PROJECT LEAD THE WAY

PLTW

February 7, 2018

Frankfort, Kentucky

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Schedule of Activities
February 7, 2018

11:00 a.m. ...…….…Project Lead the Way Display Registration Opens (House-side Mezzanine)

11:00 a.m. to 12:00 p.m. …….. Poster Setup and Legislative Visit Time

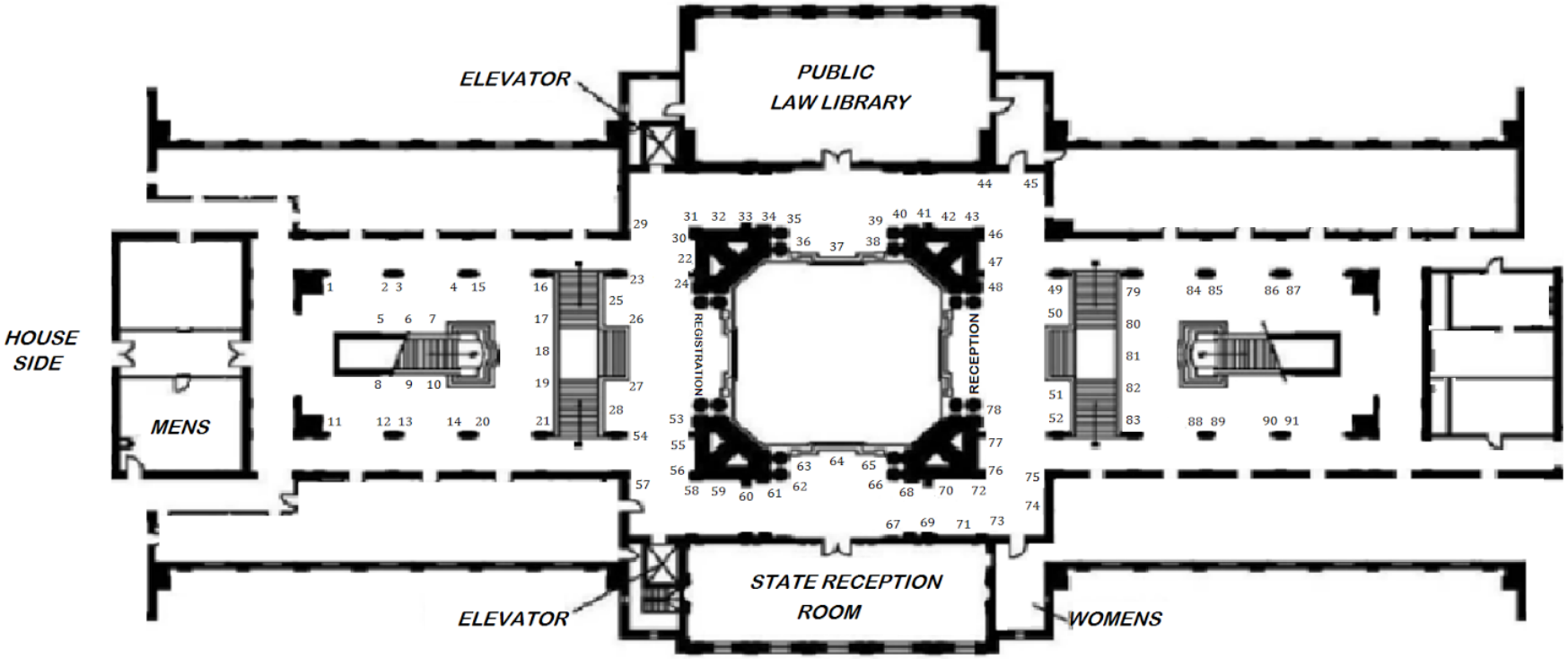
12:00 p.m. ……Lunch Provided for Participants and Mentors (Capitol Education Center)

1:00 p.m. to 3:00 p.m. ……..……..……..……...…..…..General Poster Display Time

2:30 p.m. ...…….....….Group Photograph (House Staircase)

3:00 p.m. ……...……...….Conclusion

All times listed are Eastern Standard Time.


ELEVATOR
PUBLIC
LAW LIBRARY
HOUSE
SIDE
SENATE
SIDE
MENS
REGISTRATION
RECEPTION
STATE RECEPTION
ROOM
ELEVATOR
WOMENS

Poster No.	Student		Mentor	House No.	Senate No.
21	Ballow	Daniel	Tom Rowe	63	23
11	Blanco	Bobby	Jennifer Wilson	80	15
12	Blanco	Bobby	Mike Crohurst, Jennifer Wilson	80	15
9	Brown	Kodie	Jennifer Wilson	80	15
5	Burkhardt	Caroline	Tim Oltman	58	20
34	Calhoun	Julia	Chad Wilkerson	12	8
24	Chesser	Jonathan	Greg Conley	24	14
30	Clarkson	Skylar	Robert Bauer	23	9
27	Combs	Lindsey	Julye Adams	61	17
10	Cook	Layla	Jennifer Wilson	80	15
12	Creech	Devon	Mike Crohurst, Jennifer Wilson	80	15
32	Crowe	Ashton	Chad Wilkerson	14	8
33	Daley	Wayne	Chad Wilkerson	7	8
31	Davis	Cassidy	Robert Bauer	23	9
20	Deters	Ethan	Tom Rowe	63	23
15	Dinga	Jackson	Stephen Drawbaugh	59	26
6	Early	Grant	Kristin Howell	58	20
6	Eldridge	Julianna	Tim Oltman	58	20
13	Elmore	Hagan	John Franklin	85	15
3	Fielding	Alana	Tim Oltman	58	20
35	Gardner	Natalie	Sara Anderson	69	23
8	Geralds	Carly	John Franklin	65	23
4	Gribbins	Blake	Tim Oltman	58	20
16	Hadley	Christy	Rachel Page	60	11
34	Haimes	Emily	Chad Wilkerson	12	8
32	Hall	Samantha	Chad Wilkerson	14	8
31	Hammer	Brooke	Robert Bauer	23	9
4	Hernandez	Daniel	Tim Oltman	58	20
12	Hopkins	Brookelynn	Mike Crowhurst, Jennifer Wilson	80	15
1	Johnson	Mallory	Elaine Dietz	61	17
2	Jones	Trenton	Elaine Dietz	61	17
17	Kalany	Katelyn	Rachel Page	60	11
23	Kaminski	Nicholas	Greg Conley	24	14
7	Kerns	Grant	Mike Crowhurst, Jennifer Wilson	80	15
26	Kindrick	Kirsten	Julye Adams	62	17
36	Knott	Tara	Chad Wilkerson	14	8
30	Lile	Brooklyn	Robert Bauer	23	9
19	Lind	Zachary	Tom Rowe	63	23
24	Logsdon	Cameron	Greg Conley	24	14
4	Lopez	Americo	Tim Oltman	58	20
15	Lu	Kevin	Stephen Drawbaugh	59	26

Poster No.	Student		Mentor	House No.	Senate No.
30	Madison	Chloe	Robert Bauer	23	9
34	Mayer	Katarina	Chad Wilkerson	12	8
14	McTaggart	Kelly	Stephen Drawbaugh	59	26
25	Miles	Brandon	Greg Conley	24	14
36	Miller	Annie	Chad Wilkerson	14	8
3	Murphy	Stuart	Tim Oltman	58	20
23	Palagi	Jane	Greg Conley	24	14
28	Payton	Alexis	Julye Adams	78	17
14	Reed	Ellie	Stephen Drawbaugh	59	26
27	Rodriguez	Luis	Julye Adams	61	17
20	Rottinghaus	Trey	Tom Rowe	65	23
29	Schmidt	Ashton	Julye Adams	78	17
21	Seibert	Patrick	Tom Rowe	63	23
7	Shawen	Hannah	Mike Crowhurst, Jennifer Wilson	80	15
8	Shepherd	Jacon	John Franklin	65	23
33	Singh	Aman	Chad Wilkerson	7	8
11	Singleton	Morgan	Jennifer Wilson	80	15
12	Singleton	Morgan	Mike Crohurst, Jennifer Wilson	80	15
28	Smith	Suellen	Julye Adams	78	17
5	Sprout	Robert	Tim Oltman	58	20
26	Steffen	LiAnna	Julye Adams	62	17
3	Stewart	Jackson	Tim Oltman	58	20
25	Thomas	Luke	Greg Conley	24	14
6	Thompson	Noelle	Kristin Howell	58	20
22	Turner	Madison	Robert Mayton	95	29
35	Webster	Meghan	Sara Anderson	69	23
26	Whitlock	Gabby	Julye Adams	62	17
14	Whitlow	Zachary	Stephen Drawbaugh	59	26
15	Winkle	Matthew	Stephen Drawbaugh	59	26
13	Wright	Caleb	John Franklin	85	15
18	Wu	Amber	Rachel Page	60	11

1, Mallory Johnson, Elaine Dietz (Mentor)

Grant County High School

Antifungal Activity of Different Essential Oils

Fungal infections are extremely common and can linger for years. Traditional antifungal treatments require repeated doses and result in a multitude of side effects which led to the study of alternative treatments. Essential oils are rising in popularity as a substitute for a plethora of medicines, including antifungals. In this study the fungicidal activity of 5 different essential oils solutions that were created were tested against a control of distilled water on yeast cultures that had been grown. Data was collected over the course of a 15-day trial and cell death was recorded daily. Once the trial came to its conclusion four of the five oil solutions had t-statistics greater than the critical value of 1.701. Lavender oil showed the most cell death, yielding a t-statistic of 5.101. These findings indicate that certain essential oils possess qualities of a fungicide, making it a viable side effect free alternative to antifungal creams for those plagued with recurring fungal infections.

2. Trenton Jones, Elaine Dietz (Mentor)

Grant County High School

The Effect of Automotive Stimulus on Seated Human Drowsiness

Currently accounting for 21% of all traffic accidents, drowsy driving is a global problem that is worsening in severity as more and more sleepless drivers are on the road. The purpose of this innovation is to reduce the frequency of drowsy driving, presented in the form of a steering wheel redesigned to detect and stop drowsy driving. On the steering wheel cover is a microphone to detect the sound of the car going over a rumble strip, a microcontroller to process the noise, and a combination of stimulating components such as light, vibration, and sound – all shown to increase human alertness. The proposed result is a decrease in accidents caused by drowsy driving, and an increase in the safety of late night roads.

3. Alana Fielding, Stuart Murphy, Jackson Stewart, Tim Oltman (Mentor)

Martha Layne Collins High School

Automated Scoring Cornhole Board

Our team's goal is to develop an automated cornhole scoring system. After gathering input from a wide range of education levels and ages, the team concluded its usefulness would be appreciated well enough so that the product would be of feasible economic interest. Current solutions to issues associated with cornhole scoring still require the user to perform manual calculations. One could account for the success of this product by comparing its technology with the advent of the credit card. The credit card has optimized the money transaction process, and its popularity explains society's general interest in an automated scoring system. Accordingly, the technology our team has selected to gauge a cornhole team's score at any point in the game is exactly that which the credit card uses. This way, no mechanical failure should incur, which would otherwise result in immediate decline in the product's credibility and demand. Responders to our survey further showed value in aesthetic quality of our product, which shall be resolved by allowing personalization of the product, e.g. adding a favorite sports team or college to the design.

4. lake Gribbins, Daniel Hernandez, Americo Lopez, Tim Oltman (Mentor)
Martha Layne Collins High School
Baseball Scooper

There are many baseball teams in the U.S. and in other countries; through research we found out that teams waste a lot of time picking up baseballs during their practices, while they could be perfecting their hitting, throwing, catching, and other techniques. Another problem we found was that baseballs are torn from lawn mowers all the time. After a ball is torn it's thrown away and when a ball is thrown away, they have to buy new balls which means money. That is why we plan to solve these problems by creating a product that will attach to a gator or golf cart. My team and I surveyed people in our school, outside of school, and baseball coaches near us. Our results were that 4 people did not want our product but 95 others (including baseball coaches and players) said yes they would buy it. Another question in our survey was, if baseball teams were wasting time on collecting their balls? 87 people said yes and 8 said no. Our product will collect baseballs up from the ground efficiently, quickly, and will be able to save the balls from ever being torn which will save money from not having to buy new balls. We are making our baseball scooper to be all terrain, the scooper will be able to travel on any terrain to accomplish its goal and teams could pick up baseballs anywhere a gator or a golf cart can fit. This product is not like any other because it is more durable, reliable, it will run on any terrain, more efficient, and better looking. Plus you will be able to pick up any ball that is the size of a baseball, the scooper does not have to be used just for picking up baseballs. Our product known as the Baseball Scooper will be affordable as well because on average MLB teams make at least 301 million dollars a year and schools that fundraise make at least 55,000 dollars. The cost for this product will be around $500 and with our Baseball Scooper we will be able to accomplish the goal, that teams will not have to waste time on collecting their balls, it will save teams thousands of dollars, and it's affordable.

5. Caroline Burkhardt, Ropert Sproul, Grant Early, Tim Oltman (Mentor)
Martha Layne Collins High School
Gutter Filtration System

More than 35% of the world's population lack access to clean and fresh water each day. One in every five people die due to water related diseases. Recently, there has been a push to help these communities gain access to the basic need of life: water. It has been seen that these projects have truly made a difference in the health and lives of those in developing communities. Our group was inspired by the efforts of other companies to provide fresh water to communities in need. However, we took a different angle: rain water. Rain water contains bacteria that is unsafe to drink. We aim to construct a filter that has the capacity to harness rainwater and convert it into safe drinking water through the structure of a gutter. Fresh water can be the start for communities to begin an upward climb to development, to help themselves and surrounding communities. Through our invention families will not have to rely on organizations, governments, or others providing them with an essential to life. We strive to make the next generation healthy and continually working towards development and improved life standards.

6. Julianna Eldridge, Noelle Thompson, Kristin Howell (Mentor)
Martha Layne Collins High School
The Effect of Stress on Reading Accuracy

Previous work has shown that school children exposed to prolonged environmental noises (aircrafts, railways, traffic) have impaired cognitive functioning. The purpose of this experiment is to test the effect of noise, an acute stressor, on reading accuracy. Participants (n=15) wore headphones and held Vernier hand-grip heart-rate monitors in an upright position. Each subject had 25 seconds to read a novel paragraph, with repeated non-sense words. The paragraph was read once with the noise stressor and once without. The noise stressor consisted of a mixture of white noise, counting, and words from the reading. Statistical analysis showed that noise significantly increased heart rate [$t(14)= 3.500$, $p<0.05$], indicating that it did function as a stressor in this experiment. Results also showed that reading accuracy was significantly lower in the presence of the noise stressor [$t(14)= -2.387$, $p<0.05$]. This data suggests that the noise acted as a stressor on students, causing them to read less accurately than when they were not under auditory stress. The current findings can be extended to student learning and standardized testing settings. Students exposed to excessive talking or a series of distracting noises may experience an increase in heart rate that may affect how they perform academically.

7. Hannah Shawen, Grant Kerns, Grant Crowhurst (Mentor), Jennifer Wilson (Mentor)
Pulaski County High School
Biofeedback Therapy at Your Fingertips

The purpose of this study is to develop and field test an app using a biological form of calculation know as Biofeedback Therapy to utilize biological information to decrease stress responses. This study was quantitative and focused on the use of Biofeedback Therapy to manage extreme stress in the everyday life of the consumer. In today's society, stress is very prevalent, and it is not uncommon for anxiety over necessary activities (i.e. getting blood drawn, dental procedures, or taking an exam) to reach a debilitating level. The human body reacts to stress with characteristic physiological responses, such as elevated heart rate, increased blood pressure, and increased body temperature. Long term effects of these physiological stress responses can lead to harmful influences on health, including high blood pressure, high cholesterol, and migraines. Biometrics such as heart rate are easily measured through common devices such as Apple and Garman watches, making it possible for individuals to use this information to gauge stress responses. The principle of biofeedback therapy is that by becoming aware of a certain stress response, an individual can then make conscious effort to relax, thus decreasing the stress response. This project begins with the development of a mobile application called 'bioMEtrix', using MIT App Inventor. With this app at your fingertips you can become aware of the stress response your body is having to an event and discover how to control that response. Volunteers will engage in a stressful event, then use the app. The time it takes for the stress response, in this case heartrate, to return to normal will be measured and compared to the time it takes for the stress response to return to normal without using the app. It was found that when using the app, the average heart rate three minutes after a stress event was 87 bpm, compared to 101 bpm without using the app.

8. Carly Geralds, Jacon Shepherd, John Franklin (Mentor)

Pulaski County High School

Collapsible Shampoo Bottle

How many times in a year does a bottle stop giving you the substance when the pump can no longer reach it? Not only is it an annoyance but also it can simply be fixed. We surveyed 200 people, 76% of people found that when the pump can no longer reach the liquid at the bottom it was an annoyance. While only 31% of people found an answer to their annoyance. The Container Recycling Institute states that more than 60 million plastic bottles end up in landfills and incinerators every day- a total of 22 billion last year. Many of these still had useable soap and other products inside them. This shows a waste of material and is harsh on the environment. Using biodegradable materials we have innovated the shampoo bottle so that all the substance left at the bottom after the pump cannot get it is easily accessible for everyone. Much like a collapsible funnel that you would use in cooking the bottle folds up on a section at a time so that at the end you can get all of the substance. As the bottle gets emptier the sections fold up so once you've used enough for the first section it will fold up allowing for you to get all of the substance. Testing our prototype will be done by comparing the amount of substance remaining our collapsible bottle versus normal shampoo bottles. Data will be compared to determine which bottle on average, by percentage of product left in bottle, is more efficient.

9. Kodie Brown, Jennifer Wilson (Mentor)

Pulaski County High School

Effects of Caffeine of Drosophila Melanogaster Larvae Development and Behavior

Caffeine is widely consumed in today's society by all age groups. Present in energy drinks, soft drinks, and, of course, coffee, caffeine activates many behavioral and neurological mechanisms, and is associated with increased positive subjective effects such as higher alertness and faster development. In this project I will conduct an investigation to determine the effects of diets high in caffeine using Drosophila melanogaster larvae. The larvae will be transferred during first Instar stage in groups of twenty-five to thirty, to two tubes. One tube will contain a diet of commercial fruit fly media alone, and the second tube will contain a commercial fruit fly media containing the same amount of caffeine as the average cup of coffee contains (95mg/8 oz or 237g). I will study larval survival rate, timing of development milestones, and behaviors such as body wall contractions and mouth hook movements to determine if consumption of caffeine negatively impacts normal larval development. Results cannot be finalized due to the experiment being ongoing at the time of this abstract.

10. Layla Cook, Jennifer Wilson (Mentor)

Pulaski County High School

Effects of High Protein Diet on Organ Anatomy Using a Murine Model

Many high school athletes utilize protein supplements to improve athletic ability by gaining muscle mass. These supplements can come in many forms such as powders, pills, and food items. Excessive consumption of protein in teens has been tenuously linked to damage to the liver and surrounding digestive organs. Due to the excessive consumption of protein powders seen in high-school and col-

lege student athletes, these students are in danger of liver damage. This study investigates the effects of a high protein diet using a murine model. Two six-week-old Balb/cAnNHsd mice, one male and one female, were given a sixty percent protein diet (using a common protein powder supplement). Two six-week-old Balb/cAnNHsd mice, one male and one female, were given a standard murine diet with eighteen percent protein, a standard diet for laboratory mice. At the end of the investigation, the gross macroscopic anatomy and histology of the liver and other digestive organs will be examined. Observational data on the behavior of the murines given protein, show that behavior is significantly different than the counterparts. The investigation is ongoing at the time of this abstract, so all results are not yet available.

11. Bobby Blanco, Morgan Singleton, Jennifer Wilson (Mentor)
Pulaski County High School
Fight Nature with Nature: the Use of Essential Oils in Preventing the Spread of E. coli

Escherichia coli (E. coli), a fecal coliform bacterium, is one of the various infectious pathogens that haunts our communities, resulting in illnesses that are detrimental to our health. One in seven Americans suffer from the spread from different strains of E. coli that lead to symptoms including stomach cramps and diarrhea. E. coli and other pathogenic fecal coliforms are found everywhere in our environment, not just the bathroom. Passed through multiple avenues such as food contamination or a simple handshake, the ease of transmission of fecal coliforms, including E. coli, pose a problem to which a solution must be created. Some studies involving E. coli have found certain essential oils to be effective in controlling the bacterium. Based on this information, we intend to create a lotion infused with tea tree essential oil to fight the contamination of E. coli through touch. We will sample the hands of volunteers before the investigation begins, then after use of the lotion throughout the day. These samples will be compared to volunteers who will not use the lotion. If the lotion is successful, there will be a lack of E. coli colonies on the agar plates containing the cultures while samples from untreated volunteers will present with colonies. Results are still in progress and will be released shortly.

12. Bobby Blanco, Morgan Singleton, Devon Creech, Brookelynn Hopkins, Mike Crowhusrt (Mentor), Jennifer Wilson (Mentor)
Pulaski County High School
Our Addiction to Technology: Physiological Responses to Cell Phone Deprivation

In today's world, 9 out of 10 Americans own a cellphone. In addition to the multitude of cellphones, the average time of usage is a staggering 5 hours a day. 80% of that time is used in communication. Consequentially, as a whole we have become dependent on technology and created a psychological attachment to our cellphones bordering on addiction. This experiment studies the effects of that addiction by having volunteers sit for a fictional “experiment” in which their heart rates, surface temperature of the skin, and blood pressures were being recorded. During this time, a researcher repeatedly texted the volunteers, who were unable to look at their phones. The results demonstrated a universal increase in heart rate and blood pressure, along with a decrease in surface temperature of the skin. These responses mirrored stress responses, indicating that the psychological attachment to cell phones resulted in a physiological response by the body when deprived of access to cell phones. This “addiction” could lead to self-harmful behaviors, such as texting while driving,

talking on the phone during work, or checking social media during class. It has come to the point that laws have been passed prohibiting the use of cell phones during driving, employees have been fired, and students have failed class due to cell phone use. This experiment focuses on not only demonstrating the dependence that we feel to our cell phones, but also on methods that could help to lesson that dependence. Primarily, the effectiveness of an app that rewards the user for not using his or her phone during a specific time frame will be measured. As the experiment is still ongoing, no results for this portion of the experiment are available at this time.

13. Caleb Wright, Hagan Elmore, John Franklin (Mentor)
Pulaski County High School
Train Energy

We look to provide a better source of energy for all people. The current sources of energy that are provided are outdated and need to be replaced. The current renewable sources have many flaws such as the inconsistencies of solar and wind, or the danger of nuclear power plants. Also the nonrenewable resources that we have used over the past century, fossil fuels cause about 78% of the pollution to our atmosphere alone. We gave a survey to 100 people yielding a result that shows the emphasis of our issue. 75% of people to took our survey said they would be interested in eliminating fossil fuels and switching to green energy if we could produce it as consistently as fossil fuels. To do this we are going to use something common that every town has, trains. The force a train creates while running down the track is of enormous amounts of force. Knowing this we plan to harness the power of the trains to turn a generator and distribute power to others.

14. Zachary Whitlow, Ellie Reed, Kelly McTaggart, Stephen Drawbaugh (Mentor)
Arvin Education Center, Oldham County
CO and Smoke Detector with Garage Door Opening Capabilities

Over 500 Americans die each year from carbon monoxide poisoning, and about 15,000 are sent to the ER. Leaving a car running while the garage door is shut can lead to the buildup of these fumes. If a person forgets to shut off the vehicle's engine after the garage door has been lowered, they will be inhaling the fumes without evening realizing they are breathing in this odorless gas. CO gas has often used in order to commit suicide by breathing in the fumes emitted from the exhaust. Garage fires are also a determining factor in the design of this product. 30 deaths, 400 injuries, and $457 million in property damage are caused each year due to garage fires. Electrical malfunction is the leading cause of residential garage fires, a faulty wire or electrical outlet can spark and engulf the structure with flames. In order to limit the number of people who die each year from carbon monoxide poisoning, a device will be created that will be able to detect harmful CO gases and respond to these gases by opening the garage door. The device will also be able to detect smoke as well as alert the fire department when levels reach dangerous heights. The project design team will combine a carbon monoxide detector, smoke detector, and an alert system for the fire department in order to provide homeowners with a device that will detect these gases and open the garage door when levels reach dangerous amounts. The combination system will be installed within the garage door opener and will send a signal to the sensor that will automatically open the garage door when CO and smoke are detected. The product will provide a safe and efficient way for homeowners to get the help they need when exposed to these two gases. This system will prevent and limit the number of deaths, injuries, and

property damage caused by CO and smoke.

15. Jackson Dinga, Matthew Winkle, Kevin Lu, Stephen Drawbaugh (Mentor)
Arvin Education Center, Oldham County
Moroni Smart Mirror

The number one time waster, for the average adult, is a handheld computer. When getting ready for their day, people will use their phones check the weather, time, schedule and possibly turn on some music to set the tone for the rest of the day. Often times a user will become distracted and sucked into the realm of technology. The Moroni Mirror's goal is to reduce the time on your phone in the mornings by keeping you up to date on the time, you calendar, and many other everyday necessities. Our concept incorporates coding a new user friendly GUI for a Raspberry Pi 3, while displaying it on an LCD monitor which will be placed behind a two-way mirror making the product usable in everyday life. We aim to keep this product at lower production costs to be able to distribute it easily in the end.

16. Christy Hadley, Rachel Page (Mentor)
Ryle High School, Boone County
Effect of Diagnosis of ADHD in Adults

There are a multitude of resources for young children struggling in the early years of schooling with mental disorder, ADHD specifically. However, if left undiagnosed, the problems carry over into adulthood where these issues can then become amplified and affect their home and work life without having established a coping mechanism. In this study, the effect of a diagnosis of ADHD was researched in adults. It was hypothesized that the population felt as though their diagnosis had positively impacted their lives and had improved the way that think about themselves. Participants had not been diagnosed prior to adulthood and surveys were collected in regards to how they felt the diagnosis affected their lives. Over 100 survey responses were gathered in order to obtain a fair sample and opinion of the group. The survey consisted of multiple scaled questions that concerned their feelings both before and after both diagnosis and treatment. EX: "Before diagnosis, I felt ADHD was affecting my home life negatively"; the answers then ranged from "strongly agree" to "strongly disagree". That same question would then be posed in the after diagnosis section. With this data, support can be raised for adult mental disorders and try to decrease the stigma placed on adults who have them.

17. Katelyn Kalany, Rachel Page (Mentor)
Ryle High School, Boone County
Improving upon the Compatibility of Occlusion Therapy in Pediatric Cases

Amblyopia is a detrimental side effect in the case of pediatric cataracts. This condition, also known as "lazy-eye", can only be corrected with the usage of occlusion therapy following the cataract removal surgery. Thus far in this field, occlusion therapy for children primarily relies on patching therapy. Patching therapy involves the physical usage of a patch covering the stronger eye to allow the brain to recognize the weaker eye. This therapy method can be difficult in young children because of the irritation entailed with having an adhesive covering over their eye. The outlook of this project is to adjust this therapy experience to increase patient to treatment compatibility. Within this design, participants will have an adjusted therapy schedule that will reduce their occlusion time to smaller in-

crements. The therapy also includes a series of visual games in combination with patching therapy that focus on strengthening depth perception and acuity. The purpose of this innovation is to distract the children and work towards improving their lazy eye. It is the hope that with this addition, the patients will have an eased therapy experience.

18. Amber Wu, Rachel Page (Mentor)
Ryle High School, Boone County
The Effects of Chlorine on Different Ethnicities of Hair

Hair is an important aspect of people's everyday lives. It is used as a form of protection, self-expression, and beauty. Often, drastic, involuntary changes to hair can cause dips in confidence, self-perception, and scalp safety. Specifically, teenagers who tolerate high levels of chlorine for an extended amount of time at swim practice are at a higher risk for experiencing these changes. Swimming is an ethnically diverse sport, so the effects of chlorine may vary per ethnicity. Swimmers often criticize the harsh effects of chlorine such as brittleness, dryness, and a change of color in hair. Different ethnicities produce different colors and textures of hair, possibly varying the effects chlorine in each ethnicity. The color, texture, and shape of each lock of hair will be tested after being subjected to chlorine exposure. It is hypothesized that hair from Black/African American people will have a more visceral reaction to chlorinated water because the hair naturally lacks oils. Chlorine, a hypochlorous acid, has a tendency to strip hair of their natural oils resulting in brittleness and changes in weight and length. Three locks of hair from various ethnicities (Black/African American, East Asian, Caucasian) were submerged in pure water in the dark or pool chlorine water at a pH of 7.6 with exposure to UV rays or total darkness. UV exposure simulates exposure to sunlight. Physical abnormalities and color change were qualitatively measured, and changes in weight and length were quantitatively measured. The data produced from this experiment will aid researchers in creating ethnically catered hair products or other safety methods that can potentially prevent these drastic changes from happening to swimmers.

19. Zachary Lind, Tom Rowe (Mentor)
Covington Catholic High School
Enabling People with Spinal and Neck Problems Drive a Car

Every car has rear view and side mirrors. There are people who are unable to drive due to a lack of mobility in their upper body, therefore limiting them to use of the rear view mirror only. This is not a safe way to operate a moving vehicle. Since these divers cannot turn their necks, their blind spots are magnified. Every year around 250,000 to 500,000 people suffer from spinal injuries. Some spinal disabilities can come from Ehlers-Danlos syndrome or more commonly known as EDS. People afflicted with spinal or neck injuries may be able to legally drive, but it is not safe. This would increase the likelihood of an accident thus putting other lives in jeopardy. The optimal solution would allow the immobile driver to see. "Seeing" can be physically seeing the surroundings by using mirrors, cameras, or using technology such as sensors warning them when a car is nearby. Mirrors and cameras are both now commonly used on cars to assist even the most capable of drivers. Placing the mirrors in different positions or adding mirrors in specific areas will enable the impaired person to drive. Cameras can be added for the person to be able to see by looking at a monitor. Mirrors, sensors, and cameras can all be integrated together to possibly make a more optimally safe driving en-

vironment. The ideal solution must be stable and able to withstand the elements. Optimally the solution will be affordable to the average person and will enable the driver to see around the car while only moving their eyes.

20. Trey Rottinghaus, Ethan Deters, Tom Rowe (Mentor)
Covington Catholic High School
Optimizing the Internal Combustion Engine using Variable Compression Ratios

Inefficiency is a prominent issue surrounding internal compression engines, as it is with many mechanical innovations. Gasoline engines are improving more and more over time, but even modern gasoline engines struggle with efficiency. Typical modern gasoline engines in cars have a thermal efficiency of 20% to 38%. Most modern internal combustion engines utilize stationary cylinders with fixed pistons, rods, and crankshaft designs, establishing the stroke and compression ratio of the engine. The stroke and compression ratio in traditional engines cannot be altered, which contributes to thermal inefficiency. One way to improve efficiency is to change the compression ratio for the engine's differing operating loads. To accomplish a variable compression ratio design, a dual-headed cylinder could be implemented using a bi-directional threaded rod to adjust piston to cylinder head clearance. This new and innovative design allows the compression ratio to be changed during operation for optimal efficiency.

21. Daniel Ballow, Patrick Seibert, Tom Rowe (Mentor)
Covington Catholic High School
Using UV-C Light to Disinfect Public Restroom Fixtures

The technology within public restrooms has evolved significantly in recent years, especially in regards to sanitation. Yet the problem of bathrooms being a place full of contaminants still prevails. Germs currently found in public restrooms can be as simple as the common cold to something more serious like staphylococcus (a staph infection). Currently the preferred option for avoiding germs in the restroom is to not touch anything, but that is hardly possible. Most people wash their hands, but many do not, putting other people at risk. Since there are currently solutions to reduce touch points in entry ways, faucets, soap dispensers, and towel dispensers, our project is focused on developing a product to disinfect bathroom stall doors locks and latches using UV-C light. The stall door latch is the one area that is not currently addressed by current products or methods. The stall door latch will be designed to replace existing door latches with a fixture capable of locking the door while also sanitizing the door latch. The UV-C light source will be capable of killing germs and bacteria on the latch. The device will be designed to reflect the light internally to insure that the entire latch mechanism is sanitized. Testing procedures were developed with input from infectious disease experts at Good Samaritan Hospital in Cincinnati, Ohio. Based on what we have learned from experts at Good Samaritan Hospital about methods that use UV-C light to sanitize, a plan was developed to test the effectiveness of our device. We will use controlled testing methods that consist of swabbing the area and incubating a culture before and after exposing it to UV-C light and comparing the results using chemical tests. One of the chemical tests we plan to use in accordance with our incubated cultures is ATP (adenosine triphosphate) testing. ATP is a molecule found in and around living cells. A desirable outcome would be that the sample exposed to the UV-C light will have considerably less amounts of ATP than the sample not exposed to UV-C light. Once we have proven through testing that our device

eliminates a potential health hazard point in restrooms, we will move to patent our device and subsequently we will market it to the public ideally through a company currently in the bathroom fixture market.

22. Madison Turner, Robert Mayton (Mentor)
Floyd Central High School
Mountain Top Removal VS Birth Defects

Even with today's medical and technological advances, birth defects still occur on a day to day basis. Within the United States, birth defects affect 1 in every 33 babies. The most common birth defects include heart defects, spina bifida, cleft palate, clubfoot, and congenital dislocated hip. However, the health impacts on people living in the areas affected my mountaintop removal begin even before birth. Children born in counties home to mountaintop mining are 24 percent more likely to have birth defects. The air contaminants released by mountaintop removal are known to impair fetal development, particularly in the circulatory/respiratory, central nervous, musculoskeletal, gastrointestinal, urogenital, and "other" systems. This is particularly seen in the Appalachian region, including the states of Kentucky, Tennessee, Virginia, and West Virginia. In this investigation, an evaluation of previously performed studies will be used to assess the correlation between birth defects in the Appalachian Region and mountaintop removal. In areas surrounding mountaintop removal projects, birth defects tend to occur more often as contaminants released throughout the project harm the systems in the human body more so than that of other areas. In our study, various sources, such as figures and articles, will be utilized to draw conclusions and propose solutions to this problem. Upon finishing this study, further research and consideration should become a priority to doctors, researchers, and government officials in the Appalachian Regions in order to work on solutions to diminish the rates at which birth defects occur.

23. Jane Palagi, Nicholas Kaminski, Greg Conley (Mentor)
Marion County High School
Pedal Powered

Collectively, American citizens have been reported to check their phones eight billion times per day. Eighty-five percent of these people do not carry a way to charge their phone when they are out. Studies show this is due to the inconvenience of having to remember to not only charge their phone, but also carry an alternative charging method.Creating a new alternate charging method that used the power of a turning bike wheel would ease the inconvenience of being stuck with a dead phone while out while also encouraging people to ride a bike more. This source of renewable energy is also environment-friendly. The design solely uses the power from the turning bike wheel and produces no harmful emissions that could hurt the planet.

24. Jonathan Chesser, Cameron Logsdon, Greg Conley (Mentor)
Marion County Area Technology Center
The Gutter Cone

Since 1904, Americans have been eating ice cream with an ice cream cone. On average, 43% of Americans eat ice cream with ice cream cones. Most of these people have the problem of melting ice cream and with this melting ice cream comes messy hands due to the ice cream dripping down the

sides of the cone. This means that Americans have been having this issue of messy hands due to melting ice cream for 113 years. Our product is an ice cream cone with a gutter around it to keep any melting ice cream from reaching your hands, keeping you mess free. The gutter cone is unique from other products of the same use because it is 100% edible and the gutter comes attached to the cone.

25. Luke Thomas, Brandon Miles, Greg Conley (Mentor)
Marion County High School
The Quicker Cool (Cooling Lid)

The Quicker Cool is a chambered lid designed for travel cups manufactured by companies such as YETI, RTIC, and Ozark Trail. Due to its two piece design, the Quicker Cool is effective for both hot and cold beverages. The idea of the Quicker Cool generates from the cup and saucer concept, where surface area and separation are manipulated to cool a beverage quicker, in a relatively small amount of space.

26. LiAnna Steffen, Kirsten Kindrick, Gabby Whitlock, Julye Adams (Mentor)
Elkhorn Crossing School, Scott Co.
Portable Wheelchair Ramp Wonder Wheels

Individuals who have injuries that require the use of a wheel chair for a short amount of time can have difficulty and frustrations maneuvering efficiently and effectively. This is especially true when they are alone and needing to access facilities and sidewalks that have curbs/stairs. Therefore, the product our group invented is an appliance that can be added to a plain rental wheelchair that can roll up curbs instead of needing a ramp. This appliance allows for the individual to be independent when going up or down curbs on the sidewalk. Our new wheelchair has a pulley system on the back of the chair, lifting up the front wheels so the wheelchair bound individual can easily roll over the curb. The individual sitting in the chair activates a set of brakes and cranks the lever located on the side of the chair. As they do this, the pulley system lifts their front wheels up so they can easily wheel over the curb. Once over the curb, the individual can crank the pulley system up and out of their way until the next curb. The wheelchair pulley system allows independence for individuals who are temporarily wheelchair bound. This innovation was achieved by partnering with Commonwealth Tool in Georgetown, KY.

27. Lindsey Combs, Luis Rodriguez, Julye Adams (Mentor)
Elkhorn Crossing School, Scott Co.
The Effects of Vape and Cigarettes on Rats

The goal of this experiment was to test the effects of vape and cigarettes on overall behavior and health in rats. Vaping has become more popular over time because people think it is a healthier alternative to smoking. However, the effects of vaping have not been extensively studied and there may be harmful effects that are unknown. Using three groups of rats (a control group, a group exposed to cigarette smoke, and a group exposed to vape). Data collection over 2-4 weeks included basic analyses of weight gain, water intake, and food intake, as well as a urinalysis and dissection. The results suggest that vaping can cause some damage to the lungs and affect behavior compared to cigarettes. Overall, it appears that exposure to vape can cause health problems.

28. Alexis Payton, Suellen Smith, Julye Adams (Mentor)
Elkhorn Crossing School, Scott Co.
The Effects of Water Temperature on Freshwater Prawns

Freshwater prawns are a non-traditional agricultural crop in Kentucky. Due to the specific growth needs of prawns and the time it takes for them to reach maturity, it is important to optimize the parameters that are required for this type of aquaculture so that the farmers have an effective and efficient procedures in place to maximize profits. The shrimp "farms" in Kentucky don't have all the necessary supplies to keep the death rate of the prawns low. Specific equipment, such as efficient water heaters that will help stabilize the temperature in the shrimp ponds thereby maintaining a low changing rate, allowing prawns will grow at a more constant rate from their cold blooded nature. The hypothesis is that if the temperature is increased then the growth of the freshwater prawns will increase. During this project we grew 24 total prawns, 6 in each of the four tanks to start. Each tank had a set temperature, ranging from 70 to 85 degrees. The first tank set at 70 degrees had an average growth at 1.84 cm, with 0 deaths, and a low activity rate. The second 75 degrees tank averaged with a 1.94 cm growth that came with one death on the very first day of experiment and a constant increase in activity rate. Our third tank with the recommended temperature at 80 degrees, those prawns grew to an average of 1.96 cm. Later in the experiment, one prawn died, and the activity of those prawns was greater than the other two due to the warmer temperatures. The last tank set at a temperature of 85 degrees had a tremendous increase in growth at 2.04 cm. Although this increase in growth is great, it had consequences including 3 deaths and a high activity rate. To conclude, the 80 degree temperature is the best environmental temperature for freshwater prawn growth.

29. Ashton Schmidt, Julye Adams (Mentor)
Elkhorn Crossing School, Scott Co.
The Genius Genus Knee Brace Kit

Modern knee braces offer a diverse array of options for patients. Recently, however, the efficiency of some of these braces has come in question. Knee injury patients can choose between different types of braces such as a low-support, compression brace, a complicated functional brace and everything in between. All of these options ultimately result in a lose-lose situation for those recovering from knee injuries or moderate surgeries. The Genius Genus Knee Brace Kit is a medium-grade knee brace packaged into a kit for the patient to customize for themselves. It is designed for patients with mild to moderate knee injuries, typically the group of patients that most often experience less effective and almost placebic products for the recovery process. Our kit would be offered in a medical retail setting, and offers a sturdy support form for the "cast" phase with crutches, a range of motion support form for the next stage of recovery (most commonly physical therapy), and a simple compression brace form for the final stages of recovery to offer more comfort. This brace can also be easily assembled and disassembled so that patients are able to form the brace to themselves during at-home recovery. Once our prototype was developed, we conducted a survey on seven physical therapy patients, under the supervision of Dr. Brittany Conner. Five out of seven patients said they felt more comfortable in our brace versus a competitor, and they all said they felt equally as supported. Budgets for development were met as expected, so the total price for our first model is forty dollars. If we continued this project past the prototype phase, we would update the model using patient feed-

back and look for a collaborator to contribute funds for manufacturing and further testing.

30. Brooklyn Lile, Skylar Clarkson, Chloe Madison, Robert Bauer (Mentor)
Barren County High School
Relationship Between Vitamin D Deficiency and Patients with Osteoporosis diagnosed by a DEXA scan

Unlike other diseases, osteoporosis is considered a "silent disease" because it gradually develops over several years with no symptoms. Those with osteoporosis are usually unaware of it until they break a bone or have a dual-energy x-ray absorptiometry (DEXA) performed which measures the bone mineral density. By exploring the relationship between Vitamin D deficiency, which is characterized by 30 ng/mL or lower, and patients with osteoporosis diagnosed with a DEXA, we could develop a preventative measure for a disease that affects approximately 200,000 Kentuckians every year. We are attempting to link the severity of osteoporosis with the level of Vitamin D deficiency. We are partnering with a local orthopedic surgeon to obtain data on patients previously diagnosed with osteoporosis by a DEXA scan. We have no access to names; therefore, HIPAA will not be violated. If we establish that Vitamin D deficiency can lead to an increased risk or severity of osteoporosis, doctors could begin testing Vitamin D levels when patients prone to osteoporosis are 40-50 years old, and potentially decrease the risk of developing osteoporosis which could lead to unexpected, life-threatening fractures, rather than waiting until the patient has fractured a bone to begin treatment.

31. Brooke Hammer, Cassidy Davis, Robert Bauer (Mentor)
Barren County High School
The Effect of Screen Time on Education

Children are now growing up in environments influenced by new technological advancements and are being exposed to more screens such as cell-phones, televisions, tablets, and computers. In everyday life, these devices have become more prevalent in society for informational purposes. Heavy media use has been known to cause health and developmental concerns for adolescents. We have partnered with the University of Louisville/Glasgow Family Medicine Residency to conduct research on the effects of screen time. By conducting a school-wide survey posing students with questions related to their ACT score, grade-point average, and amount of time spent on screens, we were able to compile a substantial amount of data. Analyzing the data will help us determine if there is a negative correlation between the amount of screen time and a student's education. With our data, we will be able to perform a linear regression analysis to generate an equation and R squared value. Together, we will use our data to effectively communicate the results found based upon the statistical analysis.

32. Ashton Crowe, Samantha Hall, Chad Wilkerson (Mentor)
Life Science Academy, Owensboro
Testing Bacteria Found on Bank Notes Against Antibiotics

Currency has always been considered unclean as it passes from one person's hand to the next, but does money actually harbor harmful bacteria? This experiment was focused on paper currency, as research has found many of the metals in coins prevent bacterial growth. Our goal was to determine if bacteria are present on paper currency from a variety of locations and then determine how to best combat the bacteria using a specific antibiotic, or combination of antibiotics, that best minimizes

bacterial growth with no negative impact on the paper currency or humans. Bacteria found on paper currency was cultured on agar plates then different antibiotics were introduced to the bacteria to assay for antibiotic resistance. Through our research, Doxycycline, a tetracycline, allowed less bacteria to grow compared to Amoxicillin, Levofloxacin, and Tobramycin. Doxycycline effects both gram-positive and gram-negative bacteria by interrupting the process of adding amino acids to a polypeptide sequence. If we were to combine antibiotics, our research suggests that the best combination would be Amoxicillin and Doxycycline. This combination would allow only one of the eight tested bacteria to grow, as opposed to the three colonies that survived on Doxycycline plate and the four on the Amoxicillin plates. Amoxicillin, a Beta Lactam, is also effective against both gram-positive and gram-negative bacteria and inhibits bacterial cell wall synthesis.

33. Aman Singh, Wayne Daley, Chad Wilkerson (Mentor)
Life Science Academy, Owensboro
The effects of lifestyle choices on the development of Alpha-gal

Do people's' lifestyle choices have an impact on what symptoms they develop from alpha-gal? If a person is bitten by a Lone Star Tick and contracts alpha-gal then there is a large chance that the person will have a red meat allergy from the bite based on his/her lifestyle choices. We analyzed data from a large number of studies to see if there a connection between the participants' lifestyle habits and their symptoms and determine how lifestyle affects the severity of symptoms. Our goal was to determine if there is a correlation between people who live in certain geographical locations, pet owners, and those with an active outdoor lifestyle are more likely to contract alpha-gal. We found that even certain medicines and treatments like the chemotherapy drug, cetuximab, can cause alpha-gal afflicted people to go into an allergic reaction because it is made with animal byproducts. Studies also reveal that some people afflicted with alpha-gal can show allergic symptoms by simply brushing their teeth with a toothpaste that contains animal byproducts. This can cause major confusion if a person's first allergic reaction is brought on by their toothpaste, and it is certainly not easy to link that reaction to alpha-gal caused by the animal byproducts.

34. Katarina Mayer, Emily Haimes, Julia Calhoun, Chad Wilkerson (Mentor)
Life Science Academy, Owensboro
The Relationship Between Caffeine and Short-Term Memory

The relationship between caffeine and short-term memory has been long studied. The question being answered in this experiment is what specific effect does caffeine have on short-term memory in a picture-matching game? Caffeine is expected to show a benefit to short-term memory, as it stimulates the hypothalamus of the brain. The main article we studied was from Harvard University, they concluded that caffeine does have an effect on the human brain. Our experiment tested the effects of caffeine on short-term memory as used by high school seniors. We used a memory game and timer to differentiate how caffeine affected our participants. 10 matching sets of pictures were laid out in a 5x4 square. The participant was instructed to flip two cards over at one time. If the cards did not match, they were to flip the cards back over and try again. According to the data we collected, groups that had ingested Kool-Aid mixed with 5-Hour energy completed the memory game in less time than they had before ingesting the caffeine. The groups that had ingested regular Kool-Aid completed the test in relatively the same time, with slight variation due to uncontrollable variables. Our results

supported the hypothesis: caffeine has a positive effect on short-term memory. Based on the results of our experiment, caffeine increases short-term memory recall of high-school seniors if ingested 30 minutes before the required activity. We recommend that the caffeine ingested be 100 mg, which is equal to ½ bottle of 5 Hour Energy. Though both correlations were negative, the average difference for those who drank the 5 Hour Energy was twice the average of the participants that drank the Kool Aid (Average difference for A was -9.386666667 while the average difference for B was -20.07)

35. Meghan Webster, Natalie Gardner, Sara Anderson (Mentor)
KCAIT, Kenton County
The Effect of Antibiotics on Planarian Regeneration

The experiment tested is the effects of tetracycline and amoxicillin on planarian regeneration. The two antibiotics will hopefully accelerate the rate at which planarian grow. The experiment is also expected to show that tetracycline works better than amoxicillin since the antibiotics work differently. The experiment is tested over a course of 21 days and will be measured on every 3rd day.

36. Tara Knott, Annie Miller, Chad Wilkerson (Mentor)
Daviess County High School
The Effectiveness of Local versus Imported Garlic on E. Coli

Garlic has known antibacterial effects, but not much is known as to possible factors that might make slight differences in these effects. One such difference could be due to location of growth (i.e. imported versus local garlic). An experiment was designed to test the antibacterial effects of local versus imported garlic. Local garlic was found from a family farm in Elizabethtown, Kentucky, while our imported garlic was from Mexico. In this experiment, we grew E. coli and tested it using alcoholic extracts. In addition, we had another plate of discs that had been dropped in only methanol for control purposes. Data was collected by finding the zone of inhibition. Bacteria was smeared on agar plates and grew multiple colonies covering the whole plate. Paper discs were saturated with extracts from local or imported garlic then placed on bacteria-containing agar plates. The zone of inhibition is characterized by no growth surrounding the garlic disc. The data collected showed that locally grown garlic is slightly more effective at killing E. coli than imported garlic. The average zone of inhibition for locally grown garlic was 1.8mm for the first trial and 1.8mm for the second trial. The average zone of inhibition for imported garlic was 1.5mm for the first trial and 1.6mm for the second trial. The experiment was shown to be reproducible, but due to time constraints, we could not perform a third trial to increase statistical significance. Results point to garlic being the easier way to treat bacteria that are multi-resistant and to slow down, and possibly, stop the growing antibiotic resistance problem we face.