

PROJECT LEAD THE WAY

**PLTW**

**March 1, 2017**

**Frankfort, Kentucky**



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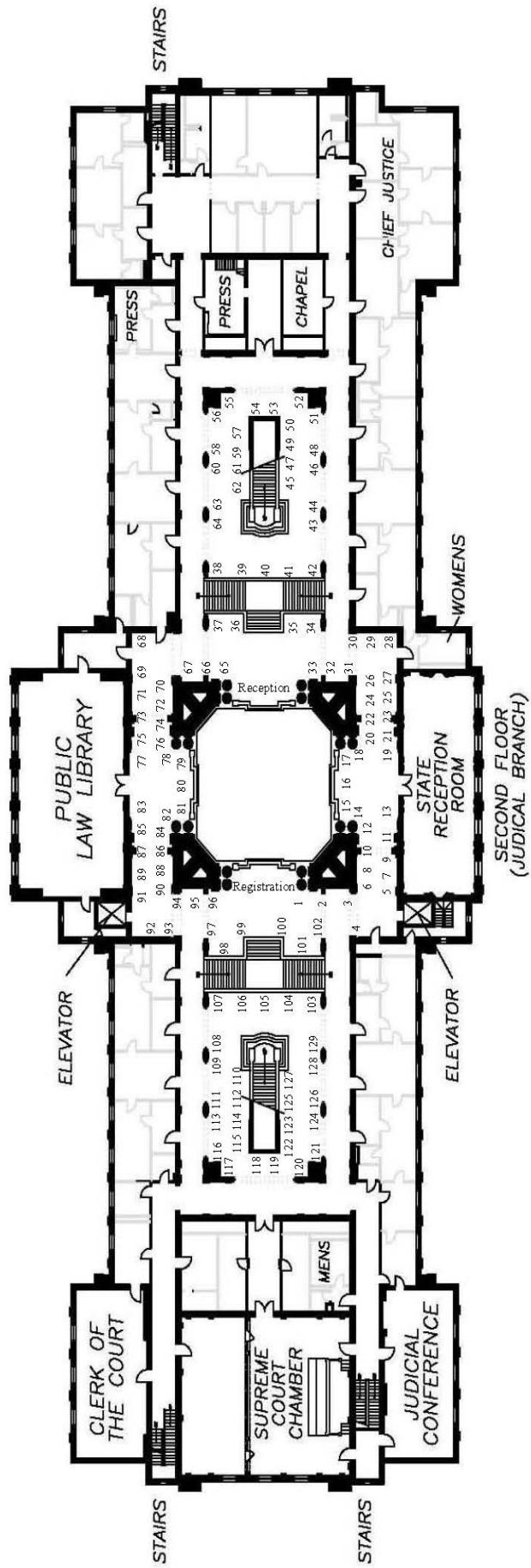
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## Schedule of Activities

**March 1, 2017**

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.



## Project Lead the Way

Poster No.	Student		Mentor	Page No.	House No.	Senate No.
1	Tackett	Amanda	Robert Mayton	6	29	95
2	Stallings	Abbie	Dr. Natalie Mountjoy	6	14	8
	Jones	Jenna				
	Vora	Sddhi				
3	Stallings	Abbie	Dr. Natalie Mountjoy	7	13	8
	Vora	Siddhi				
	Towery	Neil				
4	Arlinghaus	Seth	Adam Klaine	7	63	23
5	Carey	Brianna	Robert Bauer	7	23	9
	Trulock	Caitlyn				
6	Howard	Jacob	Dr. Natalie Mountjoy	8	14	8
	Madidi	Neil				
	Murtaza	Ibraheem				
7	Baron	Daniel	Dr. Jule Adams	8	62	17
	Osborn	Ethan				
8	Davis	Taryn	Jennifer Wilson	9	85	15
	LaRue	Kyra				
	Nelson	John				
9	Phelps	Kaden	Sara Anderson	9	65	23
	Wynn	Alyssa				
10	Fultz	Autumn	Nichole Matthews	9	98	18
	Sowers	Madelyn				
11	Cook	Laila	Jennifer Wilson	10	85	15
	Wells	Allison				
12	Gilligan	Anastasia	Nichole Matthews	10	69	23
	Knipper	Zachary				
13	Sroufe	Jenessa	Jennifer Wilson	11	85	15
	Waddle	Allison				
14	Carson	Caleb	Adam Klaine	11	63	23
15	Armao	Owen	Shane Ware	11	58	20
	Kuhl	Ronald				
16	Dove	Rachel	Ashley Fishback	12	52	20
17	Munsterman	Matthew	Shane Ware	12		
18	Costa	Brenner	John Franklin	13	85	15
	Chansler	Gage				
	Teeter	Kent				
	Norris	Shiloh				
19	Hartsman	Ross	Mark McKinney	13	31	20
	Mitchell	Sam				

Poster No.	Student		Mentor	Page No.	House No.	Senate No.
20	Perez	Melissa	Ashley Fishback	14	58	20
21	Young	Lillian	Ashley Fishback	14	52	20
22	Fieger	Ben	Adam Klaine	14	63	23
	Sipple	Brad				
23	Frame	Kayla	Dr. Julye Adams	15	62	17
	Halsey	Callie				
	McComas	Sydni				
24	Aldridge	Cameron	Shane Ware	15	58	20
	Eldridge	Nick				
25	Broomhead	Will	Sara Anderson	16	61	23
	Richie	Malachi				
26	Calvert	Rebecca	Robert Bauer	16	23	9
	Kerley	Taryn				
27	Reyes	Diego	Greg Conley	16	24	14
	Spalding	Justin				
28	Kidd	Ashton	Dr. Julye Adams	17	78	17
	Putty	Kayla				
29	Lee	Wei Hao	Elaine Dietz	17	61	17
30	Kindrick	Kirsten	Dr. Julye Adams	18	78	17
	Steffen	LiAnna				
31	Lanham	Isaac	Greg Conley	18	24	14
	Russell	Landon				
32	Long	Paige	Dr. Julye Adams	19	61	17
	Yeager	Hannah				
33	Cobb	Katherine	Greg Conley	20	24	14
	Edelen	Alexis				
34	Buckman	Cameron	Dr. Natalie Mountjoy	20	14	8
	Embrey	Ava				

**1. Amanda Tackett, Robert Mayton (Mentor)**

**Allen Central High School**

***Adolescent On-Set Depression***

Depression in adolescence and adulthood is common, afflicting up to 20 percent of the population. It represents a significant public health concern and is associated with considerable suffering and functional impairment. Adolescent-onset depression tends to be a particularly malignant and recalcitrant condition, increasing the likelihood of recurrence in adulthood. Adolescence being in a transitional period from childhood to adulthood is a stage of emotional instability resulting from demand for separation and independence. Evidence suggests that early intervention for depression in children can improve long-term outcomes. Therefore, careful assessment and differential diagnosis is essential. In this experiment, an investigation into the potential use of questions to survey the effects of our region on depression levels in adolescents and adults will be used to collect qualitative data. A survey will also be conducted which includes multiple students and teachers from around the school by asking a series of questions: how are you feeling today, do you have little interest or pleasure in completing tasks or activities, are you feeling bad about yourself, have you ever felt like you are a failure, have you let yourself or your family down? The answers to these questions will help determine the data needed to analyze whether your region can affect your depression levels. Upon calculating the results of the survey, further research will be conducted in order to discover the amount of depression upon adolescents and adults in a more impoverished region outside of the Eastern Kentucky Coalfield region.

**2. Abbie Stallings, Jenna Jones, Siddhi Vora, Dr. Natalie Mountjoy (Mentor)**

**Life Science Academy**

***An Epic Challenge: The Effects of the Rising Costs of EpiPens***

Allergic reactions are caused by contact with a specific body's allergens. These reactions can range from a small, minor symptoms, such as an itchy tongue, or a life threatening situation, such as shock. People inflicted with allergies must cope with the anxiety of the possibility of contact with their allergen and potential death from anaphylaxis. A way for these people to cope with this stress and be prepared is to have an EpiPen with them at all times. This device is an auto injector that contains epinephrine – adrenaline –which allows the body to respond to the reaction at hand immediately. However, the pricing for this product has grown exponentially, no longer making EpiPens as affordable. This price increase may have had a huge impact on the allergy community. We hypothesize that the quality of life of those affected by allergies has dropped significantly in response to the price increase of EpiPens. We plan to measure this by working with a local allergists' office (who has already agreed to participate). We will create a questionnaire for their patients to fill out regarding any changes they have faced since the increase of the price of EpiPens. We plan to quantify the answers and create a data table and chart for the information collected accordingly. We will share our analysis with local allergy offices so everyone can understand the impact and perhaps seek resources for help. We also plan to innovate a cheaper method of epinephrine delivery that patients may elect use if the EpiPen price continues to make them unaffordable.

**3. Abbie Stallings, Siddhi Vora, Neil Towery, Dr. Natalie Mountjoy (Mentor)**

**Life Science Academy**

***pEARcussionists: Hearing Loss in the High School Band***

Frequent exposure to loud noises can damage hair cells in the inner ear, leading to sensorineural hearing loss. Though it can be caused by a variety of factors, the most common reason is noise induced hearing loss or NIHL. Musicians are greatly susceptible to NIHL, with a reported prevalence ranging from 38-50%. We sought to determine the prevalence of NIHL among high school percussionists. We tested hearing loss among percussionists (n=10) and non-percussionists (n=7) with a questionnaire and online hearing test. We hypothesized that the percussionists would score lower on the tests in comparison to non-percussionists. We analyzed our results using t-tests and bar graphs with standard error. Per our results, high school percussionists do show more hearing loss; they scored significantly lower than the non-percussionist group on average and on 4 of the 6 frequencies tested. Despite a musician's critical reliance on his or her ears, ear protection is scarcely used. Our study provides more evidence of the need of high school percussionists to protect their hearing. We propose instrumenting a hearing protection program in high school music departments to help prevent hearing loss.

**4. Seth Arlinghaus, Adam Klaine (Mentor)**  
**Kenton County Academies of Innovation and Technology**  
***Guitar String Corrosion***

Sometimes guitar strings, though sometimes durable, are often sensitive to humidity and temperature change, even causing them to rust a week after putting them on. Changing strings so frequently, especially so soon after applying new ones, is inconvenient. For some, there are products that assist, such as coatings for the strings themselves. However, these coatings can change how the strings feel and sound. Instead of a coating, a protective case could be made, which could keep the strings dry and cool, using plastic, Velcro, and dehumidifier packets. This product could be used when a guitar is left exposed to humidity for long periods of time. Is such a device possible? To find out, plastic sheeting was cut to the length and width of the strings and the spaces between. Next, Velcro strips were added to stabilize it around the strings. A dehumidifier packet was added to ensure the interior would stay cool and dry.

**5. Brianna Carey, Caitlyn Trulock, Robert Bauer (Mentor)**  
**Barren County High School**  
***Body Positions Effect on Number of Apneas***

Obstructive sleep apnea is defined by an apnea-hypopnea index of five or higher in association with excessive daytime drowsiness. When someone is having an apnea their oxygen saturation decreases. This makes it harder for the heart to transport oxygen to all parts of the body. Patients who suffer from sleep apnea often have heart issues as they age, because their heart has to work harder to pump oxygen when they are sleeping. Some individuals who experience apneas throughout the night do not meet the required index to be diagnosed with sleep apnea. These people are impacted by the apneas, but insurance will not pay for treatment. In our study, we will determine the best sleeping position for these individuals. Conducting this study will help patients who suffer from daytime drowsiness, and it will decrease the strain that is put on the patient's heart throughout the night. We have gathered data from sleep studies conducted over several patients who suffer from various severities of sleep apnea. Using the data gathered, we will determine which position contributes to the least amount of apneas. This will allow patients who suffer from apneas but do not reach the required index to sleep throughout the night without experiencing numerous apneas.

**6. Jacob Howard, Neil Madadi, Ibraheem Murtaza, Dr. Natalie Mountjoy (Mentor)**

**Life Science Academy**

***The Effects of Different Factors on R.E.M. Sleep***

Sleep is an important part of maintaining a healthy body. However, many people do not get their recommended hours of sleep on a nightly basis. Humans sleep in a pattern of alternating REM (rapid eye movement) and NREM (non-rapid eye movement) sleep, that repeats itself every 90 minutes. REM sleep accounts for 25% of total sleep, and some studies show that increasing just the time in REM sleep can overcome some of the negative consequences of sleep deprivation that are common in our busy society today. To explore this question, we measured the amount of REM sleep obtained by 10 test subjects using a Jawbone UP3 watch overnight, and asked them to answer a questionnaire regarding different variables that may affect sleep patterns. We hypothesized we would find a positive correlation between minutes in REM sleep and amount of total sleep and amount of exercise. We hypothesized a negative correlation between caffeine consumption, BMI and ambient light. We tested our hypotheses using Spearman and Pearson correlations. We found a significant relationship between hours of sleep and REM sleep and a negative correlation, although not significant, with amount of exercise. Our data indicate that in most cases, environmental effects may not directly affect REM, but may indirectly affect REM by affecting the total amount of time an individual spends asleep.

**7. Daniel Baron, Ethan Osborn, Dr. Julye Adams (Mentor)**

**Elkhorn Crossing School**

***The Effects of Red #40 Dye on the Development of Painted Lady Caterpillars Metamorphose***

Allura red, also known as Red dye #40 and chemically represented as  $C_{18}H_{14}N_2Na_2O_8S_2$  is a common food coloring that has been found to cause medical problems in humans, but that has not been tested in other species. This experiment tests the effects of Allura red in the development of the painted lady butterfly, the most widely distributed butterfly in the world. We hypothesize that Allura red will impede the development of painted lady butterflies, when mixed with their food. This experiment compares the effects of Allura red to that of pesticides on the declining bee populations of the world, as painted lady butterflies are also important pollinators. The experiment consisted of 40 caterpillars divided into four groups of ten, three groups of caterpillars received a dose of Allura red mixed into their food culture (High dose (Hi), Mid dose (Mid), Low dose (Lo)) and one group received culture only (Control (Con)). The time it took the caterpillars to develop in their chrysalises and to emerge was recorded to see if it took longer for the butterflies who were given dye to emerge. The higher the ratio of Allura red dye to food culture, the longer it took the caterpillars to emerge. Additionally, there was a higher mortality rate among the butterflies who received more dye, as well as higher rates of deformities. In the Con group, all butterflies emerged within 3 days of each other. In Lo group, 2 caterpillars died before chrysalis, 1 never emerged, and 2 died in emersion. In Mid group, 3 caterpillars died before chrysalis, 1 never emerged, and 1 died in emersion. In the Hi group, 1 caterpillar died and 3 never emerged. There were several deformities (crumpled wings, frayed wings, no legs, etc.) in the groups that received Allura red with their food culture.

**8. Taryn Davis, Lyra LaRue, John Nelson, Jennifer Wilson (Mentor)**

**Pulaski County High School**

***The Effects of Diet on Drosophila Larval Development***

Metabolic Syndrome, a collection of health issues including diabetes and heart disease, is becoming prevalent in today's population. More information about the effects of diet on these issues is needed. In this project,



scientists will conduct an investigation to determine the effects of diets high in certain macromolecules on fruit fly larval development. The larva will be transferred during the first instar stage in groups of fifty to four tubes. One tube will contain a carbohydrate-rich media (glucose), one tube will contain a fat-rich media (coconut oil), one tube will contain a protein-rich media (peptones), and one tube will contain a balanced commercial fruit fly media. Larval survival rate, time frame of developmental stages, and characteristics including body wall contractions and mouth hook movements will be used to determine if excessive consumption of a specific macromolecule negatively impacts normal larval development. Results are not finalized as the experiment is not concluded at the time of this abstract.

**9. Kaden Phelps, Alyssa Wynn, Sara Anderson (Mentor)**  
**Kenton County Academies of Innovation and Technology**  
***Caffeine's effect on Escherichia Coli***

This project was created to find caffeine's effect on Escherichia coli. Escherichia coli is a bacterium that continues to contaminate humans throughout the world. Previous work has failed to address a clear solution to keep E. coli from contaminating humans through undercooked meats, raw veggies, uncleansed water, and other resources. It is hypothesized that caffeine will have an antibacterial effect on E.coli. To test this hypothesis, caffeine will be applied to three of the six Petri dishes, the other three being the control group. The diameters of the colonies will be measured after incubation, to record growth results. If the hypothesis is correct, a form of caffeine solution can be created to put on or in resources to decrease contamination.

**10. Autumn Fultz, Madelyn Sowers, Nichole Matthews (Mentor)**  
**Kenton County Academies of Innovation and Technology**  
***MRSA; Methicillin Resistant Staphylococcus Aureus***

In the field of medicine methicillin resistant staphylococcus aureus (MRSA) is becoming a more and more dangerous and untreatable in today's world. There are no working antibiotics for MRSA since it's becoming resistant to current treatments. This leaves people affected by MRSA to resort to other treatments which are very expensive or damage the kidneys, and might not even be a long term working treatment, and doesn't remove the bacteria permanently from your system. Through out history essential oils have been used as medicine and home remedies: eucalyptus, tea tree, lavender, and oregano being the most common- yet no one has really put them against MRSA and put there results out till now. We want to take the four most commonly used essential oils from old medicines and other home remedies and treat MRSA with it, and also treat the bacteria with mixes of the essential oils; along with the most commonly used antibiotic (penicillin) and compare the results with one another. We expect that while doing our tests that we will see a drastic difference on how essential oils treat MRSA versus Penicillin, and hope to find that essential oils work more efficiently and quicker than the most common current treatment.

**11. Laila Cook, Allison Wells, Jennifer Wilson (Mentor)**  
**Pulaski County High School**  
***Using Rapid Staphylococcus aureus Tests to Reduce the Use of Wide-Spectrum Empiric Antibiotics of S. aureus Infections in Periprosthetic Joint Infections***

As periprosthetic joint infections, PJIs, are increasing with the number of total joint arthroplasties, the efficiency of diagnosing and treating them also needs to increase. A periprosthetic joint infection is an infection that occurs directly on or in the surrounding tissue of the implanted prosthesis. Before determining

which empiric antibiotic can be given to the patient, a wide spectrum antibiotic is used to control the growth of the infection until further testing can be done. Periprosthetic joint infections are some of the most challenging and frequent complications after lower extremity arthroplasty. This investigation proposes a method to quickly and effectively identify the absence or presence of *S. aureus* or MRSA, the most common antibiotic resistant strain in PJIs, leading to faster and more effective treatment. In this proposed test, Protein A antigens found when *Staphylococcus aureus* is causing the infection are detected in a test similar to a rapid strep test. A way to test for antibiotic resistant bacterial strains would contribute to an improved outcome for the patient.

## **12. Anastasia Gilligan, Zachary Knipper, Nichole Matthews (Mentor)**

### **Kenton County Academies of Innovation and Technology**

#### ***Natural Vs. Synthetic Drugs***

The world of modern medicine is always changing, and as future doctors and scientists, it is our job to create the most cost effective and efficient medicine for eliminating infections, illnesses, and diseases. Today, bacteria is becoming highly resistant to medications that have been used for centuries to fight these infections. This means that our generation is responsible for studying the effects of different medications on these bacteria, and comparing the results. Our research project will help in trying to solve a huge question: What will we depend on for fighting these infections in the future? We plan to study the effects of both natural and manufactured medications on common bacteria such as *E. Coli*, *Staphylococcus*, and *Bacillus*. We will carry out our project starting in January, and plan to find results that can be used to help answer this question. We will start by ordering three medications from the penicillin family, and proceed test them on the three bacteria mentioned above using care and caution as we put them in Petri dishes with the selected medium. We will then order our three natural medications (aloe, echinacea, and garlic), and repeat the same process. 18 Petri dishes will be used in total; one for each bacteria and medication combination. Nutrient agar has been selected as the medium for bacteria growth. In order to determine how effective each medication is, we will compare sizes of the zones of inhibition for each of the bacteria after the initial experiment is completed. This will give us a clear outlook on the results of our experiment, which will eventually be compared to other experiments people have done on similar topics. Not only will our research back that of professionals, it will also give us more hope for the future. We hope to continue studying the field of medicine as it progressively changes.

## **13. Jenessa Sroufe, Allison Waddle, Jennifer Wilson (Mentor)**

### **Pulaski County High School**

#### ***Observing Epigenetic Effects in *Drosophila****

The study of epigenetics, potentially heritable changes in gene expression rather than changes in the genes themselves, is a rapidly growing field. This experiment looks at modifying the environment and behaviors of adult fruit flies, primarily through diet, to determine the effects on the offspring of the adult flies. *Drosophila* are commonly used to model human systems and interactions, and their short reproductive span and relatively simple genome make them an ideal organism for this experiment. Larva will be placed in tubes containing various nutrient sources during the first instar stage of larval development to ensure that they have maximum exposure to each variable. Once they have reproduced, their offspring will be transferred in groups of one hundred to a new tube containing a normally balanced nutrition source. Larval behaviors such as body wall contractions, developmental time frames, time frame for developmental stages, ratio of pupae development and hatching, and adult survival and lifespan will be used to compare to a group of flies experiencing normal nutrition and conditions. This investigation is not complete as of this time.

**14. Caleb Carson, Adam Klaine (Mentor)**  
**Kenton County Academies of Innovation and Technology**  
***Problems in Computer Security & How to Protect Yourself***

Using the internet can be a dangerous place when browsing multiple websites per day. About 80% of the general public said they would store their password on their computer via their browser if prompted, and, with this being the case, it is no surprise that many attacks have been created around these people in order to obtain their personal information. This project reviewed the problems with storing passwords, existing fixes, and strategies to protect yourself. How can the majority of the population stores their password without having the problem of accidentally handing it over to an unwanted entity? In order to demonstrate how many passwords are stolen, 2 demonstrations were created, each consisting of a program to show how this attack might work on a smaller scale. The first demonstration showed how passwords could be stolen through Chrome and the second showed how passwords could be stolen through fake websites and phony emails (phishing). Both programs were made with Notepad++, CMD Prompt, and Google Chrome. Both demonstrations were successful in showing how the attackers take information. The first demonstration successfully showed the passwords stored on a test computer, and the second demonstration was successful in creating a carbon copy of a website, to create the phishing website. The demonstrations showed that it can be easier to steal information than first thought because the code written and time to create each demonstration was minimal.

**15. Owen Armao, Ronald Kuhl, Shane Ware (Mentor)**  
**Martha Layne Collins High School**  
***VEX Screw Sorter***

The idea we are developing is the Vex screw sorter. Our screw sorter is intended to sort Vex screws based on their size/length. The problem is that people cannot sort their screws efficiently and machines cannot sort screws accurately. We have tried many ideas and designs but none of them seem to work as good as we hoped.

Our concept is to put pegs along a plexiglass surface. The head of the screw will move along the top edge of a piece of plexiglass on a downhill angle. The pegs will have a tripping effect on the screws and eliminate their route starting from longest to shortest. After the screw is knocked off the plexiglass it will fall into a bin underneath the peg corresponding to its length. To get the screws to this point, we will dump them into a V-shaped funnel system in which the screw is hanging from the bottom point of the V. This system will work efficiently, accurately, and hopefully solve the burden of sorting screw by hand.

This system will save the time and energy of engineering students and teachers having to divide and locate screws. The time it currently takes to sort screws takes away from teachers educating their students and students working on their projects. We hope to incorporate this machine in VEX classrooms across the state to make the lives of PLTW students and teachers easier.

**16. Rachel Dove, Ashley Fishback (Mentor)**  
**Shelby County High School**  
***Ventilated Pacifier***

Pacifiers are considered a necessity in modern parenting. All babies are born knowing how to suck. This action soothes them, making a pacifier an ideal choice to calm an agitated child. Recently however, research has pointed to a correlation between pacifier usage and ear infections. This problem is also found in non-ventilated bottles. Sucking on a pacifier or non-ventilated bottle leads to an increase of pressure in the middle ear, which often leads to an ear infection. The current solutions to this problem are stopping the use of a pacifier, having tubes put into a child's ear, and using a ventilated bottle. Many parents are reluctant to take away their child's

pacifier, so a new solution needs to be found. A ventilated pacifier would offer many benefits, the biggest of which would be the reduction of pressure in the middle ear.

**17. Matthew Munsterman, Shane Ware (Mentor)**

**Martha Layne Collins High School**

***Autonomous Recording for C-Based Environments (ARC)***

Coming from the time constraints of VEX robotics while writing autonomous programs, ARC is a program that converts a driver's inputs into written lines of code. Previously in this competition, writing out programs for these robots would require a programmer to map out each individual motor and sensor on the robot. This section of code is designed to allow a programmer to write large sections of code without typing them out by hand. ARC's purpose is to make life much easier for the programmer, and streamline the programming process. Once activated, ARC takes the driver's input and converts it into a program that the robot can read. Once the program has been recorded, the driver can copy the generated program into the main section of code, and the robot will replay the actions that the driver had previously performed. This could also be used as an educational tool for younger students learning how to program. By seeing live and relevant examples to what they need to program, they can learn what the code is doing, as well as how to do it for themselves.

**18. Brenner Costa, Gage Chansler, Kent Teeter, Shiloh Norris, John Franklin (Mentor)**

**Pulaski County High School**

***Say Yes to the Desk***

In a normal school day, students spend roughly 8 hours a day sitting. Since the modern school desk's introduction in the 1970's, little to no innovation has happened. Recent studies have found that students who spend upward of 6 hours a day in a desk, can suffer from severe conditions such as lack of blood circulation and an increase of pressure on the spinal cord. Long term pressure can cause abnormal spine alignment (scoliosis), Injury in the spine, Spinal tumors, Certain Bone diseases, Rheumatoid arthritis, and infections. Our goal is to solve problems created by the average school desk to increase learning and overall health in students. (Said, Day, L. How Seating Ergonomics Affect Learning. <https://smithsystem.com>, 2014.) 3/5 students on a national survey report problems due to their sitting circumstances. We created a survey in order to narrow down where students felt the most inconvenienced in their desks. The results were: 11/32 students say the chair needs to be changed, 19/32 say it is all around uncomfortable, and 22/32 say that the desk needs to be bigger. The objective in this scenario is to make the average school desk a more compatible fit for a learning environment. Through the use of surveys and personal interviews we have narrowed down our investigation to the following areas: Seat of desk, Back of desk, and the incline that the back of the seat rests at. We have begun to build our prototype to counteract these problems. We plan to change the angle of ascent that the seat and back connect at to decrease pressure on the spinal cord, making an adjustable desk to fit to different size students, and making an overall better quality desk so that it can last longer and therefore save money. Our design will decrease spinal pressure by limiting the downward force of gravity on the spine due to an increase of force in the horizontal direction and decrease in the vertical direction. We will measure the pressure with a pressure plate on the coccyx to see if our desk causes a decrease. We can measure blood circulation using the ankle brachial index to see if it results in a decrease.

**19. Ross Hartsman, Sam Mitchell, Mark McKinney (Mentor)**

**Jeffersontown High School**

***The New Normal for Getting to and from Work***

With a world of increasing demands on our resources, renewable power supply is becoming an attractive alternative source of power especially in short distance travel. An easy way to save a little cash and increase in getting out more is to utilize solar power for transportation to and from work with little expense and a quick rate of return for your time and effort. This design will show the promise of taking used bicycles and cutting them up along with some square tubing and miscellaneous electrical parts to create a recumbent trike that is electrically powered by 2 small electric motors, 2 batteries and recharged by the means of the sun; i.e. solar panel. It will be able to run at a speed of 8-10 miles an hour. The backyard 'Do It Yourselfer' will be able to build and join others in being 'gas' free and solar driven. It is hoped that the prototype model can withstand the demands of daily use and travel a minimum distance of 3 miles before recharging.

**20. Melissa Perez, Ashley Fishback (Mentor)**

**Shelby County High School**

***Ultrasonic Carry Alert Navigation set***

Currently, people who may be blind or visually impaired are guided by either a walking stick (white cane) or by a trained service dog to be as a productive, navigating system. For the visually impaired/blind, the Ultrasonic Carry Alert Navigation set would be a new, advanced method for them to that would benefit their remote movement and eliminate their dangers as well as increase their safety. The importance of the set is for more accessibility in any environment through ultrasonic waves which signals to the sunglasses, cane, and wristband. The 3 components would stimulate protection and awareness for the person and can be managed by the user and doctor, if necessary. With the U. C. A. N. stick, the mobility and access will be 100% user and eco-friendly. Despite certain vision limitations the user may have, they can do endless travels with ultrasonic waves to enhance their navigation.

**21. Lillian Young, Ashley Fishback (Mentor)**

**Shelby County High School**

***Rehabilitating Stroke Patients Using the Motor Rehab Machine (MRM)***

In the occurrence of a stroke, a blocked or ruptured blood vessel prevents oxygen and nutrients from traveling throughout the brains causing brain cells to die. This in turn causes function loss to external appendages. Strokes are a rising epidemic within the United States; causing rehabilitation facilities, nursing homes, etc. to take on an overwhelming number of patients requiring rehab. Although the current methods in place during the rehabilitation include virtual reality simulation, external extremity support training, as well as other techniques or devices focusing on a broad ranges of body functions the majority of these rehabilitation procedures cannot take place within the patients home because the equipment needed cannot be transported to a private residence. Consequently, the creation of this rehabilitation device that is portable and simple, yet will also focus on increasing the mobility, flexibility, and regeneration of neuroplasticity in the brain that will allow function of the forearms, wrists, and hands to be regained. With further modifications to improve the overall efficiency

and functionality of the device there will be an increase in the productivity of at home rehabilitation in the specific area of forearms, wrists, and hands.

**22. Ben Fieger, Brad Sipple, Adam Klaine (Mentor)**  
**Kenton County Academies of Innovation and Technology**  
***Precise Lifting***

In industries dealing with machine manufacturing, employees need to move machines or make fine adjustments, they use machine skates to do all of the heavy lifting. This task requires jacking the machine up, which can alter the alignment, making it difficult to set these machines in the proper spot. Is it possible to precisely place a machine without compromising the necessary precision? The constructed prototype needs to lift the machine, but also skate to easily maneuver and move the machine. The result of the created jack is significant, because it makes placing a machine easier to do and does not move around much. Overall, this has the potential to improve the time-efficiency, tediousness, and difficulty for many businesses face when manufacturing heavy machinery.

**23. Kayla Frame, Callie Halsey, Sydni McComas, Dr. Julye Adam (Mentor)**  
**Elkhorn Crossing School**  
***Dentaloe: An Innovation in Dental Health***

With new and improved dental care products the objective of this innovation is to reduce plaque buildup in the mouth and improve oral care. Most believe that toothpaste is the main factor in the removal of plaque while in all actuality it is the toothbrush. In fact just using your tooth brush to brush your teeth is nine percent more effective at removing plaque than brushing with toothpaste according to clinical trials. Floss is also a main factor in the removal of plaque as it is actually going in between the teeth and making contact with the gums. So for this innovation aloe was utilized for the prevention of plaque buildup on the and in between the teeth. Aloe was added to products that clean in between the teeth such as, floss and picks. Aloe has been used in other oral care techniques but has not been used for the reduction of plaque buildup. The reduction of plaque by aloe is believed to be plausible because it has antibacterial properties. These properties were tested in the lab and the Dentaloe Picks were made and tested to determine if there was a viable market for the innovation.

**24. Cameron Aldridge, Nick Eldridge, Shane Ware (Mentor)**  
**Martha Layne Collins High School**  
***Kinect 3D Scanner***

Our project is a 3D scanner made using an Xbox 360 Kinect. The project will provide an affordable way for many schools across the country to 3D scan objects without putting money into a traditional 3D scanner, such as the maker bot digitizer which retails for \$799.00 and confines what you can scan to an area of about a foot. Our 3D scanner will provide many people and schools with an affordable way to 3D scan objects that are still of a high quality while still not having to spend as much as they would have on a traditional 3D scanner.

To use our 3D scanner you will need our 3D scanning booth, which comes equipped with a turntable big enough to turn objects even as large as people, an Xbox 360 Kinect, and a computer running at least windows 7 64-bit.

Our project started with the idea of wanting to have a 3D scanner, but not being able to have one because of limited school funds. Due to this problem, we decided to build our own and provide a way for us as well as other schools to have an inexpensive way to make high quality 3D scans. We originally started with a small

3D scanner booth that was able to scan objects that were less than one square foot in area, but are now currently creating a mechanism which is powerful enough to rotate a person.

The value of our product comes with the amount of time you save in making scale models as well as the ability to make cad models without having to be overly skilled in CAD software. Making CAD models of intricate objects, like a human head, could even take skilled cad modelers well over 5 or even 10 hours. Our software can be used by someone who doesn't even have experience in cad and still be done in less than one hour.

**25. Will Broomhead, Malachi Richie, Sara Anderson (Mentor)**  
**Kenton County Academies of Innovation and Technology**

***Force: The Effects of Impact***

Stress fractures and back pain are common for gymnasts due to the impact of landing. When a gymnast performs a back tuck, the vertical impact force experienced during landings can be very high and is a major cause of injuries. Landing forces can range from 3.9 to 14.4 times the gymnast's body weight (Panzer, 1987; McNitt Gray, 1993). How much impact force affects the body during a back tuck, and can shoe inserts reduce the amount of impact force?

Two portable force plates were secured on a gym floor, surrounded with mats, and covered with a thin mat to provide cushion. Forty gymnasts performed back tucks onto the force plates, and the results were transmitted to a computer using PASCO software for data collection and analysis. Each gymnast performed the back tucks in four ways: barefoot, wearing athletic shoes, inserting low-impact cushioned insoles, and inserting high-impact performance insoles. A total of 160 impact events were used for analysis. Results from this study revealed that vertical impact force can be reduced with shoe insoles. By understanding repetitive impact force, gymnasts will be able to reduce the stress and strain that affect their bodies.

**26. Rebecca Calvert, Taryn Kerley, Robert Bauer (Mentor)**  
**Barren County High School**

***Effects of Education and Exhaled Carbon Monoxide Testing On Cessation of Smoking***

As of 2012, 24.8% of Kentucky adults were regular cigarette smokers. Many of these same individuals know what carbon monoxide is, but do they realize the health risk? Carbon monoxide is known as a silent killer as it is odorless and colorless. The dangers of carbon monoxide stem from its ability to bind tighter than oxygen to hemoglobin, destroy lung tissue, and prevent one from obtaining sufficient oxygen concentrations in the blood. Many smokers have an idea of the risks of smoking, but they often do not realize that carbon monoxide is the cause of these dangerous smoking side effects. By interviewing many active smokers and then using a Smokerlyzer to estimate the amount of carbon monoxide in the blood, we have worked to help individuals as they attempt to stop submitting their bodies to the destructive and carcinogenic effects of cigarettes. We informed these individuals of the harms associated with carbon monoxide as well as showing them the amounts of carbon monoxide present in their body correlated with their cigarette smoking. The effects of education and exhaled carbon monoxide testing on cessation of smoking habits in our local community was then assessed.

**27. Diego Reyes, Justin Spalding, Greg Conley (Mentor)**

**Marion County Area Technology Center**

***The Chrome Carrier***

Tim Lyons and Matt Deacon came to our group with a basic Laptop Cart used throughout the Marion County School District. They reported problems of messy wires and slow plug in time rate. We were given the opportunity to innovate the cart from all aspects, while improving the time spent putting the Chrome book in the cart, thus giving the teacher back the valuable teaching time lost due to the design of the cart. While looking at other designs that although have better designs, they were not cost efficient for the district financially.

Our plan was to be able to organize the wires on the inside while also innovating the cart to where a student could just slide a laptop into its slot and it plug in automatically. We would need to invent a device that holds the male part of the charger still in the back of each laptop slot so one could plug in a laptop at ease. Once this was complete we would need to test how much quicker it was for students to plug in laptops with our carts versus a stock cart already used in our district by timing several trials.

**28. Ashton Kidd, Kayla Putty, Dr. Julye Adams (Mentor)**

**Elkhorn Crossing School**

***The Effect of Nicotine Vapors on the Behavior and Health of Sprague Dawley Rats***

In a study conducted on three outbred male albino Sprague Dawley rats, the effects of vaporized nicotine, as administered by a series of tubing, syringe, and electronic cigarette, were recorded qualitatively and quantitatively over a period of two weeks. The rats were placed inside a vapor box and given approximately 7.5 mL of vapor, which was allowed to dissipate over five minutes. After roughly a week of receiving the doses, the rats grew accustomed to the vapor, and all responded by approaching the hole the vapor came out of and became excited for the "vapor box". The rats were weighed twice during the experiment, and a urinalysis was conducted at the end of the experimental period. The test data returned with lower specific gravity, which could point to mild dehydration, and proteins were present in the urine, signifying a breakdown of muscle tissue. The rats were dissected, and the lungs were weighed and examined for abnormalities. Any physical health changes were minute, considering the short-term research, and the fact that the rats were euthanized with carbon dioxide may have contributed to the results. Perhaps more striking is that behavioral changes developed quickly during the project, suggesting detrimental psychological effects of addiction even in such a short time.

**29. Wei Hao Lee, Elaine Dietz (Mentor)**

**Grant County High School**

***The Effect of Time on Orally Contaminated Water Bottles***

A common topic of discussion in this day and age is the potable of drinking bottled water after it has been exposed to bacteria through consumption. The main purpose of this experiment is to determine how long it takes for bottled water to become dangerous to drink based on amount of bacteria in the water. This is done by taking a drink from a water bottle and leaving them in different temperatures for 7 weeks while taking weekly samples from the bottles and culturing them for 40 hours. The proposed result is that the longer the water bottle sits after being introduced to bacterial, the more bacteria that will accumulate. If further experimentation should be done, the water company and culturing temperature should be taken into account. With an alpha value of .05, degree of freedom of 12, a critical value of 1.782, and a t statistic of 25.8818342. Thus the null hypothesis is rejected and the results are statistically significant.



### **30. Kirsten Kindrick, LiAnna Steffen, Dr. Julye Adams (Mentor)**

#### **Elkhorn Crossing School**

##### ***Effects of the Environment on Microscopic Organisms***

The motive for conducting this experiment was to observe the effects of the environment at a microscopic level to see whether the organisms would thrive or decline in health. The hypothesis of the organisms' outcome in the different environments was that when they were kept in different conditions, things about their group would change compared to each other, such as amount, pH, and movement. The problem that is being focused on is what would happen to smaller level organisms when put in real life environmental scenarios. The different species of amoebas and protozoa were mixed together in a large container and then were separated equally into smaller containers or "environments" to imitate real world situations. They were left there for 7 days to resemble just a small amount of time in the outside world. The results of the experiment showed that when microscopic organisms were placed in different environments, their amount (quantity), speed, and pH level were affected. The four different environments that were imitated in this experiment were Global Warming (hot), Global Cooling (cold), Oil Spill (oil), and a Disease Outbreak (E. Coli) with a control that was always at room temperature. These different environments are used to model real world events that could all happen in the possible future. To record the results, a 1 to 10 scale was created to track movement (1 being least active and 10 being most active), and pH level was checked daily in all of the environments. In the hot environment, there was a large decrease in water, which lead to death of the amoebas and a movement level of 0, while their average pH level was recorded as an 8. The cold environment showed a significant decrease in the movement of the amoebas, putting them as a number 2 on the movement scale, but still having a pH of 7.5. In the oil filled environment, the algae became attached to the organisms, inhibiting their movement resulting in a 6 on the scale and changing their average pH level to the basic number 8. In the bacteria filled environment, the average pH level did not change, but staying constant with the control at 7 and had a normal movement of 8 on the movement scale. It was concluded that different habitats do have a large effect on the movement, number, and different chemical changes.

### **31. Isacc Lanham, Landon Russell, Greg Conley (Mentor)**

#### **Marion County Area Technology Center**

##### ***Easy Level***

In a year approximately 105,000 Air Conditioning Heat Pump units are put in in the United States, and there are 4 Heat Pump Risers for every Heat Pump Unit. The unit must be off the ground to let water drain out through the bottom of it during winter when it goes into defrost and it needs to set level, so traditionally you would have to level the ground for a pad to set on. This effects the HVAC business when they put in new Heat Pumps anywhere they are placing them, which could be somewhere with the same climate as the United States or hotter. They also say it is a problem for time and effort in leveling the ground and installing the heat pump riser which normally takes 45-60 minutes if done neat and correctly, which our product takes this step out by allowing us to adjust the product, by the threads we have put on our version of the heat pump riser, instead of the ground also decreasing time to install to 3-5 minutes. The product is made to with stand the weight of any small business or residentially used heat pump unit. Also this can be used to level other units than just a Heat Pump. We want to increase job efficiency to make the total cost lower by cutting down on labor cost.

### **32. Paige Long, Hannah Yeager, Dr. Julye Adams (Mentor)**

#### **Elkhorn Crossing School**

##### ***The Physiological, Cognitive and Behavioral Effects of Synthetic Estrogen on Adolescent Male Research Rats***

The purpose of this experiment was to model the effects of hormone therapy that a transgender woman (male to female) would undergo, as well as to monitor the cognitive, behavioral, physiological, and physical effects demonstrated by the research rats. In an effort to further research concerning the health and wellbeing of transgender individuals, we utilized six research rats and a synthetic estrogen solution which was used to represent hormone replacement therapy. To accurately represent the focus group of our research, transgender human females, we utilized six research rats, three controls and three test subjects, and housed each separately. Initially, one capsule of synthetic estrogen was ground up with a mortar and pestle and diluted with 500 mL of water prior to being put into the rats' water bottles. In the experiment, synthetic estrogen was dispensed into the rats' water bottles daily after the aforementioned procedure, in order to ensure that each rat in its separate cage was given a constant amount of 32 mL of the estrogen solution and 368 mL of water. Each day, heart rate and weight were monitored of both the experiment and control group, and a weekly urinalysis was conducted as a more invasive procedure to determine the presence of particular substances in the urine, and to ascertain if the aforesaid levels were abnormal. Furthermore, the rats in both the experiment and control groups were trained in a maze prior to the distribution of the synthetic estrogen solution in order to test cognitive behavior. Eventually, the rats became accustomed to the maze and were timed to test cognitive behavior and potential stress. Furthermore, the rats were monitored both nocturnally and diurnally with a Guerilla night vision camera, allowing them to be photographed and observed closely. This also allowed us to view the rats' behavior when not in contact with humans. Concerning the results, both rats gained weight at a relatively similar rate; the average weight for each rat began near 190g and ended at approximately 290-310g after approximately a month. Additionally, heart rate fluctuated in both groups; however, it may be of importance to note that the control group, rats 1-3, possessed the lowest average heart rate, as well as the highest average heart rate—459 bpm. Significantly, rats 4-6, the experiment group, produced urine samples with significantly higher quantities of protein and leukocytes. Maze times for rats 4-6 gradually became faster as time progressed, ending at an average of 1:16 sec; this time was significantly faster than that of the controls, which averaged 3:59 sec on their final maze time. Moreover, dissection of the subjects revealed no observable differences concerning the weight of the heart, kidneys, testes, and adipose tissue of the abdominal cavity—all areas of the body that have previously been noted as affected by hormone-therapy. In conclusion, it has become evident that the synthetic estrogen solution had no significant impact on weight and heart rate; however, it is likely that the solution was responsible for the excess of proteins and leukocytes found in the urine, resulted in the inactive behavior of rats 4-6, and may have actually improved the rats' cognition.

### **33. Katherine Cobb, Alexis Edelen, Greg Conley (Mentor)**

#### **Marion County Area Technology Center**

##### ***The Knife Home***

The knife home is a combination of individual kitchen knife blades and handles. The blades and handles are designed to be stored in a small box able to fit in a standard kitchen drawer. The blades will not be exposed,

they will be covered up by the storage box, so you never have to touch the actual blade. The handles are constructed with a lever arm making the blades interchangeable. When going to insert a blade, you will slide a clip releasing the lever arm upward, insert the blade into the handle slot, lock the lever arm back into place. When desired to remove the blade you would follow the same steps. When cleaning the blade it will be recommended to separate the two parts for the most efficient method of sanitizing. The purpose of this product is to reduce the everyday dangers of knives around children. Also the compact design allows the user to store/transport their knives. We researched patents to see if there were any other products like ours on the market. We could only find utility knives that had interchangeable blades, in which they were very difficult to remove and replace. We also surveyed approximately 104 people on questions related to our product, safety issues, and the use of kitchen knives.

**34. Cameron Buckman, Ava Embrey, Dr. Natalie Mountjoy (Mentor)**

**Daviess County High School**

***Trotting All Over the Navicular: The Effect of Environmental Variables on Navicular Syndrome in Horses***

Navicular Syndrome is a condition affecting horses that can cause lameness. It leads to the degradation of a bone in the feet, called the navicular bone, and one or more of the attached ligaments. It can also cause calcification of the ligaments, or cyst-like lesions within the bone. The disease and accompanying pain account for the lameness. Some research suggests breed or certain environmental conditions may increase the risk of Navicular Syndrome occurring in horses. Some of these include housing on hard or inclined surfaces, or the amount of calcium, phosphorus, or magnesium in a horse's diet. I intend to investigate these conditions among 10 local horses of varying breed, 3 of which have been diagnosed with Navicular Syndrome. I will then compare these environmental and genetic characteristics between the groups with and without Navicular Syndrome. I hypothesize more athletic horses, horses kept on hard surfaces, horses kept on inclined surfaces and horses with mineral deficient diets will be more likely to have the condition. Navicular Syndrome impacts a lot of today's horses and is like osteoporosis in humans; it causes many of the same discomforts and is equally incurable. Though it may not be curable, it may be preventable or there may be measures that can make the condition easier on horses and their owners. I am hopeful this research can contribute to increasing the quality of life for horses with this condition.

