Nebraska Junior Academy of Sciences

2023

Central Regional Science Fair 2023 Abstract Booklet

DATE

Tuesday
February 28, 2023

HOSTED BY

HASTINGS COLLEGE

SCAN ME

Nebraska Junior Academy of Sciences
Central Regional Science Fair 2023

Welcome to the 2023 NJAS Central Regional Science Fair!

We would like to extend a **Thank You** to all of the participants, parents, teachers, and judges. Without all of your support, this event would not be possible.

Neil Heckman, Science Fair Director

Hosted by

Contents

Participating Schools

Adams Central Jr./Sr. High School

Jay Cecrle & Zac Foster

Central City Public Schools

Chelle Gillan & Anna Detlefsen

Hastings Public Schools

Bailey Johnson

Sandhills Public School

Zeta Greene

Silver Lake High School

Kim Bonifas

Map of Hastings College

Schedule

<table>
<tr><th>Time</th><th>Teachers</th><th>Jr. Division Students</th><th>Sr. Division Students</th><th>Judges</th></tr>
<tr><td>8:00</td><td>Check-in at Morrison-Reeves Science Center
(east entrance)
#8 on the map

Project Setup
(must be ready by 9:00)</td><td>Check-in at Morrison-Reeves Science Center
(east entrance)
#8 on the map

Project Setup
(must be ready by 9:00)
2nd Floor</td><td>Check-in at Morrison-Reeves Science Center
(east entrance)
#8 on the map

Project Setup
(must be ready by 9:00)
1st Floor</td><td>Check-in at Morrison-Reeves Science Center (east entrance)

Judge’s Meeting 8:30
Room 219
2nd Floor</td></tr>
<tr><td>9:00</td><td></td><td rowspan="2">Face-to-Face Judging
2nd Floor</td><td>Educational Presentations
UNL Extension Office

Location: Walk over to
Wilson Building
(#13 on the map)

Rotating Sessions:
A Room 120 (main floor)
B Room 010 (basement)
C Room 030 (basement)</td><td rowspan="3">Face-to-Face Judging

Jr. Division
2nd Floor

Sr. Division
1st Floor

<u>Lunch</u>
(Optional)</td></tr>
<tr><td>10:00</td><td>Teacher’s Meeting
Room 130
(next to main office)</td></tr>
<tr><td>10:30</td><td></td><td>Educational Presentations
UNL Extension Office

Location: Walk over to
Wilson Building
(#13 on the map)

Rotating Sessions
A Room 120 (main floor)
B Room 010 (basement)
C Room 030 (basement)</td><td>Face-to-Face Judging
1st Floor</td></tr>
<tr><td>12:00</td><td><u>Lunch</u>
Hazelrigg Student Union Dining Hall
#23 on the map
(1 lunch ticket/per person)
Seating in room A&B</td><td><u>Lunch</u>
Hazelrigg Student Union Dining Hall
#23 on the map
(1 lunch ticket/per person)
Seating in room A&B</td><td><u>Lunch</u>
Hazelrigg Student Union Dining Hall
#23 on the map
(1 lunch ticket/per person)
Seating in room A&B</td></tr>
<tr><td>1:30</td><td>Awards Presentation
Chapel</td><td>Awards Presentation
Chapel</td><td>Awards Presentation
Chapel</td><td></td></tr>
</table>

.

Junior Division Entries

Animal Sciences

J-1 Does the Difference Between Dog Food Affect How Your Dog Eats?
Tyla Held
Sandhills Public Schools – Zeta Greene

I wanted to do this project so that my dog is eating because he is getting very old. I feel this can help him have a stronger and better life. My question is, could there be a difference between dog food, and will it affect how my dog eats? My hypothesis is if I introduce my dog to 300 pieces of cheaper, and more expensive dog food then I think my dog will consume more of the expensive brand. I will feed him 300 pieces of dog food and measure what he does and doesn't eat. My dog will get a fresh new bowl every day. Eventually, I will switch the dog food out and repeat the same process.

J-2 Determining Which Food Deer Prefer Most
Xander Journey
Silver Lake Public Schools - Kim Bonifas

I got this idea after a conversation with my father about how scarce deer are getting in the state of Nebraska, and it crossed my mind of something that might work. I used plots to attract deer and I observed as they ate the things from the plots.

J-3 Seeing if the Barometric Pressure Would Affect How Many Claves Born on the Same Day
Colton Leach
Sandhills Public Schools – Zeta Greene

If the barometric pressure would affect how many calves are born on the same day. Why I'm doing this is because it seems like the cows calve right before the storm gets her or right in the storm. My hypothesis is that the cows calve before and as the storm gets here because of the pressure would make the cows have more stress and make them pop them right out. So, for my procedure look back on the 2021 and 2022 calving books and put them on an IXL sheet and number the calves born on the same day. After that go back and look on the National weather service website for the barometric pressure.

J-4 Calving Preparation
Aaron Hall
Sandhills Public Schools – Zeta Greene

Which gloves are the warmest so when you go to check or feed or tag your fingers won’t get cold and calving is already stressful enough cold fingers are the last thing you want. Out of all the gloves that will be tested the leather gloves will be the warmest Put on the gloves on your dominate hand and put the thermometer on the inside and hold your hand in the snow for 1 minute 5 times after warming them up between trials.

Behavioral & Social Sciences

J-5 Background Noises and Puzzles
Alondra Rascon
Hastings Public Schools – Bailey Johnson

Different types of music can really affect the way people can focus on doing a task, but what type of music really helps you concentrate better and do your work more efficiently? This project looks at which music or no music helps someone build a puzzle to see what the fastest time was. The three different trials that were used was no music, calm music, and tense music by timing (dependent variable) the person to see what music helps someone concentrate better. My hypothesis was that calmer music would help someone focus better on building a puzzle. The projects results supported my hypothesis by showing that calm music (30 minutes) time was the fastest and better concentrating background sound. This experiment also shows that tense music isn't really the best to use if you really want to concentrate on something.

Chemistry

J-6 Does Detergent + Fabric= Flames?
Cora Martindale
Sandhills Public Schools – Zeta Greene

Have you ever wondered if the type of laundry detergent you use could make you more exposed to catching on fire? If I test tide pods, Purex+ oxi, Xtra Ultra, Gain boost, baking soda, vinegar, and Ecosense then, I think that clothes washed in baking soda and vinegar will not catch fire, and tide pods will be the most inadequate for resisting fire. Before this procedure use a washing machine to wash a piece of cloth on a "quick wash" while using the recommended amount of detergent for a medium/small load of laundry and having it air dried. After doing those steps cut out the 10x10 cm square and put the cloth in a fire-safe jar and light the fabric on fire, then record the data as the cloth is on fire (time of burn), then examine the ashes and mass them.

J-7 The Effect of Stretching Time on Leap Height
Shauna Stull
Central City Public Schools - Anna Detlefsen

I chose this topic for my project because I love dancing and I have always wondered how changing the amount of time I stretch affects how high I leap. I predicted the longer I stretched, the higher my leap would be. First, I attached a tape measure to the wall so I could measure the leap height. Then, I asked a friend to take a video of my right leg leap. I slowly looked over all the videos and paused at the highest peak. Next, I recorded the leap height on a piece of paper. I recorded the block of stretching time after every five leaps. Once I had all of my leaps performed, filmed, and recorded on my draft I created my data table and averaged out my data. The results showed stretching for zero minutes had an average leap height of 33.6 in, five minutes averaged 34.4 in, and stretching for 10 minutes averaged 36.2 in. Finally, the last set of five leaps- stretching for 15 minutes was at an average of 38.4 in. A single factor analysis of variance was completed on the results with p=1.7375E-6; stretching time does have a

statistically significant effect on leaping height. Overall, the data supported my hypothesis. The longer amount of time spent stretching will contribute to higher leaps. If I were to expand this experiment, I would test the height of a leap in different shoes or on a different surface.

J-8 What is the Best Way to Cook Popcorn?
Paizley Zutavern
Sandhills Public Schools – Zeta Greene

Every time I make popcorn, there are a lot of kernels left over. I would like to find a more productive way to cook popcorn. Therefore, my main question is "What is the best way to cook popcorn?" If I cook popcorn three different ways (stovetop, microwave, and air popping), I think that air popping would be the most productive method of popping corn and reduce the number of kernels left behind. To run this test, first count the starting number of kernels. Then pop the popcorn with one of the three methods. After the popcorn is popped, count the number of kernels that did not pop. Repeat this process for each method. Then record the data.

J-9 How the Cookie Crumbles (Does the outward appearance in cookies change if you use the substitutes instead of the normal ingredients)
Georgia Pfeil
Hastings Public Schools – Bailey Johnson

In baking, you often won't have all the ingredients you need, so you use the substitutes for them. In this project, I tested if the outward appearance will change when you do use them. For this experiment, I used the same recipe for them all but switched a variable in each (a substitute) then baked them. After 10 minutes of baking & a few to cool, they were judged on a scale out of 10 on: Melted, expanded, height, softness, & color. Each category had a possible number of points of 2, adding up the 5 categories, you'd get a number out of 10 for their score. This experiment supported my hypothesis by demonstrating a small amount of difference between them all. In conclusion, this investigation proved you can use the substitutes but not that the cookie will end up being their yummiest if used.

J-10 Looking at Lactose
Shaylee Milleson
Sandhills Public Schools – Zeta Greene

The following test was designed to determine if lactose intolerance milk will have a reduced shelf life. I want to know what type of milk will store longer. In my hypothesis if I test strawberry, chocolate, 2%, fat free skim milk, 1% low fat, 2% filtered, whole filtered, and Vitamin D milk, I think that the 2% filtered milk will allow more bacteria to grow. To do this test I used test tubes by pouring 6 ml of each milk in the tubes. Then I proceeded to use a pipette to drop two drops of methylene dye in each tube. After I made sure to roll the tube around so it was mixed in the milk. I used different shades of numbered blue cards to measure the change. The less blue the more bacteria. I used a camera to document pictures of the data.

J-11 Science Fair Lab
Emma Huffaker
Hastings Public Schools – Bailey Johnson
I did this project because I wanted to know if a candle would last longer based on its color. Not only that, but I feel that this would help if you want a candle that will last longer, you would know what color to get.

J-12 Well Water or Bottled Water
Ella Held
Sandhills Public Schools – Zeta Greene

My science project is testing the difference between general well water and boughten water. I am using 4 different tests to decide whether well water or bottled water has reasonable levels of nitrate, pH, dissolved oxygen, and phosphate. The 4 tests being done are pH, dissolved oxygen, nitrate, and phosphate. If I test bottled water and well water in the Sandhills I would hypothesize that the bottled water would have neutral levels in pH, low levels in dissolved oxygen, low levels in nitrate, and neutral levels in phosphate. The procedure for this project is using a low-cost water monitoring kit and testing each water twice with every test. Use the water test kit to choose your first test. Follow instructions for each test. Take pictures of the water and record the levels and color rating. Clean out each container after every test so you don't impact the levels when you test again. You need tap water from a sink in a town and tap water from a sink in the country as well as hydrant or well water. You also need 3 different bottled water, Fiji, Dasani, and Smart Water. As well as a low-cost water monitoring kit with instructions.

J-13 Flour and Sugar vs. Water
Caylen Donner
Hastings Public Schools – Bailey Johnson

The purpose of this was to see which one, flour or sugar, would dissolve the fastest in a bowl of water. To do it I got out a medium sized glass bowl, liquid and dry measuring cup, and two knives to help me stir and level the flour and sugar off the measuring cups. Then while I was getting the materials out my younger brother asked to help, so I let him. He would put the 1 cup into the glass bowl and help me level the ingredients, while I stirred every ten seconds, and wrote down the data. We did this three times, the same way. I tested the question “Which one will dissolve the quickest, flour or sugar?” I did this because I was trying to think of something to do with the current materials that I had. I ended up with flour dissolving quicker than sugar, as I predicted. And as stated earlier in the results, the flour only dissolved longer than two minutes once, while sugar dissolved over two minutes all three times. My project contributes to the area I worked in by giving people an idea of which one, flour or sugar, would mix better, depending on the ingredients it’s being mixed with.

J-14 Processed vs. Original
Mattie Zutavern
Sandhills Public Schools – Zeta Greene

Can a human tell the difference between doterra oils and the original product I think that they will be able to tell the difference? For my test I applied one drop of each oil to different cotton swabs. Apply original product to different cotton swabs. Find a willing test subject, blindfold a person. Have the

person smell which one is the original product and which is the doterra oil. Repeat the step 5 until all cotton swabs are smelled and identified. Repeat steps 3-7. Record data in the composition book.

J-15 Gum Taste and Weight
Mason Sutton
Sandhills Public Schools – Zeta Greene

Dentists recommend that sugarless gum be chewed for 20 minutes after meals to help prevent tooth decay. Does the weight in sugared gum decrease drastically, and does sugarless gum do the same? Which gum will lose the most flavor and weight over the course of chewing? To test this, 7 types of gum were tested; Orbit spearmint, Big Red, Juicy Fruit, Bubble Yum, Double Mint, Hubba Bubba and Extra Winterfresh. If we test the 7 gums, I believe that Orbit will retain its flavor the longest, while Juicy Fruit will last the least. First the mass of the gum was taken prior to chewing, then chewed for 2-minute increments with the mass being remeasured each time.

J-16 Environments vs. Apples
Athena Barney
Hastings Public Schools – Bailey Johnson

The purpose of this project was to figure out how different environments affect an apple's weight. My overall hypothesis was that the apple in the fridge would retain the most crispiness and the apple on the countertop would retain the least. I completed this experiment by first removing the wax off of the apples, placing them in their environments, checking the weight every week for 6 weeks, and then comparing the information. The data which I collected said that the apple in the garage lost the most weight with approximately 3.66 grams of loss, and the apple in the fridge lost the least weight with only 1.0 grams lost. Each week, they all lost approximately 1–4 grams, but during the first week they lost the most weight. My conclusion to this experiment is that, if you want to keep an apple fresh for a long time, then you should store it in the fridge.

J-17 Will Mold Die with Radiation?
Ember Chavez
Sandhills Public Schools – Zeta Greene

The following experiment was engineered to test berries subjected to different amounts of time. For my question I was curious if mold growth on berries would increase with received microwave radiation? If I subject a variety of berries to 0, 3, 5 and 10 seconds in the microwave then I think the greater the time in the microwave the more mold will grow. For my procedure I weighed my berries in a plastic weight boat and numbered them 1-3 and put them in plastic sandwich bag in the order of 0, 3, 5, and 10. Then I proceeded to microwave them during to the number of seconds labeled. I advanced on this every day until I weighed again 9 days later and wrote down the weights. Repeated this procedure again until 4 days later I weighed wrote down my answers. In the end the berries with the most radiation ended up molding the most resulting in my hypothesis was correct. The berries that I didn't do anything to molded but not as bad as the others.

J-18 How Different Drink Mixes Affect the Boiling Point of Water

Rebecca Schmidt
Hastings Public Schools – Bailey Johnson

Most people know that liquids boil at a certain temperature, but did you know that adding different solutions to water changes the boiling point? This experiment looks at how different drink mixes change the boiling point of water. The drink mixes tested were Peach Crystal Light, Grape Crystal Light, Lemonade, Fruit Punch Kool-Aid, plus a sugar solution and a salt solution. They were each heated at the highest temperature until boiling, then were watched for two minutes, then the temperature was taken. My hypothesis was that some of the drink mixes would change the boiling point. The experiment's results supported my hypothesis, with all but the Kool-Aid either increasing or decreasing the boiling point. The experiment also showed that both the Grape Crystal Light and Peach Crystal Light had lower boiling points than water.

Engineering: Electrical/Mechanical

J-19 What Airfoils Work the Best at Different Airspeeds?

Ethan Prickett
Hastings Public Schools – Bailey Johnson

There are many airfoils (a structure with a curved design for the favorable ratio of lift to drag) out there. Many research articles claim they have found the best one, but many are foils better and some are worse for certain applications, which are the best for general flight, and is lift (to push something up) impacted by the shape of the airfoil. This project looks at which airfoil creates the most lift at different airspeeds. The airfoils were tested at a slow airspeed, a medium airspeed, and a fast airspeed. We would measure the lift (dependent variable) and change the airspeed for each airfoil (independent variable) My hypothesis was that the commonly used airfoil for jet airplanes (laminar flow) will work best at high speeds because it is designed to lift many hundreds of tons up in the air and jet airplanes move at very high speeds. The experiment did not support my hypothesis, because the early foil wing with the most camber (an arch) worked the best at all speeds. The experiment also showed that laminar flow and semi-symmetrical airfoil did the worst out of all.

J-20 Identifying Which Brand of Duct Tape is the Strongest

Jordan Bonifas & Lee Gibson
Silver Lake Public Schools - Kim Bonifas

This project is determining which brand of duct tape is the best. This is also determining if the price matters. The hypothesis for this project was that the most expensive roll of duct tape would be the strongest. We tested each tape twice, then put the data into google sheets and graphs. The results for this project determined that our hypothesis was correct. The most expensive tape, Gorilla tape won by almost 50 lbs.

Engineering: Materials/Bioengineering

J-21 Which Bat is Best?
Gracie Craig
Hastings Public Schools – Bailey Johnson

People are always debating whether the composite bat is better than the aluminum bat. I wanted to investigate this by testing each bat individually to see if there really is a difference. People should care about my experiment because it can help themselves or their kids be able to have fun and hit the ball. I found out that they aren't all that different, I already knew that most will say the more expensive bat will obviously hit farther than a cheap bat you can buy from Walmart, but they seemed to be wrong. I concluded that they are very similar in lengths of what they would hit. My experiment contributes to the cost-friendly bat versus the expensive bat, so families won't feel they need to spend over 500 dollars on a bat to make a ball go a little bit farther than a 30-dollar bat.

J-22 Paint Pours Soar!
Hadley Buschow
Hastings Public Schools – Bailey Johnson

Artists are constantly debating which paint-pour liquids work best. But which liquids actually work best at creating cells in a paint pour? This project explores whether adding pouring medium, adding water, or not adding liquid works best at creating cells. The paints were tested when no liquid was added, then when mixed with either pouring medium or water, and lastly, measuring the number of cells formed (dependent variable) using different liquids (independent variable). My hypothesis was that the pouring medium would work best at creating the most cells. The experiment results supported my hypothesis by showing that the pouring medium produced the most cells (10), versus water (5), and no added liquid (0).

J-23 Fuel Erosion
Tristen Swisher
Sandhills Public Schools – Zeta Greene

We own the gas station in Dunning NE, so I want to know if gas or diesel will wear out the cement first? To test the erosion of fuel on concrete surfaces have a control of water, and test highway diesel, red diesel, no-lead, and super. I think the diesel will break the cement before the gas and water. The first step is to make cement bricks, put the cement mix in the mixing bowl. Then add water into the mix and stir the mix until all the dry is incorporated. Next, pour the mix into the mold so it can dry, make sure the bricks are cured for 3 days then measure what the weight of the bricks are before putting them in the fuel. Finally, put the bricks in the gas or diesel in the coffee containers. Then take your bricks out of the fuel and dry them off so you can see if there is a loss in weight by grams.

J-24 How Long Do Certain Lip Glosses Last?
Gisselle Henriquez
Hastings Public Schools – Bailey Johnson

There are many influencers telling people to buy certain beauty products based on their liking, but how are people supposed to know what products work better than others based on relativity? This experiment looks at different types of glosses and their ability to contain moisture without drying for the longest period of time. The types of glosses that were tested were Hard Candy Glosstopia, NYX Filler Instinct, and NYX Butter Gloss (independent variables). They were applied three times each and were then timed (dependent variable) to see how long they would last. My hypothesis was that none of the lip glosses would last no longer than 30 minutes, as they were all drugstore brands. The experimental results did not support my hypothesis, as Hard Candy Glosstopia passed the mark in all three trials, and NYX Filler Instinct passed the mark in one trial. The investigation also showed that the thicker the formula, the more hydrating and moisturizing the lip gloss is on your lips.

J-25 What Is the Closest Surface to a Gym Floor?
Thatcher Teahon
Sandhills Public Schools – Zeta Greene

Basketball is not always played on a wood court. Would the different type of surfaces change how dribbling occurs? If the basketball is dribbled on ice, carpet, concrete, dirt, tile then I think concrete will be closest to a gym court. I am doing this because some people out here is not anywhere near a gym court, so I want to see what surface is closest toa gym court so people can practice dribbling not on a gym court. When testing this you would go to each surface and dribble five times for 30 seconds with your right and left, so five 30 second test with your right and five 30 second test with your left.

J-26 Sports Drinks: Do They Really Work?
Bennett Baack
Hastings Public Schools – Bailey Johnson

Advertisers are always talking about how their sports drinks will help your sports performance, but is this true or does water work just as well? Why would we buy sports drinks if water works just as well? I investigated the hypothesis “do sports drinks improve physical performance”? All I needed for this experiment was different sports drinks to test against water and a treadmill to run on. I discovered that sports drinks can improve your physical performance. All of the sports drinks I tried worked better than water alone. This will help people in real situations when they don’t know if they should buy sports drinks. Most people buy them because they assume they work, but with my data, they can see just how well they actually work.

J-27 What Popcorn Brand is the Best?
Eva Magallanes
Hastings Public Schools – Bailey Johnson

Do different brands of popcorn affect how many kernels are left unpopped? My hypothesis was the Orville Renebacher’s would have the least amount of unpopped kernels. However, it had the most. Pop secret had the least amount of unpopped kernels. Jolly Time had the second least number of kernels.

The more unpopped kernels a bag had, the cheaper it was. Pop Secret was the most expensive, and Orville's was the cheapest. I did my experiment by popping the popcorn in the microwave for 2 minutes and 9 seconds.

Medicine and Health Sciences

J-28 Music? Slay or Nay

Jazzel De Leon

Hastings Public School – Bailey Johnson

The purpose of this experiment is to prove if music can help people concentrate or could it be distraction. At first, I believed that music does help us focus, but after researching and doing my mini experiment, I started to believe that it depends on 3 variables: the person, surrounding and the music type. Scientist are not entirely sure either if it actually helps, scientist found that it can improve mood and cure stress, while other scientists found music could damage our brains.

J-29 The Effects of Different Foods on Heart Rate

Isabella Whitten

Silver Lake Public Schools - Kim Bonifas

In this experiment my question was what types of food will affect your heart rate the most. The methods I used were 1. Check heart rate before they eat food 2. Have them eat food 3. Check heart rate 2-5 after they eat the food 4. Repeat with other foods. What I found affected heart rate the most was the sweet and salty foods. My conclusion was that the sweet and salty foods will have a major effect on your heart rate, healthy foods will not change much.

J-30 Shooting Free-Throws Everyday

Brayson Richardson

Hastings Public School – Bailey Johnson

By testing shooting free throws every day to find an average. My hypothesis in this experiment was that if practice really does make perfect by shooting every day. My project after the testing showed that my hypothesis was true that practice makes perfect it made my shooting percentage go up. Finally, it showed me that the more you shoot and the longer duration you do it for the better results you'll get.

J-31 The Effect of Hand Washing Education on a Middle School Population

Amelia Buhlke

Central City Public Schools - Anna Detlefsen

The purpose of the project is to determine if hand-washing education is effective in a middle-school population. Recently, hospitals have been overwhelmed due to significant increases in pediatric RSV cases. The CDC is trying to prevent the spread of the virus by promoting proper hand-washing techniques. I started watching my classmates wash their hands and most barely got their hands wet. I decided to evaluate if hand-washing education is effective in a middle-school population. My hypothesis was that hand-washing education would be effective in a middle school population by decreasing the

amount of CFUs present after washing. Eight middle school students were randomly selected and GlitterBug Potion was applied to their hands. The subjects' hands were swabbed, then students were told to wash their hands with no formal handwashing education. Subjects' hands were then swabbed. All samples were plated, incubated for 24 hours, and counted. A black light was used to educate the students how they could improve their handwashing as the GlitterBug Potion illuminated where they did not effectively wash. On day two, the process was repeated but hand-washing education (according to the CDC) was completed following initial swabbing. The results showed that the hand-washing education was not effective in decreasing the amount of CFUs on subjects' hands. Statistical Analysis was completed using a one-way ANOVA test with a $p<0.07$. The hypothesis that handwashing education is effective was rejected. The method taught and frequency of handwashing education used was not effective within a middle-school population.

J-32 What Workout Will Make My Heart Rate the Highest?

Adaline Nelson
Hastings Public School – Bailey Johnson

This experiment involved recording the type of workout I did at different times, included my max heart rate during the workout overall. My hypothesis was that 10 minutes HIIT cardio class would make the heart rate the highest out of all of my workouts that I did. The experimental results did not support my hypothesis because my heart rate reached its highest point during my 30-minute Peloton ride. This shows that the time in which you work out matters about as much as what you do in the class, because they both contribute to your heart rate. The experiment also showed that core classes do not affect your heart rate as much as other workouts do. I think the reasoning behind this is because you focus on your breathing a lot during core workouts, so that you can activate the right muscles.

J-33 Determining Which Disinfectant Wipes are Most Efficient

Libby Soucek
Silver Lake Public Schools - Kim Bonifas

The purpose of this project is to figure out which of three disinfectant brands is the most logical. This could change the way how frequently people clean often touched surfaces. Especially surfaces such as tables, countertops, or any other surfaces that food touches on a daily basis.

All of these brands are known well, but are they known just for their names or how good they actually are. Many people could be wasting their money. Some people say that the most expensive are the higher quality. Others will say that the cheaper kinds work just as well and the higher priced ones are just overpriced to gain more profits.
For this project top brands Clorox, Lysol, and Super Sani Cloth will be tested. Each will be tested at separate times. A sample of an object will be taken, then the object will be wiped and another sample will be taken. This process will continue until everything is tested and the data will be put into graphs.

The end results can solve any debates anyone has ever had about these brands. Which can be good for many things as mentioned before prices, which one works best over time, or frequently people clean.

J-34 Environment and Reading Speed
Araya Schroeder
Hastings Public School – Bailey Johnson

Everyone talks about how reading in a quiet environment helps you read faster, but is this really true? Is your reading speed changed at all because of the noise level in your environment? This project looks to answer these questions. This is tested by having two people (or participants as I call them throughout) read in both a quiet environment and a loud environment (independent variable) and then measuring how long it takes them to read (dependent variable) in each environment. My hypothesis was that you would read faster in a quiet environment and slower in a loud environment. My experimental results showed that my hypothesis was correct for some people but not everybody. This is shown in my data seeing as how participant 1 read faster in a quiet environment than a loud environment but participant 2 read faster in a loud environment than a quiet environment. Based on these results you can conclude that overall, it really depends on the person whether noise makes a difference in your reading speed.

Microbiology

J-35 Identifying How Long Bread Lasts with Certain Types of Preservatives
Molly Hemberger
Silver Lake Public Schools - Kim Bonifas

The purpose of this project is to find which brand of bread molds the fastest. The methods used on this project were placing the bread open on a counter for two hours to collect bacteria like normal bread would. Then place it in Ziploc bags and let it sit for however long it needs to mold. The results were not surprising. My hypothesis was that the most expensive mold would last. The hypothesis was wrong. The two brands that lasted over 3 months were Sara Lee and Great Value. The two that molded the fastest were Sam's Choice gluten free bread and homemade bread maker bread. The most expensive was Sam's Choice and it was the second bread to mold. So to conclude, the bread that lasts the longest is not the most expensive and it can last a very long time.

J-36 The Effect of Reusable Face Wash Pad Fiber Content on Bacterial Growth
Claire Detlefsen
Central City Public Schools - Anna Detlefsen

I use makeup remover wipes every day and that produces a lot of waste, so I started to make my own reusable ones. When looking at the content of different threads I used I saw they were different. That led me to think about bacteria that would be on the wipes after I used them and if different fiber contents would affect the number of bacteria that would grow on the wipes. I predicted the thread consisting of 85% Bamboo and 15% silk would grow the least number of bacteria because bamboo has naturally antimicrobial properties. I cut three equal sized pieces of each type of yarn and place them in individual bags. I grew a Staphylococcus epidermidis culture to use as the bacteria on the yarn. After 24 hours of incubation, I pipetted 200 microliters into each bag and let them set for 12 hours at room temperature. After 12 hours I took the thread out of the bag with sterile tweezers and swabbed the thread. I swabbed an agar plate for each thread, incubated for 12 hours, then counted the CFUs. The

highest CFU count was present on 50% Cotton/50% Viscose fibers; the lowest CFU count was present on the Viscose/Polyester blend. An ANOVA was run on the data with a p=0.31; fiber content was not a statistically significant factor in CFU growth. My prediction was rejected; bamboo and silk fibers did not have the lowest bacteria growth; it had the third highest CFU count.

J-37 Determining Which Common Household Items Can Keep a Food Warm the Longest
Justin Sharp
Silver Lake Public Schools - Kim Bonifas

In this project, the most common household storage items such as aluminum foil, saran wrap, Tupperware containers, and leaving a variable in open air, will be tested on which item can keep a food warm the best and longest over a period of time. Many may have a different opinion, but the hypothesis for this experiment will be that the aluminum foil will retain, or keep, the food variables heat the longest. While the project was tested, the variables used were pizza and hot dogs. This experiment was tested twice, and the results came out almost exactly the same. In both times the project was tested, aluminum foil was, in fact, the best storage item to use to keep heat the longest. Saran wrap was second after the aluminum foil. The saran wrap, like the aluminum foil, was a great storage method to use but unfortunately fell short and didn't retain the heat well like the foil. In conclusion, the best storage method to use when trying to keep food warm is aluminum foil.

J-38 Determining Which Fruit Lasts the Longest
Brooklyn Himmelberg
Silver Lake Public Schools - Kim Bonifas

This project is Determining Which Fruit Lasts the Longest. It's determining which fruit when left outside the refrigerator will last the longest. The reason that apples, grapes, strawberries, bananas, and mangoes were chosen is because they are the most common of the fruits. The reason that this project was chosen was to see how long it takes for the fruit to go bad. The methods used for this project are, select fruit, take a picture, observe data, take pictures once bad and then throw them away. The major finding is that apples last the longest outside the fridge. Most people put apples in the fridge when they should be left out. Bananas are always outside of the refrigerator and last over 1 week. The grapes were close to last, which was shocking. They say that usually grapes last 2 to 4 days long. There was a trend that some fruit(s) would go bad after four days of the other one. The first one to go bad was the strawberries. The second one to go bad was bananas and mangoes. The third one to go bad was grapes. Lastly, the apples went bad last.

J-39 How Long Does It Take for Mold to Grow on Touched vs Non-Touched Bread?
Pyper Witte
Hastings Public School – Bailey Johnson

The purpose of this experiment was to see how many days it takes for touched bread and non-touched bread to mold. The non-touched bread and touched bread were all put into zip lock bags and then were placed in the same room in the same spot. The bread that was touched grew mold in 2–3 days, and the non-touched bread grew mold in 9–10 days.

Physics & Astronomy

J-40 The Effect of Air Pressure on Free Throw Percentage

Cash McLaughlin

Central City Public Schools - Anna Detlefsen

I chose this project because it was basketball season, I enjoy basketball, and I own a hoop of my own. I predicted that changing the air pressure in a men's high school basketball would decrease my free-throw percentage because it would be different from what I'm used to shooting. I measured the free-throw line distance from my hoop and drew a line for where I needed to shoot. I used an air pump to air up the basketball to the appropriate pressure and checked the air pressure every 10 attempts. I shot 100 free throws on 6, 8, and 10 PSI, recording my results after every set of 10 shots. I then averaged all sets into percentages. My results were surprisingly very similar compared to my prediction. I shot 54% at 10 PSI, 51% at 8 PSI, and 51% at 6 PSI. A single-factor analysis of variance was conducted on my results with a p=0.86. I have concluded that air pressure in a men's high school basketball does not have a significant effect on my free throw percentage at the air pressures I tested. If I were to expand on this project, I could do three-point shots instead of free throws. I could also do layups.

J-41 The Effect of Ice Shape on Melting Time

Fyn Fasbender

Central City Public Schools - Anna Detlefsen

I wanted to know if ice shape could affect melt time and which would be best for drinks. I am a Dr. Pepper enthusiast and I love ice in my beverages. Thus, I chose a topic for both personal inquiry and scientific curiosity. I predicted, because of the volume of the sphere, it would have the longest melt time due to having the most space throughout. I put water in multiple molds and let them freeze. After freezing, I put each piece of ice in identical cups. I waited for each to melt and recorded the time they became fully liquid. I repeated this process for each of the different kinds of ice. Nugget had the quickest time with an average time of 50 min 24 s. Crescent had the second quickest time with an avg time of 56 min 39 s. Crushed with third slowest time with an avg time of 2 hrs, 3 min, 26 s. Cube was the second slowest time with an avg time of 5 hrs, 20 min, 4 s. And sphere was the slowest with an avg time of 6 hrs, 4 min, 6 s. A single factor analysis of variance was conducted on my results; ice shape had a statistically significant effect on melt time with a p=1.3913e-12. My hypothesis was supported, the sphere was the slowest melting ice shape. In conclusion, I would test different amounts of liquids with the sphere to see how much liquid type affects melt time.

Plant Sciences

J-42 How Does Saltwater Affect Plants?
Kallan Cox
Sandhills Public Schools – Zeta Greene

The project I was investigating was how saltwater affects grass. The reason I am doing this is because in states like Georgia or Florida that get a lot of hurricanes, you will want to know what flowers can't handle salt water. My hypothesis was that after 3 days of being watered with salt water, the grass would begin to die. To do this, I planted grass seed in 10 different containers and watered five of them with 10 milliliters of tap water and the other five with 10 milliliters of salt water a day.

J-43 Cow Manure, Eggshells, Garden-Tone, Which One is Better?
Camila Hilerio
Hastings Public School – Bailey Johnson

The purpose of this experiment was investigating the kinds of fertilizers people use and test each one with a sunflower seed. This information could interest farmers, florist, or gardeners, because they use fertilizers for their crops, flowers, and plants, and they would want to know which ones make their plants grow faster and healthier. In my hypothesis, I said that the Garden-Tone fertilizer would work best out of all three, but unfortunately, I got the wrong one and ended up with a vegetable fertilizer. The result was, cow manure worked better them eggshells and Garden-Tone. Turns out, natural fertilizer works best them man-made fertilizer. Her cow manure had a lot of nitrogen that the sunflower needed, but maybe it had too much, which caused the flower to die. I could have probably added less, so it would grow better. The results were surprising but promising.

J-44 3-Way Fertilizer Experiment
Julien Brandenburger
Hastings Public School – Bailey Johnson

I did this science project because I really got curious about what fertilizer makes plants grow the fastest and be the healthiest. And you should care about the work I did on this project because it might help you if you need to care for a plant.
My hypothesis was that an all-purpose fertilizer would be the best. I investigated this hypothesis to some surprising results.

My procedure was that I'd measure each plant after a few days of administering each fertilizer. Oh, and for consistent similar results, make sure each plant is similar to each other.
For results, the plant that was on all-purpose fertilizer had an average growth rate of 73.3 centimeters, which was the highest out of all three plants.

Alright, for my conclusion, my science fair project contributes to the scientific area(s) of botany and biology because my test subjects were plants, and because I was (temporarily) influencing the lives of my test subjects. And I'm happy to say that my objectives were met with no major setbacks.

J-45 The Effect of Sound on Plant Growth

Natalie Warner

Hastings Public School – Bailey Johnson

Plants can be kept for many reasons, like eating or appearance. Many people tend to plants just for fun, and deeply care for their plants. As a result, it is no surprise that many people search for ways to make their plants healthier, bigger, or even just nicer-looking. There are countless studies, products, and articles based on different ways to improve the overall health of plants. My project specifically focuses on sound and its effects on the growth of plants. By the use of one solid, unchanging, high-pitch sound, I tested this on plants with headphones. Through doing this, I had hoped to receive results showing an increase in growth. To show that the results were better than those without sound, I had split the plants into two groups: a control group and a sound group. I had also decided that I would only test it over a period of three days to show if it would be able to take effect within that time. At the end of my experiment, the control group had grown 0.1 inch more than the sound group, showing that the sound had either had no effect, a negative effect, or too little of an effect to show a definite answer. Overall, I would say that the sound hadn't increased the growth of my plant, at least within my time period.

Senior Division Entries

Animal Science

S-1 Inhabitation of Blowflies in Different Environments

Taylyn Greving

Central City Public Schools - Chelle Gillan

Forensic scientists use blowflies as a source of determining what has happened to a body and how long it has been decaying. Because these scientists struggle to determine what the effect of the blowfly are on the body in different situations, my research was done on the number of blowflies in four different environments (field, feedlot, tree/forested, urban). Three traps were set 100 meters away from each other at each of the four environments and insects were collected after each week for three weeks. Insects collected were sorted through to determine how many blowflies were in each location. It was predicted that the field environment would have the most inhabitants of blowflies due to its more open environment. The alternative hypothesis was supported with the tree/forested environment having the greatest number of inhabitants of blowflies and the field environment having the least. The data was significantly affected by a freeze between week one and week two. Further studies should be done over the span of four seasons to determine what type of environments are favored by blowflies in specific seasons.

S-2 The Effects of Sexual Orientation on the Beginning Stages of Development with Ovis Aries

Berkley Jacobitz & Peyton Hartman

Adams Central Schools – Zac Foster

It is very important for sheep breeders to know when to breed their Ewe Lambs and Ram Lambs. The Ewe Lambs tend to not be able to breed until they reach 10-20 months of age; however, the Ram Lambs are able to breed with the ewes at around 4-6 months of age. With this experiment we wanted to expand on that idea to see if there was a difference in the rate of development between Ewe Lambs and Ram Lambs. To do this we took two sets of twins, each set consisting of one Ram Lamb and one Ewe Lamb and weighed them for four weeks. We made sure that each lamb was getting consistent feedings from their moms and that they were behaving naturally. We started the weighing process the day they were born and weighed them exactly a week later for four weeks. When the lambs reached four weeks old, we compared the data and their growth rates and saw that there was no significant difference in their development in their first four weeks of life. Using this information, we did more research on the topic and found that there won't be a significant difference in their development until three months of age.

S-3 The Effects of Traditionally Processed Food Versus Commercially Processed Food on Earthworms' Length and Mass

Molly Blanchard

Central City Public Schools - Chelle Gillan

Due to all of the overfilled landfills and all of the food waste that is produced each day, I used worms to understand how the worms might be able to help get rid of waste. I tested which type of food source would be best for the worms. I used raw carrots that I cooked with water and CP carrots as the independent variables and I used leaves as my control. Each food group had 3 bins with 10 worms in

each, therefore each food source had 30 worms each. In total, I had 90 worms in this experiment. I checked on the worms for two months and fed them when they ran out of food. In the end, the worms that ate the CP carrots were both smaller in length and weight and had more deaths than the other two groups I had two very small P-values for the weight and the length (4.1e-38, 4.4e-47) showing that there was a significant difference in the length and weight of the worms that were fed the different food sources.

S-4 The Effect of Heifer Diet on Offspring Liver and Muscle, and Liver Metabolome

Madison Chrisman

Central City Public Schools - Chelle Gillan

Since the production of animals is a billion-dollar industry and many people rely on livestock to nourish their families, this study was conducted to see if heifer dietary supplements could improve fetal development through epigenetic programming, therefore advancing cattle performance. I chose this experiment because it is important to have good quality animals to get the best product and profit. It was predicted that heifer diet 63 days before and 63 days through pregnancy would have an effect on offspring liver and muscle. Each heifer was assigned a pen (4 pens, 20 heifers in each). The treatments were CHD, CHD+40g/d GAA, CHD+ 10g/d MET, and CHD+40g/d GAA+10g/d MET. Heifers were bred on day 63 of the study, and then on day 63 of gestation, they were slaughtered and fetal measurements were taken. The fetal liver and tissue samples were used for RNA and DNA analysis, and an Anova test was run to measure Methionine and Guanidinoacetic Acid in heifer serum. The data showed that the treatments with Methionine (MET) increased methionine in circulation resulting in a methyl surplus; however, the Guanidinoacetic Acid treatment (GAA) did not increase the presence of Guanidinoacetic Acid in the body. We are in the process of analyzing the transcriptome and epigenome results and determining the relationship between dietary treatments and on the ground calf performance.

S-5 Analysis of Immune Regulated Toll and IMD Cellular Pathways in a Drosophila Melanogaster Model of Peanut Allergy

Adelaide Buhlke

Central City Public Schools - Chelle Gillan

Because peanut allergies are becoming more prevalent, it is important that the process by which allergies travel through the human system is understood. This study examined Dif, Dl, Relish, and Cactus genes within the IMD and Toll pathways of Drosophila melanogaster when exposed to Peanut Flour. It was predicted that regulation of immune system pathways would be altered. There were 8 total cages, each with 100 female D. melanogaster reared at 75°F. Groups of two cages each had a different dose of PN slurry (0 or 200µL). Food and new PN slurry were administered every three days. Dead D. melanogaster were collected and frozen for RNA analysis of INR and Toll pathway expression. qRT-PCR analysis demonstrated that Dif was significantly upregulated at d24 (day 24) in comparison to the d0 (day 0) group. Dif and Relish were significantly upregulated at d24 in comparison to the d45 group, and Relish was significantly upregulated at d45 in comparison to the d0 group. Cactus was upregulated at d24 in relation to the significant increase seen in the Dif gene at d24. Gene analysis demonstrated that immune response genes were highly regulated during the d24 range, giving incite into optimal peanut exposure time for developing allergy tolerance. Accurate analysis of data is crucial to better understanding when allergens enter the body, how they affect the immune system, and how they will respond to medication. Future research will include further sequencing of the amino acids associated with the Dif, Dl, Cactus, and Relish gene pathways.

Behavioral & Social Sciences

S-6 The Effect of Time of Day and Caffeine Consumption on Athletic Performance
Josi Sharp
Silver Lake Public Schools - Kim Bonifas

Athletes practice, compete, and perform at several different times of the day. While the time they do these activities is up to them, there may be a time of day that is the most beneficial for their progress. If athletes hold the knowledge of what time of day is the best, this could change the way sports are viewed. In addition to time of day, caffeine also plays a role in an athlete's practices, competitions, and performances. Does caffeine improve athletic ability, or is that just a misconception? This research project studied which time of day athletes performed their best at by having them run 300 meters at different times of day. The other aspect the project studied was how caffeine affects athletic performance. This was tested by having athletes run 300 meters with and without caffeine in their system to determine the effects of caffeine.

After all data was collected, it was concluded that athletes performed their best during the afternoon. The majority of the subjects' time was the best when running in the afternoon. The athlete's second-best performance was in the evening, leaving the mornings to be the worst. However, while athletic performance in the morning was the worst, caffeine seemed to only affect the athletes in the morning. It can be concluded from this scientific research that the afternoon is the best time for athletes to practice, however caffeine does improve their abilities in the mornings.

S-7 Does Music Affect the Heart Rate and Blood Pressure?
Katelyn Strampher
Silver Lake Public Schools - Kim Bonifas

This project will be about if people's heart rates will increase or decrease if they listen to music. This experiment will show if there is a specific kind of genre of music people should be listening to when they are doing specific kinds of work. This will also show if blood pressure has a role in listening to music too. People have always wondered if there was a specific type of music they should be listening to if they are doing something specific like cleaning, studying, or working out. People get concerned about their bodies when they are doing physical work and listening to music because they have no idea if the music they are listening to will increase their heart rate and blood pressure.

S-8 The Influence of Career Technical Student Organizations on College Success and Self Perceived Efficacy
Samantha Bonifas
Silver Lake Public Schools - Kim Bonifas

Career and Technical Student Organizations (CTSOs) are organizations provided for high school students that aim to improve high school students' knowledge of career clusters, contextual instruction, leadership and personal development, applied learning and real-world application. There are eight nationally recognized CTSOs: Business Professionals of America, DECA, Family, Career and Community Leaders of America, Future Business Leaders of America - Phi Beta Lambda, HOSA - Future Health

Professionals, National FFA Organization, SkillsUSA, and Technology Student Association. The purpose of the study was to determine the influence of high school participation on college students. A survey distributed to 50 random and anonymous college students evaluated and measured the college students' current grade point average, career readiness, and self-perceived efficacy measured by the 21st Century Learning Skills. The study proved that career readiness and self-perceived efficacy were both significantly higher for college students who participated in a CTSO in high school compared to students who did not participate in CTSO, but there was no indication of participation in a CTSO in high school greatly affecting college grade point average. The study also indicated that CTSO members who obtained leadership positions were likely to feel more career readiness and have a higher self-perceived efficacy. This study intends to develop the claims of benefits of participating in a CTSO and potentially increase participation in these programs.

S-9 What Food is Better Name-Brand or Off-Brand
Emma Strampher
Silver Lake Public Schools - Kim Bonifas

This project will determine if off-brand foods are actually better and healthier for our bodies than name-brand foods. In the project, the method is that people try the food, and determine what they think of it and which one is better. The findings are that the people that got tested liked the name brands more. The price ranges that were big though are that the name-brand foods were 1 to 2 dollars more expensive than the off-brand.

S-10 Determining What Cattlemen Like Better: Grass Fed, Corn Fed, or Organically Fed Beef
Sophie Schmidt & Kamille Karr
Silver Lake Public Schools - Kim Bonifas

What do farmers like better: grass fed, corn fed, or organically fed beef? What will most farmers say when they fill out the survey? This project is determining what most farmers prefer to feed their beef. In this experiment it should show that most farmers like corn fed beef better than organic and grass-fed beef. The reason for this is because corn fed is more commonly used when farmers feed their cattle. The hypothesis for this experiment is that farmers will pick corn fed beef rather than organic and grass-fed beef. This topic is important to society because some farmers wonder what other people feed their cattle. People will take this survey and see the outcome, then may switch what feed the cattle are intaking. To find the outcome, a survey was made, and farmers then shared their answers on the survey. Data was then collected. The results in this project showed that corn fed is the way most farmers use to feed cattle. When asked why they prefer their beef fed this way, most of the responses said better marbling in meat, tenderness, flavor, juiciness, and it's a more economical way to produce beef. The hypothesis was accurate with the results. In the beginning it said corn fed beef would have numerous votes, and be the top picked out of the three.

S-11 Determining Public Perceptions of Beef Promotional Programs
MaKenna Karr
Silver Lake Public Schools - Kim Bonifas

This research project is about finding out whether or not beef promotional programs are known about and utilized by ranchers in the south-central Nebraska area. In this project, research will be conducted based on previous scientific studies that have been conducted on this topic.

The question for this research project is, “Do people, farmers, ranchers, and students know that these resources exist and if so, do they utilize them?”

The hypothesis for this research project is that people may have heard of the programs, but not utilize them. The data was collected through a 12-question survey. 20 people around the south-central Nebraska area took part in taking the survey. After the data was collected, it was then analyzed, and conclusions were drawn.

Cell and Molecular Biology

S-12 The Effects of Stain Removers on Stains
Phoebe Johnson & Kiera Kort
Adams Central Schools – Zac Foster

We are testing to see which stain remover is going to work the best on different types of stains. Since so many people have had to get stains out of something in their life, we thought that it would be a good idea to find out which one works best. We Decided to use OxiClean, Dawn dish soap, vinegar and baking soda, and Shout as the stain removers to test. The stains we decided on were mustard, ketchup, bacon grease, and coffee since these are spilled so often and since they are some of the hardest stains to get out. We predicted that OxiClean would work the best on most of the stains. We predicted this because OxiClean has many different strong ingredients mixed together to make it as strong as possible. Our experiment is putting a few different stains on white t-shirts and then using different stain removers to see which ones will work the best on different stains. We are measuring to see what works best by measuring how big the stain is before we apply stain remover and then comparing it to how much of the stain is left after we wash it. The objective of our experiment was to know which stain remover will work best on the different stains that we tried.

Chemistry

S-13 The Effects of Honey and Glycerin on Watercolor and Gouache
Jacie Boelhower
Adams Central Schools – Jay Cecrle

It is a race against the clock to save evidence of humanity’s past. Being that photography has only been introduced in the 19th century, the primary recorder of history has been art. However, art is no permanent thing, so it is imperative that we find a way to make our artwork as long-lasting as possible. Gouache and watercolor are two similar types of paint, with gouache having white chalk added to it to set it apart. Some watercolor brands use honey to increase the vibrancy and thickness levels in their products, so honey may just do the same with gouache. Glycerin is another common additive that other paint brands use. The question is which additive produces better results. Three sets of watercolor and three sets of gouache were made, with one set of each made with a glycerin base, a second set with a honey base, and the third set with a regular base. Each set was painted onto a small sheet of canvas paper for comparison, and saturation rates will be measured with a color-finding app.

Energy and Transportation

S-14 Disc Brakes vs. Drum Brakes
Dayton Svoboda & Aden Feezell
Adams Central Schools – Zac Foster

People drive all the time. Sometimes accidents even happen. And when they do, there is always the question of how. For this experiment we will be testing two different types of brakes. The disc brake, which is used on most cars today, and a drum brake, which is used on most older cars. We drove two similar gokarts at the same speed and hit the brakes with full force. We tested on the two main surfaces people drive on today, gravel and pavement. Our hypothesis was the drum brake will be just as good or bette than the disc brake on gravel, but the disc brake will be greatly better on pavement if the drum brake locks up. This proved to be right as our charts show that the two brakes are very even on gravel but the disc brake is much better no pavement. They both locked up and skidd on gravel. On pavement the disc brake really didn't lock up which helped it greatly because the drum brake skidd slightly. But even that slight difference hurt the drum greatly as it took about twice the amount of distance to stop compared to the disc brake. This confirms the two brakes are even on gravel but the disc brake is the best on pavement.

Engineering: Electrical/Mechanical

S-15 3D Printing a Remote Control Car and Determining if it Will be Able to Function
Blake Monie
Silver Lake Public Schools - Kim Bonifas

His project will identify if a 3D-printed remote control car can deliver office papers and boxes to a location. Many people nowadays want products to be placed faster and by machine and not hand. By using a remote control car that is made from recycled plastic and by using technology. There has been a way to make people's lives easier and make things less complicated, by using materials that we use in our everyday lives. This project will also be very beneficial and useful to people that want to save their time on something that could take hours to do, and do in less than twenty minutes. The final objective of this project is to build a sustainable movable device that will make an automated delivery in buildings. How to build a 3D-printed remote control car. The only problem in my way with this project was the amount of time the construction and design process took.

S-16 The Effect of Skirt Diameter on Hovercraft's Weight Capacity
Kit Brooks
Central City Public Schools - Chelle Gillan

Hovercrafts could be widely used for transportation if more development and research was done on them, so I decided to look into the air cushion and skirt size. This experiment was conducted to see if a hovercraft's skirt diameter affects its weight capacity. I constructed a hovercraft with a plywood base, a thin plastic skirt attached to the bottom of the base, and a leaf blower intaking air for the air cushion in the plastic skirt. I also utilized a thick plastic disk fastened in the middle of the skirt and base to create the air cushion's monkey bread-like shape. The plastic skirts were of three different diameters, which I believed would affect their upward force. In my experiment, the larger

skirt diameters did have higher weight capacities; however, the numbers began to vary more as well. Overall, it was found that the change in weight capacity could have been from other factors than the skirt diameter. Increasing the variables in the battery life, temperature, stability, and weight placement would be beneficial for future research.

S-17 Utilizing a Drone to Manage a Cattle Herd

Beau Bonifas
Silver Lake Public Schools - Kim Bonifas

Cattle cubes are a type of cattle feed that typically contain at least 20% crude protein. Many farmers and ranchers choose to cube their cattle as a way to deliver nutrients, keep the cattle tame, and also to teach the cattle to follow them so it's easier to move the cattle to a different field or pasture. Drone usage in the cattle industry has increased during recent years to include herd monitoring and rangeland imaging. A new type of drone implementation for cattle herd management could utilize the drone delivery of cattle cubes with an emphasis on teaching the cattle to follow the drone. The purpose of this study was to identify which type of drone payload delivery mechanism can best deliver cubes to cattle. The study evaluated four separate drone delivery systems based on a set of six criteria that ranked each device on a scale of 1 to 10. Two models of drones were flown with each of the payload devices. Each drone delivery system was also evaluated based on cost and payload weight capacity. The results determined that the Stork Box from a company called Storkplate was the best suited payload delivery device to deliver cubes to cattle with a drone, with an average score of 8.17 on the six judging criteria. The Stork Box came in second for load weight, and it was not cost prohibitive to purchase. The study concluded that a drone can successfully be utilized to deliver cubes to cattle and that it is possible to train cattle to follow the drone.

S-18 The Effects of Varied Thickness on the Practical and Theoretical Efficiency of a Zinc Oxide Solar Cell

Caleb Rowe
Central City Public Schools - Chelle Gillan

The purpose of this experiment was to see how the thickness of ZnO_2 solar cells affected the efficiency of the cells. I chose this topic because I find solar cells fascinating, and I hope to be able to contribute to the field of photovoltaics. It was predicted that up to a certain point, the efficiency of the cells would increase, and after that point the efficiency would decline and plateau. The way I reached this hypothesis was through the PC1D solar cell simulation. The simulation showed that under perfect conditions, at approximately 8.2 um thick, the efficiency would increase by approximately .06 and the base Isc and base Voc would decrease by .007 and .006 respectively. To compare to this, solar cells were produced in a lab. The cells were placed in a sputtering system for 15 minutes, 30 minutes, and 60 minutes to produce varied thicknesses of zinc-oxide layers. The data showed a difference in the base max power, base Isc and base Voc of thicker cells. A possible explanation for this is a decreased amount of surface recombination than in thinner cells. This would increase the efficiency by decreasing the number of electrons that travel to the bottom of the cell, without contacts, and the energy is lost. To extend this study it would be interesting to vary the sputtering process for longer, and take more trials to allow for statistical analysis to be possible.

S-19 How Does the Amount of Pitch in Airplane Propellers Effect the Airplane's Overall Efficiency?
Serese Janssen
Adams Central Schools – Jay Cecrle

This project is about experimenting with propeller design to find the most efficient airplane propeller by changing the amount of pitch in an attempt to improve an airplane's efficiency overall as a result. This project is important for the future of propeller-based aircraft, the world of small aircraft, and electric airplanes, which are still dominated by propeller aircraft. If we can get the airplane to be faster, and more efficient, the world of propeller aircraft could be improved. I designed a propeller using blueprints and then changed the amount of pitch. Previous research predicted that a five-blade propeller would be the most efficient. I predicted this using last year's project data. I designed multiple different pitched propeller blades using SolidWorks then used a Elegoo Mars 3, a resin 3-D printer to create the blades. I then sanded down the propeller to achieve a smooth surface if needed. The propeller was then mounted to a 1.5-volt DC motor which was mounted to a glider and tested on a Vernier Air Trac. A set of digital timers was used to measure the velocity of the cart. More propellers need to be designed and tested to determine a definite best pitch.

S-20 Determining the Most Effective Method to Sharpen a Knife
Casey Conway & Clay Plambeck
Silver Lake Public Schools - Kim Bonifas

This project is about determining the most effective method to sharpen a knife. This project is essential so that people can keep their knives sharp and can use their knives efficiently and effectively. The question is what is the most effective method to sharpen a knife? The hypothesis was that the electric sharpener would be the most effective at sharpening a knife. The hypothesis was incorrect and it turned out that the honing rod was the most effective at sharpening the knives.

S-21 How Do Shock Pistons Affect the Efficiency and Ride Quality of a Shock
Dominic Stutesman
Adams Central Schools – Jay Cecrle

Shock absorbers are important to all transportation in the modern day. As technology advances, shock technology is advancing as well. Shocks are specially designed for the application they will be used on. This experiment is to test and determine the different shock pistons. Each piston that is tested as well as the cup, was all designed myself and 3D printed. It was hypothesized that the more holes or holes for fluid to pass through, the faster the piston would rebound and make the shock softer. My engineering goal was to make a shock absorber as efficient as possible for the application. In a 3D-printed shock cup, all three pistons were tested on the rebound from bottom to top. The cup was filled with water. One piston has two regular flow holes, another has only one regular flow hole, and the last has a rectangle hole. The regular piston measured 2.89 seconds, the single-hole piston measured 3.55 seconds, and the rectangle piston measured 1.81 seconds. The results showed there is a direct relationship between the shock piston and the shock itself. With more holes, the flow increases. The results stated that the more holes you have in a piston, the softer the shock will be, as well as more flow. Fewer holes will make the shock stiffer, as well as not allow as much flow.

Engineering: Materials/Bioengineering

S-22 Designing a 3-D Printed Key Holder
Landon Duester
Silver Lake Public Schools - Kim Bonifas

The main purpose of this project is to make a key holder that can help any elderly that have any disease that can cause muscle spasms or shakiness. To figure this out and create a key holder, a 3-D printing software called Tinkercad will be used and the printer used is a MakerBot Mini 5th Gen. After they print which can take anywhere from a couple hours to even a day depending on the type of printer and quality of filament used. The overall reaction of all the elders and grandparents they were given to have been very positive and that it has helped them solve this everyday problem.

Environmental Management

S-23 Using Iron to Produce Phytoplankton to Combat CO_2
Chase Harper
Adams Central Schools – Jay Cecrle

Phytoplankton is one of the most vital microorganisms to all of our ecosystems acting as a biological carbon pump, removing approximately 30-50 billion metric tons of carbon dioxide annually. Phytoplankton can grow in fresh or salt water environments depending on the nutrients in the water, such as iron, nitrates, and phosphates. The purpose of this experiment is to determine if adding iron to fresh water while maintaining steady nutrient levels will create a stable culture of phytoplankton. My hypothesis was if I add in 10 ml of my iron supplement, then the water with the iron supplement will grow 20% more phytoplankton due to there being more of the base nutrient iron the phytoplankton need to thrive. Adding in 0.5ml of F/2 fertilizer to local lake water with added 5ml of phytoplankton, with 1 ml of fertilizer to keep the nutrients up after 3 days, and using an air pump to replenish the water of its oxygen. My control group (without added iron) was still successful, creating 0.33g, 0.32g, 0.26g, and 0.28g of dried out phytoplankton, but my experimental group (with added 10 ml of Flourish Iron) was even better and more consistent with creating 0.43g, 0.45g, 0.43g, and 0.46g of dried phytoplankton. A T-test was conducted which came out to be a p value of 0.0001, $p < 0.05$. My results suggest that adding in 10 ml of Flourish Iron per 1 quart of fresh lake water will result in more phytoplankton production by about 48.74% than that of regular lake water. My hypothesis was correct in the idea but the results overwhelmed the hypothesis creating 28.74% more phytoplankton than previously expected. Overall, implementation of this experiment to a lake full year around it would save our dying ocean ecosystems by creating a safe atmosphere to harbor more natural phytoplankton cultures, lowering our carbon dioxide pollution, and having more resources to harvest for biodiesel reducing the prices of fuel, and finally, a more sustained atmosphere leading to a world that will last longer and harbor much more life to come.

Environmental Sciences

S-24 The Effects of Man-made Water Sources on Wildlife Drinking Behavior
Grant Nielson
Central City Public Schools - Chelle Gillan

Because drought was affecting most of the state of Nebraska during 2022, the natural water sources were significantly depleted and wildlife had to find new sources. Such wildlife was observed drinking from livestock tanks and a question arose: What is the effect of artificial water sources on drinking behavior? This study attempted to learn more about the visitation frequency of wildlife between different types of water sources. Three sites were chosen based on the existence of a water source. Site A contained a natural water source. Site B contained an artificial water source that was a livestock tank. Site C contained both a natural source, that was dry, and an artificial source. A game camera was placed on each site to observe wildlife visitations. Each site held many uncontrolled variables such as water freezing, pasture livestock activity, water availability, to name a few. Each site was close enough to each other to experience the same weather and all cameras were collecting data on the same days. Trials were a period of 6 days for 2 trials. Site B showed a higher number of visits over all trials, and the P value ($1.02x10^{-7}$) was much smaller than the critical value (0.05). This means that the null hypothesis that artificial sources will have no effect on animal drinking behavior can be rejected. However, more trials may need to be conducted. In future experiments, it is recommended that more variables are taken into control. The most important variables that should be in control are water presence and water state.

S-25 The Effects of Microplastics on Daphnia magna
Kennedy Montague & Abbey Fish
Adams Central Schools – Jay Cecrle

Microplastics have begun to infest our freshwater resources. Microplastics are extremely small pieces of plastic debris in the environment resulting from the disposal and breakdown of consumer products and industrial waste. These microplastics have known effects on the health of the environment and its organisms. Research done by graduate student Loren Hou suggest this. While researching fish specimens over the decades, they found evidence of microplastics in remains dating back to the 1950's. "It just looks like a yellow stain; you don't see it until you put it under the microscope" (Hou 2021) The volume of microplastics polluting freshwater lakes and rivers has grown tremendously in recent years. In this experiment we used background knowledge of microplastics to determine the effects of microplastics on Daphnia magna. If Daphnia magna are exposed to microplastics for an extended period of time, then their heart rates will increase and reproductive rates will decrease because of the microplastics they have ingested over a specific time period. Four beakers filled with spring water and varying numbers of Daphnia magna were tested repeatedly for Nitrate and PH levels using a water testing kit. Two tubes per beaker were filled with 5 mL of water and in one vial three drops of PH indicator were added and in the other five drops of nitrate indicator were added. Also tested and recorded were the average heartbeats over three weeks using an online heart rate monitor. According to the data, it suggested that the microplastics did not affect the chemical levels in the beakers significantly. The heart rates stayed very consistent over the three weeks without any substantial changes. The results suggested that the Daphnia magna have begun to adapt to their living conditions, even though they were surrounded with varying amounts of microplastics. These results suggest that

the Daphnia magna adapted to living conditions containing microplastics. These results did not support the hypothesis.

S-26 Using integrated Soil Management to Improve Corn Plants

Will Johnson
Central City Public Schools - Chelle Gillan

This study was conducted to gain more information about how using integrated soil management techniques affects soil health and mineral uptake by corn plants. Integrated soil management uses no-till grounds, cover crops, and application of natural substances such as humic acid. I applied humic and fulvic acid to one side of a field that corn was grown in and took data on the leaf tissues and soil on both the treated and untreated sides of the field. Throughout and after the growing season, all the things that I researched, which were phosphorus in the leaves, available phosphorus in the soil, percent of microorganisms in the soil, and the % of mycorrhiza in the soil, the treatment with humic and fulvic acid had higher values than the untreated part. The hypothesis that if a field is fertilized with humic and fulvic acid there will be a positive effect was supported. There may have been more phosphorus in the treated area due to higher numbers of mycorrhiza that carry phosphorus. The rye cover crop in the treated field was much taller and denser than in the not-treated field. This indicates a higher level of photosynthesis and more carbohydrate exchange between the plants and microorganisms. The effect was more than likely due to differences in the cover crop size as opposed to the humic acid. It is very important to continue to develop effective integrated crop management techniques to make farming more efficient and profitable and produce enough food for the growing population.

S-27 The Solubility of Garden Fertilizers

Madison Karr
Silver Lake Public Schools - Kim Bonifas

There are certain substances that are very soluble in specific fertilizers. Urea, Ammonium Nitrate, Calcium Nitrate, Potassium Nitrate, and ammonium phosphate all have high solubility in water. These substances can be mixed in with each other in fertilizers, but they can also be single-nutrient fertilizers. Potassium nitrate was the most soluble out of all these. Research has been done on Nitrogenous fertilizers and it was concluded that all Nitrogenous fertilizers are soluble. MicroVeggy is a plant business who has conducted research on water soluble fertilizers. They concluded that Water Soluble Miracle Gro works the best and is the most water-soluble fertilizer for plants. The University of Minnesota and the Ohio Cooperative Extension service did a study in 2018 and found out that Ammonium Polyphosphate (APP) is 100 % water soluble. APP is present in many common fertilizers. The hypothesis for this project is that Miracle Grow will be the most soluble. This hypothesis was made because Miracle Grow has a strong presence of Potassium Nitrate and most importantly, Nitrogen. Nitrogen and Potassium Nitrate both create a large amount of solubility.

In order to keep the variables constant, all of the water needs to be kept at the same temperature and the amount needs to be the same on all of them to find which fertilizer is the most effective by determining water solubility. The amount of fertilizer being put in the water to dissolve also needs to be the same on all samples. The variable being changed by the researcher is the type and brand of fertilizer. The water will be kept at the same temperature so that will not affect the solubility or dissolving time.

S-28 The Effect of Farming Technique and Microorganisms on Soil Aggregation

Akeyli Bush
Central City Public Schools - Chelle Gillan

The goal of the study was to determine the effect that organic and inorganic farming techniques have on soil aggregate stability and microbiome. Soil aggregates are soil particles that are combined with organic matter and stick together more strongly than other soil particles. They are crucial for soil health due to their importance in holding water, maintaining soil structure, and the ability to increase microbial activity. I tested the soil aggregate stability in an organic and non-organic field using the Wet-Sieving Method. The mean stable aggregates in the soil from the organic field (66%) were higher than in the inorganic field (56%) but the Anova test did not show a significant difference. The hypothesis that the farming technique will affect soil aggregation was not supported. The P-value of 0.06 was close to showing significance so further testing should be conducted to verify these results. The soil from the organic farm may have had more stable aggregates because the microbiome was in balance. Application of pesticides can potentially kill microorganisms, and application of fertilizers can cause exponential growth in the microorganism population followed by population crashes. These microorganisms play an important role establishing the soil aggregations by secreting a sticky substance to act as a glue. Microbial analysis is ongoing at this time. This study is important because in today's society agriculture is one of our biggest resources, so how to improve soil health for optimal crop growth is very important.

S-29 The Effect of Water Hardness on Algal Growth

Julia Buss
Central City Public Schools - Chelle Gillan

Harmful algal blooms damage habitats all around the world by using up all the oxygen and nutrients in bodies of water leaving none left for the plants and animals living in them. I conducted this experiment to help focus testing for harmful algal blooms in the most at-risk bodies of water. In this experiment, I tested water with different hardness levels on algal growth. The levels were 30 parts per million, 100 parts per million, and 200 parts per million, and distilled water as a control. I added two milliliters of concentrated Chlorella algae to each beaker of water. There were four trials for each hardness level. After three weeks I looked at the percent transmittance of the water with a spectrophotometer; this told me how much the algae had grown over the three weeks. Even though the statistical test did not show a significant difference, visual observation showed differences in algal growth that should be further investigated. Algae in water with a higher hardness grew faster than algae in water with a lower hardness, which tells me lakes with higher water hardness ratings should be checked more often for harmful algal blooms. In the future, if I wanted to continue my research I could go to lakes with a hardness level of greater than 150 ppm to collect water and test it for harmful algal blooms; this would be an exciting way to extend my experiment.

Medicine and Health Sciences

S-30 The Effect of Music Tempo on Listener's Heart Rate
Lawrence Beyer
Central City Public Schools - Chelle Gillan

Studies have shown that music of different tempi can affect people's heart rate, suggesting that it may be possible for music to be used to decrease stress and anxiety and increase motivation and confidence. To be able to utilize this to its greatest potential, it's important to dig deep and understand why it happens. Every piece of music is intentionally crafted by the composer to affect the listener in a certain way, and the tempo is an aspect that has been commonly considered but rarely, if ever, isolated. With this study, I aimed to isolate tempo as a variable to see whether the results found by studies that did not isolate it resulted from the tempo itself or from the related aspects of the musical pieces used. To do this, I composed a musical piece to be exported at 40, 75, 110, and 145 beats per minute. These tempi were played for 10 participants, and their heart rates were recorded before and after the duration of each file. The results showed no correlation between tempo and heart rate with no significant difference in the recorded results ($P=0.98$, $\alpha=0.05$). This rejects the hypothesis that heart rate would approach the tempo of the music similarly to the way it has in previous studies where it was not isolated. It's essential to continue studying how music affects people, as the possibilities for music are astounding. After tempo, the next aspect worth examining the effects of could be musical mode.

S-31 Amount of Escherichia coli on Different Temperatures of Ground Beef
Savannah Lewis & Brooke Baker
Adams Central Schools – Jay Cecrle

Having bacteria free meat is important to the economy of South-Central Nebraska because there are many ranchers who raise meat producing animals. E coli is well known to have negative effects on the health of people. To make meat safer, it is cooked to kill E coli. This experiment attempted to determine which temperature is safest for human consumption. It was hypothesized that if higher heat killed E. coli, then well done will be the safest meat because it is cooked at the highest temperature. Six different temperatures were tested: Refrigerated raw, 125, 135, 145, 150, and 160 degrees Fahrenheit. Six patties were placed on a pan on a burner and all cooked at the six different temperatures. One gram of meat was placed in a vial of water and shaken to distribute the bacteria. This process was repeated 3 times per temperature. The mixture of the meat and water was then squirted onto the petri film. The petri film was then placed in an incubator for 3 days. After 3 days the E. coli colonies were counted. The dependent variable of the experiment was how many E. coli colonies that were on the meat at different temperatures. The independent variable of the experiment was the temperature the meat was cooked at. The Anova test confirmed a 0.0009 p-value, and it showed an indirect relationship between the temperature and number of colonies. The results showed there was an indirect relationship between the temperature and number of colonies. These results supported the hypothesis. These results suggest that cooking meat at higher temperatures has the least amount of E. coli and is the safest. Overall, our research question was answered.

S-32 Determining the Solubility of Different Pain Reliever Medications
Taylor Hanson & Lana Swanson
Silver Lake Public Schools - Kim Bonifas

1 in 3 people use over the counter pain relievers daily according to Pubmed.gov. Pain relievers are used often by many people on a daily basis. They are used to reduce minor pains. Different types of pain relievers such as ibuprofen, acetaminophen, and aspirin each have different solubility rates. This project will determine what brand and type of over the counter pain reliever dissolves the fastest. The hypothesis for this project is that the off-brand aspirin tablets will dissolve faster than the rest. One pill of each pain reliever will be placed into 200 mL of water at 37 ℃. After this, every three minutes the mixture will be stirred until completely dissolved. The time it takes to dissolve one tablet will be recorded. To follow that step, the dissolved solution will be poured through filter paper to separate the amount of pain reliever left over. The amount that is leftover will be measured. From this project, it has been concluded that Tylenol dissolves the fastest out of all the pain relievers. Bayer Aspirin dissolved the second fastest, and Advil dissolved the third fastest. This shows that all of the name brand pain relievers dissolve faster than off-brand pain relievers. This experiment shows that the more expensive products dissolve faster than the off-brand products. This inference shows that off-brand pain relievers are the more cost-efficient option, yet the name brand options dissolve faster.

Microbiology

S-33 Isolation of Antimicrobial Compounds from Soil Microorganisms Using a Novel Ichip Technique
Jerzie Schindler
Central City Public Schools - Chelle Gillan

35,000 people die annually in the U.S. from antibiotic resistant infections (Antibiotics/Antimicrobial Resistance, 2021). Efficacy of antibiotics is endangered by rapid emergence of resistant bacteria. One gram of soil contains approximately 60,000 bacterial species, some of which produce antimicrobial compounds (Reid, 2005). Despite abundance of soil bacteria, over 99% can't be cultured by traditional techniques, causing loss of potential antibiotics (Ling, 2015). This study was conducted to find a way to more efficiently grow microbes from which to isolate antimicrobial compounds. Soil samples were taken from an ephemeral stream. An ichip was constructed from a micropipette tip box with a filter membrane attached to allow nutrient diffusion. A diluted soil sample and agar were dispensed into ichip wells, along with agar-only controls and soil inoculated and agar-only Petri dish controls. This was placed back in soil for 3 weeks of incubation. 65% of ichip wells and 42% of Petri dish surface area exhibited growth and there was no growth on controls. Extracts from isolates were spotted on a lawn of several strains of gram negative and positive bacteria to observe inhibition. The null hypothesis that no microbes would grow was rejected as several different bacterial strains grew. Analysis of antimicrobial production against the gram negative and gram-positive bacteria is ongoing. This type of research is essential to help identify isolates that have potential for antibiotic development.

S-34 Using Image Analysis to Study the Effects of Carbon:Nitrogen Ratios in Mock Root Exudates on E. Coli Chemotaxis

Elaina McHargue
Central City Public Schools - Chelle Gillan

With an ever-growing global population, discovering how to grow crops more efficiently is imperative. Plant-microbe interactions in soil are essential to plant growth, and nutrients are a key component of these interactions. The purpose of this study was to test the effects of the carbon:nitrogen (C:N) ratios of mock root exudates, or compounds released by plants to attract bacteria, on Escherichia coli chemotaxis using a method currently being developed by researchers at Doane University. Image analysis was used to measure the movement of bacteria towards or away from two mock root exudate solutions at two concentrations. Issues with the methodology were discovered upon data analysis, so no conclusive results were found on the effects of the C:N ratio of exudates on chemotaxis, but progress was made towards optimizing the image analysis method for measuring chemotaxis. There were also trends in the data such as a concentration effect that could be reasonably explained by biological processes and should therefore be tested further. Research on developing this method should continue because it is time and cost efficient and able to show the process of chemotaxis, which is not true of other current methods of measuring chemotaxis.

S-35 The Effect of Artificial and Natural Flavorings on Dental Enamel

Lauren Thompson
Adams Central Schools – Jay Cecrle

Flavored water additives are commonly consumed beverages with the idea they are healthy alternatives to soda and juice due to their reduced sugar content. While the sugar content of flavored additives is zero the additives often alter the pH to enhance taste. Dental enamel dissolves at pH of 5.5 or less predisposing the consumer to irreversible loss of tooth structure. The purpose of this project was to demonstrate the effect of continuous exposure to low pH beverages on human teeth. Five groups of extracted human teeth were dried and weighed prior to exposure to the tested solutions. The human teeth were soaked in Fiji water pH 7.5, distilled water pH 7, lemonade pH 2.8, fruit punch flavored packet added to distilled water pH 3.1 and hydrochloric acid pH 1.8. Solutions were changed at two-week intervals for a total of eight weeks. At the conclusion of the experiment each tooth was dried and weighed after exposure to the assigned solution. ANOVA found significant differences in the width of teeth. ($p<0.05$) Chef test was done and discovered the significant difference was between lemonade and distilled water. ($p<0.05$) Results show that teeth exposed to acidic solutions lost more weight than those exposed to pH neutral solutions indicating that while low pH enhances taste it can also cause damage to tooth structure.

Physics and Astronomy

S-36 The Effect of Different Materials on Blocking Ionizing Radiation
Dalton Lovejoy
Central City Public Schools - Chelle Gillan

With a boost in the interest of space travel and colonization, we must learn what we are up against in the vast darkness of space. Ionizing radiation is one of the largest risks to astronauts traveling in space today. We must learn how we can lower or even prevent this risk and protect the future of space travel. I used different materials to block low amounts of ionizing radiation to see what material could perform the best. It was predicted that there would be a difference in the ability of the different materials to block the ionizing radiation. Three different materials were polyvinyl plastic, tin, and aluminum foil. All three of these materials were put on top of an ionizing core from an ionizing smoke detector. The amount of radiation that passed through them and reached the Geiger counter was recorded and averaged. With no material (control), 1207 mR/hr reached the Geiger counter. The least amount of radiation that reaches the Geiger counter was tin with 83 mR/hr, followed closely behind by aluminum foil with 113 mR/hr. Polyvinyl plastic blocked the least amount of radiation with 143 mR/hr reaching the Geiger counter. The densest material, tin, blocked the most amount of radiation, and the least dense material, polyvinyl plastic, blocked the least amount of radiation. Different materials did have an effect on how much ionizing radiation was blocked.

S-37 Sun Protection Factor (SPF) Level Accuracy of Sunscreen
Sarah Musil
Central City Public Schools - Chelle Gillan

As skin cancer is one of the most prevalent cancers in the United States, this study was done to show if sunscreen is accurately protecting us from skin damage. One of the best ways to prevent skin cancer is protection from the sun using sunscreen. I wanted to know if the SPF levels of sunscreen were accurate. It was predicted that with each different level of SPF the number on the UV Index scale would change. Three Petri dishes of the same size, with sunscreen in the middle were placed in the sun for 20 minutes. This was done for each level of SPF for three trials. During each trial, the dish was immediately tested with a UV monitor by placing the monitor 2 inches away from the sunscreen, and it was recorded with a UV Index number. After all three trials were done for all three levels of SPF, it was determined that there was a difference in number between the 15 degrees protection, 30 degrees protection, and the 50 degrees protection. The average number on the UV Index scale for each level were 1.3, 3.4, and 5.4. These results supported the hypothesis that said there would be change in numbers between all three levels of SPF. Further research could be done on humans to get a more accurate reading on the UV scale.

S-38 The Effect of Distance from a City on Sky Glow
Dylan Lovejoy
Central City Public Schools - Chelle Gillan

The purpose of this experiment was to see how distance from a city affected the amount of sky glow present in the area. I chose this experiment because I am very interested in astronomy, and sky glow can

make it dramatically more difficult to see astronomical bodies such as stars. It was predicted that distance from a city would have an effect on sky glow. Four locations were chosen. Two locations were at the brightest areas of two cities, and the other two locations were 11.5 miles away from the two cities. Three pictures were taken on crescent moon lit nights using a sky quality meter to measure the brightness of the sky. A table was used to make sure all pictures were taken at the same angle. The brightness of each sky was then averaged. It was found that both locations in the cities were brighter than both the locations outside of the cities. There was a statistically significant difference between the sky brightness of the locations in the cities and their counterparts outside of the cities with all the P values being under 0.03. These results support the hypothesis that the distance from a city would have an effect on the sky glow.

S-39 The Effect of Corked Bats on Batted Ball Speed
J.J. Foster & Nick Mousel
Adams Central Schools – Zac Foster

In the early 2000's of MLB baseball there was a major problem. Players were using corked bats to hit with. To make a corked bat they would drill holes in them and place very light material inside. This would make the bat lighter and help it swing faster. The MLB decided to ban corked bats in 2005. We wanted to find out the reasoning behind why they made these certain bats illegal. After looking into many studies and doing experiments ourselves we found out a lot. Although the bats may be lighter, that means there is less mass to help increase the velocity of the ball once it bounces off the bat. Also, when we calculated the collision efficiency for a corked bat and a normal bat the corked bat had a lower efficiency due to the density of the bat.

Plant Sciences

S-40 Effect of Stratification Temperature on Germination on Native and Non-Native Grasses
Bren Vaughan
Central City Public Schools - Chelle Gillan

This study was performed because of my concern about climate change and how it is impacting our world. In previous research I had many seeds that have failed to germinate and wanted to explore a possible connection between seed germination and climate change. I was also concerned about non-native species that are a large factor of global change. (Pyšek 2010). I hypothesized that the temperature that seeds are stratified at will affect the germination of native Western Wheatgrass (WWG) and non-native Intermediate Wheatgrass (IWG). WWG and IWG seeds were stratified at -4°C, 1°C, 6°C and 25°C and then germinated at 23°C for 2 weeks. An ANOVA test (α=0.05) was used to see if there was a significant difference in germination at the different stratification temperatures. Significant differences in germination were observed between the different temperatures in WWG trials, but not in IWG trials. IWG, the non-native grass, had significantly more germination than the native grass, WWG, at -4°C, and greater, but not significantly different germination at 25°C. Because this study showed that stratification temperatures affected germination of native WWG and not non-native IWG, it is important to do more research like this on other species to explore if this is a trend among native and non-native species or an outlier. This research is important because it can help anticipate how climate change could change ecosystems and inform us how to conserve them.

S-41 Determining the Effects of Different Irrigation Methods on (Zea Mays) Corn Growth
Ashley Bonifas
Silver Lake Public Schools - Kim Bonifas

This project will find which irrigation method has the most impact on corn growth. It can help to make Nebraska agriculture and their corn production most efficient. Increasing the growth rates and yield of corn can really benefit our world as a whole and the amount of food Nebraska can provide for our world. If farmers know which irrigation method can benefit them the most, it could increase their production drastically. This project will compare the average differences between multiple samples of three different irrigation locations over a period of time. Many universities and other research facilities have done similar projects to this one. All of the seeds will be planted at the same time, and then they will be transplanted to larger containers once each corn plant has sprouted. Once the plants have been transplanted, they will be measured for their height in millimeters each day. It was hypothesized that the corn plant samples watered underground, similar to drip irrigation, will have the fastest and most growth at the end of this study. The goal of this project is to inform farmers of which method of irrigation will give their corn plants the most height and quickest growth rate. Later, this project could also be expanded to show the differences in yield as well. In the future, this research can benefit our world by helping farmers and producers to grow more food in the most efficient way possible.

S-42 The Effect of Red Bull on Wisconsin Fast Plants
Josiah Davis
Central City Public Schools - Chelle Gillan

This project was about the effect of Red Bull on plants. Red Bull is an energy drink that contains carbonated water, sugar, acidic acid and caffeine. I wanted to test Red Bull because it gives us energy so I wanted to see if it gave plants energy too. I hypothesized less seeds would germinate, the stem length would be shorter, and the color would be unaffected. Eight control and experimental plants were tested. They were planted in styrofoam squares. Germination data was taken once. Plant height and color were taken four times. The germination hypothesis was not supported because it was found that Red Bull had a positive effect on germination. This may have been because the acetic acid in the Red Bull helped break down the seed coat. The stem length hypothesis was supported by the data because there was a negative effect on the stem length. This may have been because the Red Bull clogged the tubes that transport water. The color hypothesis was not supported by the data because there was a negative effect on plant color. This may have been because it did not have enough water because the sugar interfered with water absorption and therefore chlorophyll production and photosynthesis.

S-43 Conventional Till vs. No Till
Trevor Kral
Silver Lake Public Schools - Kim Bonifas

This project was by far my best one. It was really fun, and I got to do what I like best. I put out four different test plots (two on irrigated and two on dryland) to test if no till was better than conventional till. The results really surprised me. I thought that the no -till would do better in the plots, but in the irrigated plot the conventional till did better, but on the dryland the no - till did better. I also found out that the no -till stayed wetter because he held the water unlike the conventional till. The reason why

conventional till did better was because it had a nice even stand and was watered every week. The no-till did better on the dryland because it held the moisture for a lot longer. This will definitely help the farmers in our area improve their bushels to the acre. I hope farmers in my area will take this research into acknowledgement. In conclusion it is better to till irrigated ground and leave the dryland alone.

S-44 The Effect of Music on Wisconsin Fast Plants

Emma Schuele
Central City Public Schools - Chelle Gillan

This project was about the effect music has on plants. For humans, music is used for elevating mood, reducing stress, managing pain, and it is heart healthy. I wanted to test music because it has always been a big part of my life, and I wanted to see how it can affect plants because I have seen the effects it has on humans. I hypothesized that playing music for the plants would cause no difference with seed germination, the stem length would be longer, and the plant's leaf color would be a darker green than the plants in a normal sound environment. Eight control and experimental plants were tested. They were planted in styrofoam quads. Germination data was taken once. Plant height and color were taken four times. The germination hypothesis was not supported because it was found that music had a negative effect on germination. This may have been because the plant embryos sensed the vibrations as stress signals and responded with less cell growth. The stem length hypothesis was not supported because there was a positive and negative effect on the stem length. This may have been because the faster pace of the music can speed up processes such as the transfer of nutrients which makes the plant grow faster which sped up the life span. The plant color hypothesis was not supported because there was not an effect on plant color in the end. This may have been because the music did not affect the chlorophyll.

S-45 The Effect of Various Water Retention Resources to Rid Drought-Stricken Zea Mays Fields from Drought-Induced Problems

Evan Frink & Brody Eckhardt
Adams Central Schools – Jay Cecrle

One of the world's leading challenges is raising more arable crops to support the world's rising food demands, while also farming on less land and with less resources, such as water. This research explored how soil additives, such as Vermiculite, could help conserve water. We started by putting the manufacturer's recommended amount of additives in the soil, and then we planted the seeds at an even depth. We watered them periodically for ten days, then allowed them to grow without water for eleven days. We measured the height of the plant growth, the moisture of the soil, and made visual observations of the plant and the root for signs of water adequacy. The control grew 5.25" while exhibiting the expected signs of drought, such as leaf shriveling and decreased root growth. The Peat Moss grew 5.62" with signs of wilting in the early stages and healthy root growth. The third group, the Vermiculite, grew 5.23" with no signs of wilting, stayed green, and had healthy roots. The fourth group, the paper shreds, grew 4.52" with good soil water absorption, but did not appear to release the water for use by the plants. The leaves were extremely shriveled up and the roots were small. The last group was the Sodium Polyacrylate, which grew 4.60", stayed extremely green, but with small roots. The Paper Shreds vs. Peat Moss was the only significant data (ANOVA $P<0.05$), but the others were extremely close. We concluded that the Sodium Polyacrylate was the best additive to use when trying to create a healthier plant in the early stages of development. Overall, the results were consistent with our hypothesis, as the majority of the experimental groups were healthier, exhibiting less signs of drought than the control group. In the future, we could

possibly grow Zea Mays that are healthier than plants grown without material additives, while conserving water.

S-46 The Effect of High Nitrates on Wisconsin Fast Plants

Olivia Wymer

Central City Public Schools - Chelle Gillan

This project was about how increasing the levels of total dissolved solids affected plant growth. Total dissolved solids are the concentration of dissolved substances in water. The dissolved substances are either organic matter or inorganic salts. I wanted to test high TDS because Nebraska struggles with high nitrates specifically, which contribute to TDS. I hypothesized that watering the plants with high TDS would cause more germination along with taller and darker plants than the ones watered with normal TDS levels. Eight control and experimental plants each were tested. The experimental plants were watered with high TDS water. Germination data was taken once. Plant height and color were taken four times. The germination hypothesis was not supported because it found that high TDS did not affect germination. That may have been because the seed already has a built-in food supply that supplies nutrients like nitrates. They would not need to absorb the nutrients in the water if they had them to begin with. The data supported the stem length hypothesis because there was a positive effect on the stem length. It may have been because TDS gives the plants more nutrients for protein production. The data supported the plant color hypothesis because there was a positive effect on plant color. This may have been because TDS cause more conductivity in the plant, which indicates more nutrients that could be used to produce more chlorophyll.

S-47 The Effect of Salinity on Corn Plants

Shelby Hostler

Central City Public Schools - Chelle Gillan

This study was performed because I have grown up around agriculture and my dad's entire family makes a living though agriculture. I became interested in climate change because of the affects that it can have on agriculture. Climate change has an effect on salinity because the heat from the sun makes the water evaporate leaving whatever is left in the water behind like salt. The goal was to figure out how salinity affects plant growth. I planted 8 corn seeds for each treatment group and watered them with 50 mL of water each with the following salinity levels: no salinity (control), 0.3, 0.6, and 1.0 dS/m. I took data on germination once and on plant color, and plant height each week. I took data for 8 weeks. The mean height for the control group was taller than all other treatments, with the 1 dS/m group having the lowest mean height. The height of the 1 dS/m group was significantly less than all other groups ($P =/< 0.01$). The control plants were constantly taller than all other treatments each week. I found that the higher salinity levels did negatively affect corn plant growth so it is important for farmers to monitor soil salinity and take actions to manage saline soils. To extend this study, I would like to test how salinity affects other crop plants such as soybeans.

S-48 The Effect of Swine Manure on Wisconsin Fast Plants

Levi Webb
Central City Public Schools - Chelle Gillan

This project was about the effect of swine manure on Wisconsin Fast Plants. Swine manure is used for fertilization of crops. It contains many minerals but the most abundant ones are nitrogen, phosphorus, potassium, and calcium. I wanted to test swine manure because I thought that the growth and germination rate would be exponentially better. I hypothesized that the plants given swine manure would have a higher germination rate, be taller, and be a darker color than the control. Eight control and experimental plants were tested. The experimental plants were planted in a mixture of regular soil and swine manure and the control plants were planted in plain potting soil. Germination data was taken once. Plant height and color were taken four times. The germination and stem length hypotheses were not supported because it was found that swine manure had a negative effect. This may have been because the manure lost much of the nitrogen and retained the phosphorus, resulting in an excess of phosphorus. Studies show that swine manure loses nitrogen within five days and after that there is an abundant amount of phosphorus, which can lead to deficiencies in zinc and iron. The plant color hypothesis was not supported by the data because there was a negative effect on plant color. This may have been because the nutrient imbalance affected the ability of the plants to produce chlorophyll.

S-49 The Effect of Water with Seed Treatment Residue on Wisconsin Fast Plants

Dakota Sage
Central City Public Schools - Chelle Gillan

This project was about the effect of runoff from Hefty Complete Corn Seed Treatment on plants. The seed treatment maximizes early growth and decreases disease and insect pests. I tested this because there was a water contamination event in Mead, Nebraska, from AltEn. AltEn used treated seed corn to make ethanol. They did not dispose of waste properly—more than four million gallons of wastewater spilled. I hypothesized that watering plants with water from fungicide and insecticide-laced kernels would cause fewer seeds to germinate, shorter stem length, and darker color. Eight control and experimental plants were tested. The germination hypothesis was supported because it was found that water with seed treatment residue had a positive effect. This may have been because the seed treatment is supposed to encourage and maximize early growth. The stem length hypothesis was supported because there was a negative effect on stem length. This may have been because the water was slightly acidic (pH 6). I believe that the acidic water, along with the chemicals in the water, stressed the plant, and excessive abscisic acid was produced. Abscisic acid is a hormone that inhibits growth. The plant color hypothesis was not supported because there was a negative effect. This may have been because the plants became unhealthy. The water with seed treatment residue was very cloudy, containing a number of small chunks. This may have inhibited roots' ability to absorb water, thus affecting the plants' overall health and ability to produce chlorophyll.

S-50 Effects of Hydrogen Peroxide Plant Growth

Ziara Larson

Central City Public Schools - Chelle Gillan

This project was about the effect of hydrogen peroxide on plants compared. Hydrogen peroxide is made of water and oxygen. I wanted to test hydrogen peroxide because it seemed like it would help germinate and grow the plants better than water. I hypothesized that hydrogen peroxide would have a positive effect on the plant's germination, increase stem length, and cause the plants to be a darker green. 8 control and experimental plants were tested. Germination data was taken once. Plant height and color were taken four times. The germination hypothesis was not supported because it was found that hydrogen peroxide had a negative effect on germination. This may have been because hydrogen peroxide is a bleaching agent and could have caused the seed to dry out. The stem length hypothesis was not supported because there was a negative effect on stem length. This may have been because the hydrogen peroxide is acidic and could have negatively affected the soil's nutrients. The plant color hypothesis was supported because there was a positive effect on plant color. This may have been because the experimental plants were shorter, therefore having smaller cells, which tend to be greener.

S-51 The Effect of Different Amounts of Fruit in Storage Container on the Sugar Content of Fruit

Autum Hewitt

Central City Public Schools - Chelle Gillan

The purpose of this experiment was to see how storing different combinations of fruit would affect sugar content of apples. I chose this experiment because I wanted to find the best way to store fruits, whether at home or at a grocery store. Different groups of apples and/or bananas were put in Debbie Myer green bags. Each week for three weeks, I chose a random apple out of the bag and cut, and blended it. I then ran it through a cheesecloth to separate the liquid from the solids. I tested the sugar level with a refractometer. My hypothesis was that the variations would affect the sugar content but it was not supported by the data. This showed that storing bananas and apples together does not help to sweeten them. Storing the fruit together didn’t change the sugar content, but it did change other ripening aspects. The apples stored without bananas were not nearly as soft as those with bananas. Both bananas and apples produce ethylene gas, therefore when stored together, they both become softer faster than they normally would. A possible explanation as to why the sugar content did not change was because when apples ripen, they do get sweeter, but that is based on when they are still green. The apples I used were already decently ripe, so there wasn’t much of a difference in the sugar content. To add to this study, I would like to try using unripe apples instead of already ripe apples.

Junior Division Index of Entries

Senior Division Index of Entries

Plambeck	Clay	S20	31
Rowe	Caleb	S18	30
Sage	Dakota	S49	44
Schindler	Jerzie	S33	37
Schmidt	Sophie	S10	27
Schuele	Emma	S44	42
Sharp	Josi	S6	26
Strampher	Emma	S9	27
Strampher	Katelyn	S7	26
Stutesman	Dominic	S21	31
Svoboda	Dayton	S14	29
Swanson	Lana	S32	37
Thompson	Lauren	S35	38
Vaughan	Bren	S40	40
Webb	Levi	S49	44
Wymer	Olivia	S46	43