 and has now been found in fish species native to the Mississippi River. To date, a non-lethal screening technique for this virus has not been established. This study took swab samples from the gills of 35 common and quillback carp from pool 10 of the Upper Mississippi River. Samples were tested using nested reverse transcriptase polymerase chain reaction (RT-PCR), and results were shown using gel electrophoresis. Though SVCV was not detected in any carp samples, the positive control was successfully identified through the RT-PCR. This means that when present in high enough concentrations in the gills of carp - SVCV can be detected using RT-PCR. The results of this study prove that the use of RT-PCR as a non-lethal screening technique to detect SVCV can be effective and certainly warrants further investigation.

MEGAN CULPITT Cashton High School Organic Insecticide Options for Alfalfa in Wisconsin

The potato leafhopper is the number one alfalfa pest in the state of Wisconsin, and these pests are not controlled or managed in organic alfalfa production (I.P.M.P.U.W.E, 2017). In order to assist producers in combating this problem, research was done to evaluate the effectiveness of certain pesticides approved by the Organic Materials Review Institute (OMRI) that specifically target potato leafhoppers. Currently, there are no organic pesticide recommendations for leafhopper control, so three insecticides were tested using a randomized complete block plot layout at two separate locations (I.P.M.P.U.W.E, 2017). Each pesticide was replicated four times at each location, and each replication block was swept in order to gather a sample of the insect population. Each sample was later counted and ran through a statistical analysis used to determine the least significant difference, which was Duncan's New MRT at a confidence level of 95%. Based on statistical analysis, there was not a significant difference between treatments. However, data displayed a noticeable trend that demonstrated a biological difference in the product Azera. When compared to other treatments tested, Azera reduced the number of insects by half compared to other products. This warrants the need for further testing of the effectiveness of this product. These results will be used by the University of Wisconsin-Agriculture Extension Agency to further examine organic pesticides and identify potent and cost-effective pesticide recommendations to organic farmers in the near future.

NEIL DOGRA University School of Milwaukee Effect of Microstructure on Contact Angle and Corrosion of Ductile Iron: Iron-Graphite Composite

Using hydrophobic metal pipes to create intrinsically corrosion-resistant piping is desirable because artificial coatings on metal pipes can degrade over time leading to high cost of replacement and contamination to water systems. Ductile iron samples with similar compositions and varying microstructures were uniformly abraded, and the effects of phase fractions (ferrite, pearlite, and graphite) on the apparent contact angle (with water) and corrosion characteristics of ductile iron were investigated. The effect of droplet volume on the apparent contact angle of ductile iron was also investigated. Irrespective of the droplet size, the ductile iron system followed the Wenzel model of wetting, and the contact angle increased with increasing droplet volume. The Wenzel and Cassie-Baxter contact angles were calculated, and the calculated results agreed well with the experimental results. It was experimentally shown that pearlite is more susceptible to corrosion than ferrite and graphite, and a higher portion of pearlite in the microstructure can be detrimental to the corrosion resistance of the material. Increasing phase percentages of graphite showed higher contact angles with water and thus more hydrophobicity. Understanding the relationship between the microstructure, contact angle, and corrosion can be used to develop materials with higher contact angle and corrosion resistant microstructures.

MELISSA KONKEL Big Foot High School Determining Best Concentration Percentage of FBS in DMEM Media for Mammalian Muscle Cell Growth

The effects of lowering the FBS (Fetal Bovine Serum) concentration in DMEM/Ham's F-12 growth media on bovine skeletal muscle cell growth were tested to determine if lowering the key nutrient source for the cells could still result in optimal growth. By lowering the FBS concentration, this research aims to lower procedural expenses regarding the technology, as well as help the rising levels of world meat consumption. If bovine muscle cells are grown in different concentrations of FBS growth medium, then cells grown in media containing 20% FBS will have the highest concentration of live cells per mL because 20% FBS is the widely accepted concentration used in industry. This research encompassed the breakdown of tissue to obtain muscle cells which were placed into concentrated FBS media and grown in a CO2 incubator with media changed every 3-4 days. Subculturing was conducted every 7-10 days and cells collected and measured using a hemocytometer. Using these results, it can be concluded that the lowering of FBS is productive toward cell growth. The highest number of live cells counted were found in the 10% FBS media, with a total average live cell count at 753,333.33 among the trials.

ZADAN MASON University School of Milwaukee A Novel Approach to Determining Cost-effective Federal Spending on Urban Homelessness

The homelessness problem in the US, especially for children, significantly increased after the 2008 financial crisis; one in every 200 Americans spends at least one night each year in a shelter. As the scope of the problem has increased so has federal spending. Prior studies have analyzed data from a single region or funding source. Although data on federal spending has been reliably available since 2007, it has not previously been aggregated into a single database and matched with census data. In this study, a 'big data approach' is used to determine the most cost-effective category of federal spending (permanent housing, transitional housing, supportive services, vs. administrative spending) for reduction of the total homeless population. It was hypothesized that permanent housing spending would have the biggest impact, however, when limiting analysis to urban areas, cohorted based on size, a difference-in-difference econometric analysis reveals that dollars spent on supportive services (e.g. case management, social work, life coach, job training), result in the greatest decrease in the number of homeless per dollar spent. Specifically, every \$1 million spent on support services eliminates homelessness for 890 people. This study supports targeting dollars to social service programs over bricks and mortar housing units.

QIUSU MIAO Wisconsin Lutheran High School Fourier-transform Infrared (FTIR) Spectroscopy Analysis of Seven Wisconsin Biosolids

This research explores the use of Fourier-transform infrared (FTIR) spectroscopy to better understand the phosphorus (P) characteristics of biosolids and provide insights when biosolids are applied to agricultural production. Biosolids from five Wisconsin wastewater treatment plants (Madison, Delafield, East Troy, Mukwonago, and Fort Atkinson) were obtained. From the Madison location, several samples were obtained from different parts of the treatment process – cake, final liquid (labeled as Metrogro), and composted biosolids. FTIR spectra from these samples were compared to P standards, aiming to identify the dominant P species. Several FTIR methods were employed: attenuated total reflectance (ATR), NaCl salt plates with mineral oil, and pressed KBr pellets. The P standards indicated two critical wavelength regions in which the inorganic species' IR peaks are shifted to a higher wavenumber than those of the organic species. The results are preliminary, but the future work will compare the FTIR and 31P NMR results alongside chemical extractions. Such research will provide both qualitative and quantitative information to describe the inorganic and organic P forms and species in biosolids resulting from different wastewater treatments and biosolids production processes. The research findings could provide farmers useful information in applying biosolids to their fields.

EMMA SCHLESNER Cashton High School The Potential Unintended Effects of RNAi as an Insecticide Targeting the Colorado Potato Beetle

The Colorado Potato Beetle (CPB) (*Leptinotarsa decemlineata*) is a very common pest to many potato farmers in America, and increasingly around the world. The beetles feed on and destroy many members of the nightshade family (*Solanaceae*), and can cause tremendous damage to potatoes including up to a complete loss of the crop. Using conventional methods to control this insect could potentially cause a lot of damage to the environment. Using alternative control treatments could end the negative impacts on the environment associated with conventional insecticides. The method used in this experiment was RNA interference (RNAi), which exploits a natural phenomenon in all eukaryotic organisms. Simply, RNAi is a natural, biological process in which double stranded (ds) RNA molecules inhibit further gene expression effectively halting the synthesis of a specific protein, by silencing a targeted mRNA molecule. Previously, this process was often termed post-transcriptional gene silencing. In our experiments, we applied different rates and formulations of dsRNA molecules onto potato plants infested with CPB and compared not only the number of potato beetles collected, but also the number of other, 'non-target', insects on the plants. Ideally, if the specific dsRNA molecules we applied only targets in the CPB, then we would observe no unintended consequences on other insects. Insect abundance and diversity in dsRNA-treated plots were compared directly to a set of plots receiving conventional insecticides as an experimental control. These experiments clearly demonstrated that using RNAi is an effective way of killing a specific insect species without harming non-target insects.

EDEN WINGA Central High School X-ray Protein Crystallography and Kinetic Analysis of Salmonella Fumarase C

During the tricarboxylic acid (TCA) cycle of cell metabolism, the enzyme fumarase catalyzes the reversible hydration of fumarate to S-malate. Fumarase has also emerged as a key factor in DNA damage response and tumor suppression. Although the biochemical properties of class II *E. coli* fumarase have been studied extensively, no investigations on class II *Salmonella enterica* Fumarase C (Se FumC) have been conducted. In this study, the gene for Se FumC was cloned into a protein expression plasmid, expressed, purified, and characterized using biochemical techniques. Protein crystals were obtained to determine the three-dimensional structure of Se FumC, and initial X-ray diffraction data was collected. Biophysical and kinetic analyses were also done, thus providing a more comprehensive understanding of the role of Fumarase C in the essential process of life.