Nebraska Junior Academy of Sciences

2022

Central Regional Science Fair 2022 Abstract Booklet

DATE

Tuesday
March 1, 2022

HOSTED BY

HASTINGS COLLEGE

SCAN ME

Nebraska Junior Academy of Sciences
Central Regional Science Fair 2022

Welcome to the 2022 NJAS Central Regional Science Fair!

We would like to extend a **Thank You** to all of the participants, parents, teachers, and judges. We would also like to thank the Hastings Museum for allowing us to reserve their space. Without all of your support, this event would not be possible.

Neil Heckman, Science Fair Director

Sarah Higby, Science Fair Coordinator

Hosted by

HASTINGS COLLEGE

Contents

Participating Schools

Adams Central Jr./Sr. High School

Jay Cecrle & Zac Foster

Central City Public Schools

Chelle Gillan & Anna Detlefsen

O'Neill Jr./Sr. High School

Nic Simonson

Sandhills Public School

Zeta Greene

Silver Lake High School

Kim Bonifas

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>8:15</td><td>Check-in at the Hastings Museum (main floor lobby as you enter the building)

Project Setup
(must be ready by 9:00)</td><td>Check-in at the Hastings Museum (main floor lobby as you enter the building)

Project Setup
(must be ready by 9:00)
UPPER FLOOR</td><td>Check-in at the Hastings Museum (main floor lobby as you enter the building)

Project Setup
(must be ready by 9:00)
MAIN FLOOR</td><td>Check-in (main floor lobby as you enter the building)
Judge’s Meeting 8:30
Abbott Room (main floor)</td></tr>
<tr><td>9:00</td><td></td><td rowspan="2">Face-to-Face Judging
(Upper Floor)</td><td rowspan="2">2D Educational film in the Theatre

Digital Scavenger Hunt Immediately following

*Feel free to shop museum concessions/ gift shop (if time allows).</td><td rowspan="3">Face-to-Face Judging

Jr. Division
Upper Floor

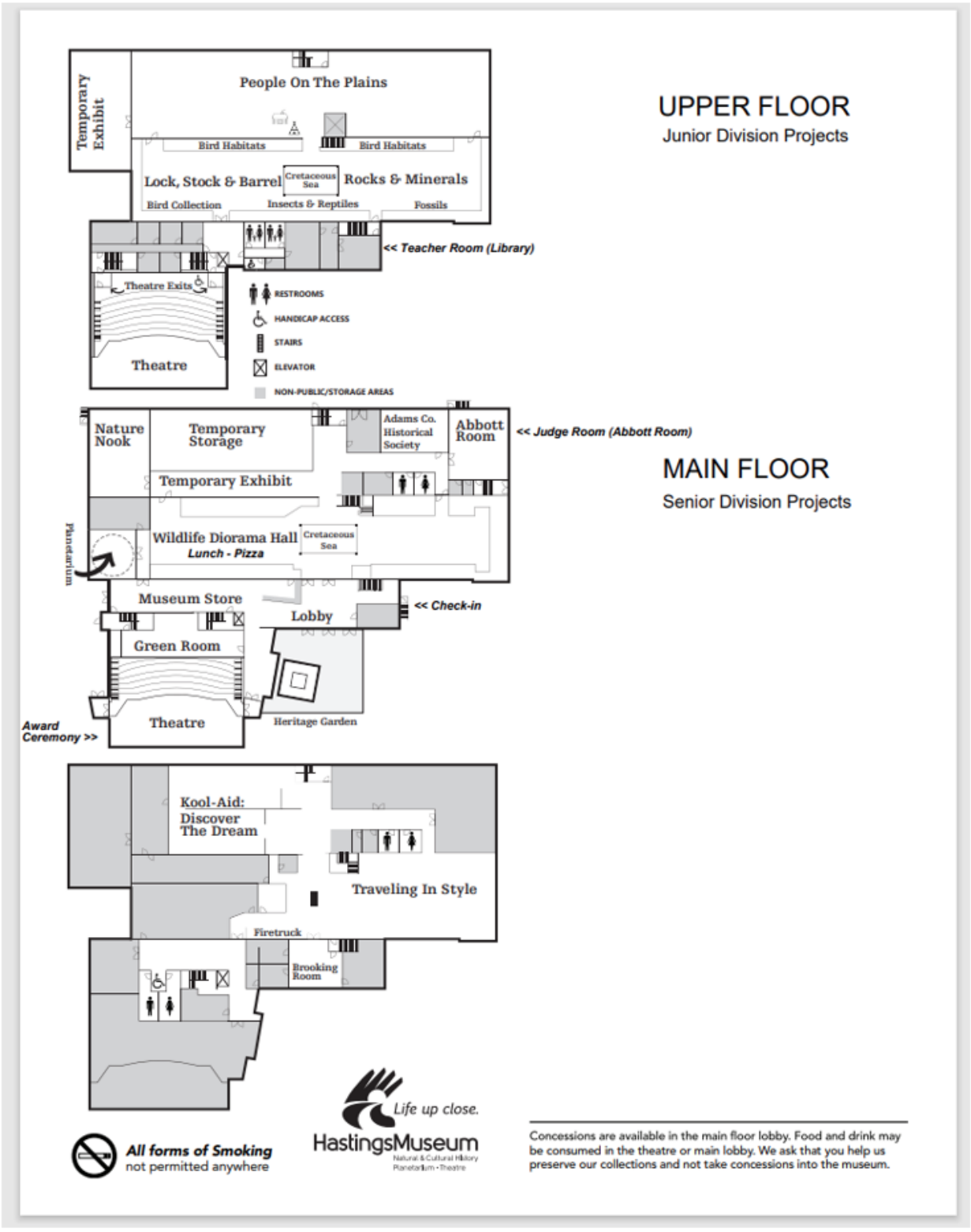
———

Sr. Division
Main Floor</td></tr>
<tr><td>10:00</td><td>Teacher’s Meeting
Library
(2nd floor near the restrooms)</td></tr>
<tr><td>10:30</td><td></td><td>2D Educational film in the Theatre

Digital Scavenger Hunt Immediately following

*Feel free to shop museum concessions/ gift shop (if time allows).</td><td rowspan="2">Face-to-Face Judging
(Main Floor)</td></tr>
<tr><td>12:00</td><td>Lunch
Wildlife Diorama Hall</td><td>Lunch
Wildlife Diorama Hall</td></tr>
<tr><td>12:30</td><td></td><td></td><td>Lunch
Wildlife Diorama Hall</td><td>Lunch (optional)
Wildlife Diorama Hall</td></tr>
<tr><td>1:30</td><td>Awards Presentation
Theatre</td><td>Awards Presentation
Theatre</td><td>Awards Presentation
Theatre</td><td></td></tr>
</table>

Hastings Museum Map



Junior Division Entries

Category 1 –Animal Sciences

J-1

The Effect of Temperature on Tenebrio Molitor Maturation

Julia Buss

Central City Public Schools, Anna Detlefsen

I first chose this project when I started observing the mealworms (Tenebrio molitor) for the toad in my science teacher's classroom and noticed how incredibly long it took for the mealworms to mature into adults or Beatles. I predicted the mealworms in the hottest incubator at 29oC would mature the fastest. I placed seven small mealworms in a container that would be primarily used to feed to pets and left them to rest at room temperature until they had all matured from larva to pupa. During this time two mealworms died in each container. Next, I put the three containers of mealworms in the pupa stage in incubators at different temperatures: 29oC, 27oC, and at room temperature 22oC. Every other day I would mark the number of mealworms that had matured into adults. My results were similar to my control but the mealworms in the incubator at 29 degrees matured very quickly, maturing five days after I had originally put them in the incubator when they had all been in the pupa stage. A single-factor analysis of variance (ANOVA) was conducted on my results. Temperature did have a significant effect on the maturation of Tenebrio molitor pupa ($p=0.0992$). I concluded that mealworms at hotter temperatures mature faster; therefore, 29oC is the most hospitable temperature if I wanted pupa-stage Tenebrio molitor to feed the toad. Next, I would like to test what bedding helps mealworms mature the fastest because my mealworms were all living in ground oats.

J-2

Deer in the Headlights

Peyton Saner

Sandhills Public School, Zeta Greene

Deer in the headlights. I hope this isn't the case but I wonder what is going on with our deer population at night. The hunters of Nebraska have seen less deer than usual and as a fellow hunter I want to know when these deer are showing up and what species are showing up. In my test I set up a trail cam and put out corn in a tub and observed how many species of deer and noted what time of day they showed up. Surprisingly, only white tail deer showed up on the camera. And of those appearances there were more doe than bucks. Also, the three bucks I saw were usually together. I thought most of the arrivals would come in around seven pm until five thirty am but instead the arrivals were all over the time line. I was disappointed that only two species showed up on the camera since it's been up however, on the last day of the trail cam pictures a coyote showed up.

J-3

Cattle Weight Gain

Kallan Cox

Sandhills Public Schools, Zeta Greene

I live in cattle country and my family has been in the cattle industry for many years. I was curious about what feed mixtures will cause the cows to gain the most weight. To do this the researcher started out by feeding 3 pens of cows all the same mixture for 16 days. After those 16 days, the researcher changed 2 of the pens to mixture 2 while one of them stayed the same. They were fed those mixtures for 11 days and then 2 pens were changed to the third mixture while the one continued to be fed the first mixture for nine days. The 2 pens were changed to the fourth mixture while the one pen continued to be fed the first mixture for 36 days. The researcher kept data on how much weight they gained total and per day during each mixture. I found out that the fourth mixture caused them to gain the most weight. My hypothesis was wrong because I thought that the mixture that had the most distillers would cause them to gain the most weight. The fourth mixture did not have the most distillers, but it had the most corn. When it comes to feed mixtures you have to make sure there's not too much corn because too much corn can lead to liver damage. Distillers are also included in all of my feed mixtures and distillers have more protein than corn so it is a good source of protein to have in your feed mixtures. This project was a lot of fun and a good experience.

J-4

Determining The Handedness In Animals

Kamille Karr and Sophie Schmidt

Silver Lake High School, Kim Bonifas

Do dogs use their right paw or their left paw more? What dog will use their right paw more than their left and what dog will use their left more than their right paw? This project is determining the handedness in animals, and finding out if they are left or right handed. In this experiment, there should be more right-handed animals than left-handed animals. The reason for that is because it's found more common in dogs for them to use their right hand. The hypothesis for this experiment is that animals use their right hand more than their left hand, but some other animals might use their left hand more than their right hand. When the results came back it showed that dogs do use their right paw more than the left. The hypothesis for the project was accurate with the results.

J-5

Determining Whether Horses Have a Preference on the Color of Bucket to Eat from

Karah Bartels

Silver Lake High School, Kim Bonifas

This project is going to help Equine owners spend less on feed buckets that their horses will not eat from. Most of the reaches that have been done found out that the lighter colored buckets are what horses prefer. The hypothesis for this is that the blue and purple buckets will be chores the most. How the project was conducted was the buckets were put in a line in the same order every time and the horses were put ten feet away and then were released to choose a bucket. The conclusion for this experiment was that there were two ties, the orange and black buckets were chosen five times, the orange and purple buckets were choses three times and the blue bucket was chosen the least amount of times.

J-6

Determining Which Breed of Cattle Steak Has the Best Appearance and Taste

Makenna Karr

Silver Lake High School, Kim Bonifas

This project is about whether or not there is a best-tasting and best-looking breed of cattle steak. The hypothesis for this project is that it will be a close competition between Hereford and Angus. Farmers around the South Central Nebraska area have different breeds of cattle so steak can be bought from them. The steaks will all be cooked at the same temperature. The people will taste test and determine which one looks the best without knowing which is which. The steaks will go head to head so people only have to compare two steaks at a time. There were six different steaks that were tasted and looked at. The first comparison was between Hereford and Simmental, The second comparison was a Hereford Cross and a Red Angus. The third comparison was between Charolais and Black Angus. Last year when this project was done there were only four steaks, sixteen taste testers, and Black Angus was the overall winner. This year there were six steaks, eighteen taste testers, and a new question was added about the steak appearance.

Catetory 2 –Behavioral & Social Sciences

J-7

The Effect of Visitor Travel Distance on Home Field Advantage in C-1 Football

Luke McHargue

Central City Public Schools, Anna Detlefsen

I wanted to include something about football in my project because I love football, and one thing I wondered about football was how prevalent home field advantage actually is and if it was impacted by how far a team travels to play a football team. I predicted the home team would win 55% of C-1 football games, but that percentage would increase to 60% if the visiting team traveled over 50 miles to play. First, I found the schedules of all class C-1 football teams on the NSAA website. Then, I recorded the distance between competing schools and the outcome for all games in the chosen year, ranging from 2014-2019. After that, I calculated winning percentages for the home team compared to the away team. Finally, I found the winning percentage for teams traveling over 50 miles to play compared to teams traveling less than 50 miles. I found the average winning percentage for home teams in C-1 football games was 53%. When a team traveled over 50 miles to play the percentage decreased to 52%. The winning percentage for games where the visiting team traveled less than 50 miles was 54%. The results of my analysis show, while home field advantage does exist at a small margin of 53%, other factors, such as the quality of the team, likely have a stronger impact on the results. If I was to conduct another experiment on home field advantage, I would either want to analyze it across college or professional football.

J-8

Testing if Money is Counter Fit

Aaron Hall

Sandhills Public School, Zeta Greene

For my science fair project, I wanted to study how a pen could tell if money was counterfeit. I started by doing research on the internet and buying one of the special markers. I figured out that a chemical iodide reacts with wood. This is why the marker turns black when the bill is counterfeit because it is made mostly from paper and most paper is wood-based. This is why the paper used for money is 75% cotton and 25% linen which also makes for a very strong paper. That is another one of the main reasons that America uses this type of paper for America's currency–it's strength. I was able to determine that in most cases these markers are an accurate way to detect counterfeit bills.

J-9

Coyote Calling

Thatcher Teahon

Sandhills Public School, Zeta Greene

This study was about calling in coyotes. The researcher has two different calls, electric and a mouth. The researcher plays the calls every day at 8:00 pm. The first call used was a mouth call and was played for 2-3 minutes and then repeated for 20 minutes. Wait an hour and then go back out and play the electric call for 2-3 minutes and repeat for 20 minutes. The researcher will document the research in his or her notebook and test the next day. If it is a researcher and doesn't know how to play a mouth call they would think the electric call would be more significant than the other call. Some of the researches results were that the mouth call outperformed the other call because altogether the mouth pup distress call has called in 5 coyotes and the electric call has only called in 2 coyotes altogether.

J-10

Average Hours of Sleep for a Teenager

Landon Duester

Silver Lake High School, Kim Bonifas

The main purpose of the project is to help teenagers figure out how many hours of sleep the get and how they can get more sleep. My main hypothesis of this project is that teenagers are not getting the recommended amount of sleep a night then they should. To figure out how much sleep a teenager gets a night a google form was sent out school wide. It concluded that many students are getting five to eight hours of sleep a 24 hour period.

J-11

Conducting Experiments to See if Chewing Gum Improves Test Performance

Trevor Kral and Drake Rosno

Silver Lake High School, Kim Bonifas

This tested 5 different people and had them take a test. They took a test without gum and then we had them take a different test with gum to see if they improved their score. Most people did end up improving a lot. The results showed that 60% of the people who took the test improved their scores while 40% did not improve.

Category 3 –Chemistry

J-12

Nail Rust

Ember Chavez

Sandhills Public School, Zeta Greene

It has been noticed that many nails soon rust when not being used and might not be good anymore. Is there a way to remove the rust off the nails in an affordable safe way? After researching, the researcher found that the soda that was used in this project is carbonated, allowing it to dissolve with metal oxides. The toothpaste had some interesting ingredients. It was in question that the toothpaste might to better than the soda. Next water was chosen because when a rusty object goes in water it changes. The researcher wanted to see if it would take away the rust or cause more. After this knowledge, 5 nails were put into beakers with soda, toothpaste, and water overnight. Then they were taken out and rinsed. Pictures of their progress were taken and this was repeated for 6 days. It was noticed that the nail in the soda removed rust more than in the other trials. The toothpaste came in second, there was more rust left than the soda trial. The water was the worst, it barely took any off but still did some help. There was a lot of residue of the rust in the water. The researcher learned that soda has some substances that can fix nails and help the environment.

J-13

How Much Water Will It Absorb?

HayLynn Glidden

Sandhills Public School, Zeta Greene

I was inspired to do this testing because one night my brother was eating supper and spilled a glass of water and we tried to get it cleaned up but the kitchen towel was not absorbing the water and it got to his phone and got it all wet. Right there on top of thankfully, we got his sun-dried off with a paper towel but now my question is what kind of cloth will absorb the most liquid. I think if I test the paper towels that my school provides, Bounty paper towels, Sparkle paper towels, a washcloth, and kitchen towel then I think the bounty paper towel will absorb more water. The researcher had five different cloths and paper towels and poured a cup of water on a glass plate after weighing the paper towel or cloth. Then laid the paper towel or cloth on the plate for 45 seconds then used a grams scale. After the researcher subtracted the second weight by the first. Bounty paper towels had an average of 20.8 grams than a washcloth with an average of 17.1 grams. Then Sparkle had an average of 16.6 and the school paper towels had 16.1 grams. Then the least absorb was a kitchen towel that had 6.6. Now the researcher knows that kitchen towels are not that absorbent and if there is another mess with liquids they should use Bounty paper towels.

Category 4 –Engineering: Electrical/Mechanical

J-14

Identifying if a Drone Can Deliver Cubes to Cattle

Beau Bonifas

Silver Lake High School, Kim Bonifas

This project will be identifying if a drone can deliver cubes to cattle. Many farmers choose to cube their cattle as a way to deliver nutrients, keep them 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 delivery mechanisms are widely recognized around the world. 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 it in less than twenty minutes. The final objective for this project is to build a successful payload release device that will be able to utilize a drone to remotely deliver cubes to cattle in a corn field or in a pasture. The end product will need to be stable, capable of carrying the required amount of weight, and able to fly in a variety of conditions. Updates to the constructed model will be made after each test flight until an end solution is attained. It was quickly determined that the DJI Mini 2 was not going to work for this project because it could not pick up a little Walmart box. While this was a little disappointing, the DJI Phantom 4 would definitely be able to pick up the box because it is a much bigger drone. After a countless number of test flights and many different adjustments to the box, the box was finally built correctly for flight and a release of cattle cubes. The only problem in my way with this project was the amount of time the construction and design process took. Another problem was finding suitable weather conditions to fly the drone and do test drops. When it is too windy the drone is unable to fly.

Category 5 –Engineering: Materials/Bioengineering

J-15

Determining the Best Way To Keep An Ice Cube From Melting

Cooper Wengler

Silver Lake High School, Kim Bonifas

This project is going to tell the best way to keep an ice cube from melting. One way is to wrap it in aluminum foil. Another method is to use a soft cooler. A third method tested was to use a hard cooler. The hypothesis is that the hard cooler will keep ice frozen the longest. Ice was placed in each type of container and the amount melted was recorded every hour until it was all melted. The results showed that the aluminum foil was the best method to keep ice from melting.

J-16

Researching Which Paper Towel Brand Has the Best Absorbency

Lanham Skrdlant

Silver Lake High School, Kim Bonifas

The purpose of this research project is to find the best type of paper towel by finding the most drops of water that each of the paper towels can hold. Paper towels can be used for various purposes therefore this project will help you figure out which paper towel brand performs the best when it comes to holding liquids. Using the data gathered from other research projects on the internet the paper towel brand Bounty should perform the best out of all of the paper towel brands that will be tested in this project. There will be water dropped on each of the paper towels and the paper towel that holds the most water will be the winner and the paper towel that holds the least amount of water will be the loser. The results are that the winner was bounty and the loser was Essential prints. This project has shown which paper towels to buy for the most absorbency.

Category 6 –Medicine and Health Sciences

J-17

Mask Mandate

Rylyn Moody

Sandhills Public School, Zeta Greene

One of my main things is making sure people are happy. I want to make sure that they aren't sick, sad, or feeling yucky. In order to keep people safe, I thought I could figure out what type of mask would keep individuals safe from each other's cough. My thoughts were that I could keep people safe. So in my testing, I tried to figure out what mask would create the most bacteria, and the least bacteria. My hypothesis was that the N95 mask would produce the least amount of bacteria. While the foam mask, or the shield mask, will produce the most amount of bacteria. In the end, I was expecting all the samples to have at least a little bacteria on them. But that is not how this project turned out. More than half of my samples had nothing showing on them. The only samples that had bacteria growing on them were the ST masks, and the controls. That might show that the other masks are safe to wear. But I still would be cautious.

J-18

Evaluating the accuracy of Calories Burned During a Treadmill Workout

Austin Greenough and Brody Knehans

Silver Lake High School, Kim Bonifas

Many people run or walk on treadmills. They use the calories burned on the treadmill to rate their workout. This project will determine if the calories burned that a treadmill screen shows are accurate. The hypothesis is that the treadmills say more calories are being burned than actually are. Test subjects will jog on a treadmill for five minutes. The treadmill screen calories will be compared to actual calories burned. The results were that the treadmill only calculates calories correctly for people in a specific weight range. People who weigh less or more do not get an accurate treadmill report of calories burned after a workout.

J-19

Does Age Affect Reaction Time?

Logan Duester and Brooke Talarico

Silver Lake High School, Kim Bonifas

As people get older your reflexes slowly get slower and thus people can't do as much as they could do as when you were younger. The measurements that will be taken are dropping a ruler or meter stick and seeing where test subjects catch it. The hypothesis is that older people will have a slower reaction time and catch the ruler later than younger people. The hypothesis was correct, and older test subject caught the ruler slower than younger test subjects.

Category 7 –Microbiology

J-20

The Effectiveness of Antimicrobial Surface Protectors in a School Setting

Amelia Buhlke

Central City Public Schools, Anna Detlefsen

The purpose of my project is to determine the effectiveness of antimicrobial surface protectors in a school setting. Many organizations including the local hospital in my hometown use antimicrobial surface protectors to reduce the spread of illness. Hospitals believe that patients and paterons are more protected when touching these surfaces. I decided to test NeverGerms antimicrobial surface protectors in a school setting to determine their effectiveness. My hypothesis was that NeverGerms antimicrobial surface protectors would be effective in controlling the bacteria on highly touched surfaces in a school setting. NeverGerms sheet protectors were applied to highly touched surfaces in the school for 10 days. The NeverGerms sheets were then swabbed, plated, and incubated for 24 hours on petri dishes. Then colony counts were made. This same process was completed for the control group on the same highly touched surfaces. The results showed that the NeverGerms antimicrobial surface protectors were not effective in controlling the amount of bacteria on highly touched surfaces in a school setting compared to the control group. Statistical Analysis was completed using a one-way ANOVA test with an alpha value of 0.05. Significant results were found on three of the five locations. Overall, my hypothesis that the NeverGerms antimicrobial surface protectors would be effective in controlling the amount of bacteria on highly touched surfaces in a school setting was not supported. Future projects would involve testing antimicrobial sheets on other surfaces.

Category 8 –Physics and Astronomy

J-21

The Effect of the Number of Dimples on a Golf Ball and Degree of Club on Hitting Distance and Shot Precision

Karter Negus

Central City Public Schools, Anna Detlefsen

I chose this project because I really like to golf and have always wondered if the number of dimples on the ball could affect how far I hit. I predicted the Titleist-ProV1 would generally be hit the farthest distance with its moderate number of dimples (352 dimples), and that the Pitching Wedge would lead to the most precise results because of the distance it hits. To test this I went to the driving range at Valley View Country Club and hit one of each ball with a driver in a random order twice. I then used a rangefinder to measure the distance of all trials. Lastly, I repeated all steps with a 6-Iron and Pitching Wedge. The NXT-Tour ball (302 dimples) traveled farthest at 286m with the driver; the NXT-Tour also traveled farthest with the 6-iron (192m). By a small margin the DT-TruSoft (376 dimples) traveled farthest with the pitching wedge (144.25m). A single-factor ANOVA was conducted on my results and showed the dimples on the balls did make a difference when hit with the Driver ($p=0.039$) but not with the other clubs. I concluded the dimples on a golf ball did affect hitting distance with a Driver, but not with a 6-Iron or Pitching Wedge. Also, the degree of the club does affect precision. The Driver had the smallest difference in the distances traveled by balls of any number of dimples. Next, I could test if ball cost or brand has any effect on hitting distance.

J-22

Tracking the Sky

Caleb Furrow

Sandhills Public School, Zeta Greene

Celestial bodies intrigue me very much and I have always been interested in the nighttime sky. February was a great month to seek out stars and planets with my telescope so This was a great time to do this project. There were so many planets that you could see, even with the naked eye, and so many stars and constellations that cover the nighttime sky. I wanted to see the difference in how stars and planets move in a day. I thought that if I took pictures in the same spot every night I could measure and track how much the celestial bodies move per day. To investigate my project I used a couple of books from the school library and a few websites online. I think that this project was important because It let me understand how distance can change how we see things and how they move and also it let me understand the difference between stars and planets. I used to look at the sky and see a bunch of stars but now I can look into the sky and tell the difference just by looking at them.

J-23

Rusty Nails

Colton Leach

Sandhills Public School, Zeta Greene

Do you ever wounderd what nail would be the most affected to making salt boxes for cows. The data that I have collected and learned from my science fair project is that it has surprised me a lot. My science fair project is what nail will rust in what substance. My substance is apple juice, soda, salt water, and my constant is water. I am measuring the nails in mass. The masses surprised me some days. My hypothesis was I thought the salt water would rust the most but I was wrong. Water's my Constance produces the most rust no the nail. I was all wrong about my hypothesis. My reaction was very different than expected. This project was fun and exciting.

J-24

Will Different Shoes Effect Your Performance on an Inclined Sprint

Connor Sutton

Sandhills Public School, Zeta Greene

The 2021 Summer Olympics were one heck of a year for elite sprinters, this fascinated me and decided to run a test of my own. In my hypothesis, I stated that a lighter shoe will result in a faster time than the heavier shoe. I measured the feet of elevation to get an accurate time on the Dashr app. The tester took heart rate before and after each trial at resting heart rate before testing each shoe for 5 tests. The tester used a rug on the gym floor for spikes so it would not scratch the floor, the tester waited 2 minutes total before running the next test with the next heaviest shoe. In my experiment, I found that spikes were the most efficient shoe in my experiment however, the running shoes and boots were within .23 and 1.12 seconds respectively slower than the spikes. In the experiment I found that the lighter shoe was the most efficient shoe for the experiment. If I could test my hypothesis again, I would test would the traction of the shoe determine the top speed and grip of the shoe.

J-25

Staying Hydrated at Rodeos

Shaylee Milleson

Sandhills Public School, Zeta Greene

The researcher's purpose for the science fair project is that people can have cool drinks when they are at a rodeo and when it is really hot out. When people are anywhere during the summer they want to stay hydrated. So the thought was that if the researcher figured out which drink would stay cold then people would not get dehydrated. The researcher started the project by getting different substances, then measuring the same amount of each substance into different cups. After that the researcher then froze them all for twenty-four hours. After the twenty-four hours the researcher took them out of the freezer and let them sit on the counter for forty-five minutes. After the forty-five minutes the researcher then used a syringe to measure all the liquid that had melted. The researcher wrote down the data and learned that Sparkling water stays frozen compared to the other drink.

J-26

Fire and Fabric

Cora Martindale

Sandhills Public School, Zeta Greene

Is it safe to put your baby in fabrics that ignite easily? I set out to determine that very question. I had 6 different fabrics nylon, cotton, flannel, wool, polyester, and linen. After I did some research, I guessed that the fabric that resisted fire would be the most acceptable, nylon, and the least acceptable would be polyester. Then, I put on my safety goggles and apron took 10 different strands of each fabric and slowly exposed them to the fire then took a look at the ashes. Three of the fabrics had ashes that were like plastic: nylon, wool, and polyester. Three of the fabrics had ashes that were soft and powdery: cotton, flannel, and linen. The powdery ash would not stick to the skin, unlike plastic. Therefore fabrics that have soft powdery ashes are safer for babies' onesies and pajamas.

Category 9 –Plant Sciences

J-27

The Effect of Distance from WiFi Access Point on Plant Germination

Trent Detlefsen

Central City Public Schools, Anna Detlefsen

WiFi is a wireless signal that connects electronic devices to the Internet, sending data through electromagnetic fields. WiFi signals are everywhere and continue to increase in usage. Over many years, scientists have investigated the link between WiFi and human health. I wanted to know if WiFi had an effect on plant germination rate. I thought radishes at 4m from a WiFi access point would have the highest germination rate and spinach at 0.35m would have the lowest germination rate. I placed 2.5cm of soil in each of six plastic tubs and planted rows of ten seeds each of radishes, spinach, and onion at their recommended depths. Two tubs were placed 0.35m, 2m, and 4m from an access point. After the recommended germination time, I counted the total number of seeds germinated. On average there was a one seed difference in germination rate between the plants closest and farthest from the access point. Radishes had no difference in germination closest and farthest from the access point. While spinach at 0.35m had the lowest germination rate, I decided to reject this hypothesis because it was the lowest by only 0.5 seeds. A two-factor ANOVA was completed on my results; distance from the WiFi access point did not have a statistically significant effect on the germination rate of the plants ($p=0.298$) nor did the type of seed ($p=0.686$). This tells me these results are highly unlikely to be caused by distance from WiFi signals.

J-28

Germination with Wacky Liquids

Ella Held

Sandhills Public School, Zeta Greene

Do different liquids affect the way dicots and monocots germinate and the difference between them? That's what I asked myself before I started my project and now I know the answer. The project the researcher did was about different liquids and the ways they affected the way dicot and monocot seeds germinated. The hypothesis was if the researcher used dish soap, orange juice, bleach, and water when soaking corn and bean seeds to help with germination. The first thing the researcher did was soak the seeds and then the researcher wrapped them in paper towels. After that, the researcher put the damp paper towels and the seeds in a dark space and took notes on their progress twice a day. The researcher thought that the orange juice and dish soap would help a lot but those were the least germinating seeds and the researcher thought the bleach would destroy the seeds but it was one of the highest germinating seeds including the water-soaked seeds. Along the way the seeds that soaked in orange juice started molding and got fuzzy, which is what the researcher assumes is because of the orange juice and the preservatives wearing off. The researcher also noticed that the 2 sets were very different and had way different results.

Senior Division Entries

Category 1 –Animal Sciences

S-1

The Effect of Ozempic on the Longevity and INDY Gene Expression of Drosophila Melanogaster

Addie Buhlke

Central City Public Schools, Chelle Gillan

Because anti-aging treatments are becoming more and more popular in our society, it is important that medications are tested for their longevity increasing properties. This study was conducted to see how Ozempic, a semaglutide, would affect the lifespan of Drosophila melanogaster. It was predicted that the higher the dosage of Ozempic, the longer flies would live, because Ozempic effects the AMPK pathway, which controls regulation of cellular homeostasis, metabolism, resistance to stress, cell survival and growth, cell death, and autophagy, which are all critical determinants of aging and lifespan. There were 16 vials, each with 15 Drosophila melanogaster in a controlled temperature of 75 °F. Groups of 4 vials, each, had a different dosage of the Ozempic slurry on their surfaces (0, 0.001, 0.01, 0.1 mg). Food and new Ozempic Slurry was administered every three days. During this time, the dead Drosophila were collected and frozen for RNA analysis of the INDY gene. The INDY gene is the gene that is manipulated when longevity is genetically modified within an organism. The data was used to construct the mortality curve of the specimens. The entire procedure was replicated two more times for accuracy. It was found that the lower Ozempic doses (0.01 and 0.1 mg), when compared to the control data, showed a statistically significant decrease in the longevity of Drosophila melanogaster ($P<0.05$). These results rejected the hypothesis that Ozempic would increase the longevity of Drosophila melanogaster. INDY gene expression analysis is in progress.

S-2

The Effect of Medicinal Mushroom Supplement on the Heart Rate of Daphnia Magna

Crystal Erickson

Central City Public Schools, Chelle Gillan

Because of the rise in use of supplements in our society, this study was conducted to see if a medicinal mushroom supplement would affect the heart rate of Daphnia magna. It was predicted that the Daphnia that were in a higher concentration of the medicinal mushroom supplement would have a higher heart rate than those in a lower concentration. Three beakers were filled with 300mL, 400mL, 500mL of spring water and each mixed with .25 grams of medicinal mushroom supplement. One Daphnia was placed in a petri dish with each of the different concentrations of medical mushroom for 30 minutes. After the 30 minutes of being in the solutions of different concentrations of medicinal mushrooms, heart rates of the Daphnia magna were taken. To count their heart rate, a microscope slide with one Daphnia was placed under a microscope that was connected to a promethean board. A phone was then used to record their heart rate by using slow motion. It was found that the heart rate of Daphnia that were in a high concentration was lower than those found in lower concentrations. This means that the medicinal mushroom negatively impacted Daphnia's heart rate. The null hypothesis that medicinal mushroom supplement will have no effect on the heart rate of Daphnia magna was not rejected because an Anova test resulted in a P value of 0.226 ($a=0.05$). If I were to do this experiment again, I would let the Daphnia soak for more than 30 minutes in the different concentrations.

S-3

The Effect of Caffeine Exposure On Heart Rate of Daphnia Magna

Molly Blanchard

Central City Public School, Chelle Gillan

This research was conducted to see if caffeine had an effect on heart rate. Daphnia magna were chosen because they have hearts similar to humans. It was hypothesized that the introduction of caffeine to the Daphnia magna and subsequent removal of caffeine from the Daphnia magna would have an effect on heart rate. Fifteen daphnia were used in the study, five being the control and ten being the ones with caffeine. The heart rate was recorded before the experiment, one hour in, and two hours in. At the one-hour mark, five of the ten daphnia that were originally placed in caffeine were placed in a new mixture with no caffeine to represent withdrawal conditions. The daphnia that had caffeine for one hour had an increased heart rate while the daphnia that was in caffeine for two hours had a decreased heart rate. This may be due to the fact that most of the daphnia in the two-hour exposure group were dying. The caffeine raises the heart rate of the daphnia by stimulating the heart causing the heart rate to increase. It does this by influencing the neurotransmitter that creates the action potential that causes the heart to beat. These findings help support my hypothesis that caffeine would have an effect. There were considerable deaths in both the control and the two-hour exposure group. If I were to continue this experiment, I would like to test nicotine. Another possible test would see the amount of caffeine in which daphnia can survive.

S-4

Does Moosic Effect Rate of Gain in Cattle?

Claire Stauth and Paola Vergara

O'Neill Jr./Sr. High School, Nic Simonson

The goal of our project was to find out if cattle gained more weight when listening to certain genres of moosic. The three genres of music that we chose were country, classical, and rap music. The way we went about doing our experiment was by playing 30 minutes of music while they ate. We first separated two heifers and two steers and put them in a spacious pen. In order to make sure that our results were accurate we had to get a control so we could compare it to our other results. We decided to do our trials in two week periods to allow for good results in the amount of time we had. So we did four trials over an eight week period. We would play the music from the speakers of a car while the cattle ate their food. We gave them the same amount of food for each trial. Once we had our control we could compare our results with the other trials. The way we measured our results was simply by weighing them at the end of each two week period. The results showed us that the cattle overall gained more weight listening to country music than any other genre of music.

Category 5 –Behavioral & Social Sciences

S-5

The Effect Of Quarantine On People's Habits

Kaeden Poore and Kinnick Pumroy

Adams Central Jr./Sr. High School, Zac Foster

In this experiment we are testing the effect of the Covid-19 quarantines on different habits people dropped and picked up, and to see if they could have been affected after being introverted or extroverted. Our hypothesis was that there would have been more habits picked up then dropped and more people would have been turned over to an introvert after.. For the experiment we made and sent out a google form via email and other social media apps. The Google form included questions about age, gender, habits before quarantine, habits during quarantine, and habits after quarantine. The habits we chose consisted of different sports, weight lifting, gardening, gaming, and many more. In the other categories such as the age groups, we chose ages ranging from 14 years old all the way to 84+. We have been gathering all of our data putting it into tables and graphs, seeing how age and gender could have had effects on the habits of people and how much the quarantine affected the specific group. We chose to do this experiment because on a personal level we could see how much the quarantine had affected us in ways that we didn't think it would have affected others. In the end we found out that our hypothesis was correct about people turning more over to introverts but there were more habits dropped during quarantine then not. The most drastic change we saw was the overeating habit; it went from 16 people to 37 people.

S-6

Determining If There Is A Teacher Shortage And The Reasons Behind It

Blake Monie

Silver Lake High School, Kim Bonifas

Teacher shortage is becoming a problem in today's society. With having a teacher shortage students may not have the education they need in order to succeed in life. Researchers have found that the Nebraska teacher shortage problem is turning into a crisis. One prediction for this project is that teachers are stressed out about Covid-19. Another prediction is that not all teachers have a provisional license or they lack an endorsement in the needed area. This project is going to be based on answers to surveys to be asked to schools around the area that are in a shortage of teachers. The results found that the number of teaching positions left vacant is gradually increasing for a variety of reasons. From just 12 unfilled teaching jobs across Nebraska in the 2013-2014 school year, the number rose to 62 in 2018-2019. Covid-19 is expected to expand the problem in the future.

S-7

Which Music is Better to Listen to When Studying

Katelyn Strampher

Silver Lake High School, Kim Bonifas

This project is meant to show the differences in music and how they can affect someone studying. This project will not only show how people listen to music, but it might help people see that listening can where some people had an effect if they can remember what they just read so they remember it better. This project will help people in many different ways because of the effect it will have on people who love music and want to listen to it all the time.

S-8

Determining the Correlation Between Students' Well Being and Sleeping Habits

Lana Swanson and Taylor Hanson

Silver Lake High School, Kim Bonifas

Students' well being is made up of several different factors, one of them being sleeping habits. Most people don't realize the significance of getting enough sleep. If students don't get the recommended sleep, they may struggle with academics, health, and mood. This project will show the significance of sleep in high school students. A google form will be sent to the students in the high school. It will help gather the information needed to find the results of the question. The hypothesis for this project is that students that don't get the recommended amount of sleep struggle academically and mentally. This is generally what other researchers have concluded from their research. After averaging the results from the google form, it was concluded that the students that received 8-10 hours of sleep had a better GPA, mental health, and were less drowsy. Overall the students that received more sleep had better grades, felt less tired, and better mental health. This shows that sleep affects high school students in many ways.

S-9

Effect of Screen Time on Grades

Madison Karr

Silver Lake High School, Kim Bonifas

This project will determine if there is a correlation between screen time and grades. Grades in English, Science, and Math will be averaged and compared to screen time at school and home. The hypothesis for this project is that people who spend more than more time on their phones will have a lower GPA and grades. The results of this project were that the people who spent more time on their phones, have lower grades as their screen time gets higher.

Category 6 –Biochemistry

S-10

Determining Which Microwavable Popcorn Has the Best Kernel Popping Percentage and has the Greatest Taste

Brayden Hemberger and Trey Vance

Silver Lake High School, Kim Bonifas

Our project is about the popped and unpopped kernels of certain brands and kinds of popcorn. We also tested the popularity of the taste of the popcorn. Popcorn is one of the most popular snacks in America. Christopher Columbus introduced popcorn to the Europeans. Popcorn was sold at carnivals in the 19th century. At average the kernel will pop at 347 degrees Fahrenheit. Popcorn is naturally high in fiber. Americans consume 17 billion quarts of popped popcorn each year. The Guinness world record recorded the largest ball of popcorn 12 feet in diameter and weighs over 500 pounds. The annual popcorn sale increases 2 to 8 percent. When popcorn pops it can pop 3 feet high. The testing that has been conducted shows that Best Choice Kettle Corn has the greatest popping percentage while Jolly Time mallow magic tastes the best.

S-11

Determining the Fat Content and Cost Efficiency of Varying Types of Beef

Samantha Bonifas

Silver Lake High School, Kim Bonifas

The average American eats about .6 pounds of meat per day, or 222 pounds per year, according to a 2018 Cove Creek Farm study. Purchasing meats can be done in multiple ways including farm to fork, homegrown, farmer's market, and grocery stores. At a typical grocery store, 93% lean/7% fat, 85%lean/15%fat, 80%lean/20% fat, and 73% lean/27% are among the most common meat to fat ratios available for purchase. The leaner the meat is, the more expensive it is. In this project, the fat to meat ratio of ground beef will be determined. The cost efficiency of meats will also be determined. It was found that as the fat percentage went up, cooking losses went up as well.To find an answer to which type of beef is best, there will be multiple types of beef evaluated in this project. The results from this project will benefit consumers to know the best source for purchasing meat and the most cost efficient choice. It is predicted that as the fat values increase, the amount of cooked hamburger will gradually decrease and losses such as fat and water will increase. It will be more cost effective to purchase meats with a lower fat percentage. The results of the project did not match the hypothesis. It was concluded that losses increased as fat value increased, but cost efficiency did not match the hypothesis. Grass fed beef was the most expensive and had the most cooking losses.

Category 7 –Cell and Molecular Biology

S-12

Impact of Prednisone on the Body Length, InR, and ILP2 Expression in Drosophila Melanogaster

Jenna Cecrle

Adams Central Jr./Sr. High School, Jay Cecrle

Due to asthma, I had been prescribed prednisone many times during my 6th-grade year. During my 7th grade physical, my physician noticed my growth had decreased from the 50th percentile to the 25th percentile. My doctor suggested the decrease in my growth rate may have been because of prednisone. To study this phenomenon, the fruit fly (Drosophila melanogaster) was used as an animal model. I have discovered that as the prednisone dose increases, body length significantly decreases. In humans, insulin-like growth factor (IGF-1), a hormone produced by the liver, can be affected by prednisone causing bone growth to decrease. Using the National Center for Biotechnology Information (NCBI) website, I found two genes in fruit flies, ILP2 and InR, that appeared to be related to IGF-1 in humans. I worked with a researcher at the Nebraska Center for Biotechnology (University of Nebraska Lincoln) to carry out quantitative real-time polymerase chain reaction (qPCR) to quantify changes in their expression in response to prednisone treatment. RNAs were extracted from Drosophila larva exposed to a minimum dose of prednisone known to cause a significant decrease in body length. On the scheduled day of the RNA extraction, there were insufficient larvae in one control and two experimental Drosophila vials. RNA from pupae was extracted in these three vials. Serendipitously, the qPCR results revealed that ILP2 in the pupae had a 28.1 fold decrease in mRNA quantity while in larvae there was a 1.2 fold decrease. InR in the pupae had a 3.3 fold decrease in mRNA quantity, while InR in the larvae had a 0.5 fold decrease. These results were surprising as it was expected the larvae would be most impacted by prednisone as they were ingesting food with prednisone. Based on these qPCR data, prednisone may be reducing body length by decreasing the expression of ILP2 and, to a lesser degree, InR. More research is needed to determine how this is occurring and if more than the ILP2 gene is being affected.

S-13

The Ability of the Tardigrade Damage Suppressor Protein to Ameliorate DNA Double Strand Breaks

Lauree Pickinpaugh

Central City Public Schools, Chelle Gillan

The purpose of this experiment was to see if the damage suppressor protein (Dsup) found in tardigrades can help repair DNA double strand breaks (DSB) in human cells when subjected to ionizing radiation. I chose to conduct this experiment because past studies have shown that Dsup could possibly help cure diseases, slow aging, and treat cancer patients. It was predicted that primers could be created that would allow the Dsup gene to be inserted into human cells and that the cells would recognize the gene and produce the protein. It was also predicted that the human cells with Dsup would have less DNA DSB than cells without Dsup when subjected to ionizing radiation. I generated a custom plasmid containing the Dsup protein and an enhanced green fluorescent protein (EGFP) that was successfully inserted into human cells. Through fluorescence microscopy, these cells were shown to contain Dsup protein. In the next phase of the study I will subject cells with and without Dsup to ionizing radiation in order to induce DNA damage. I will then stain the cells using a marker that detects DNA DSB. Using fluorescence microscopy, I will count the number of DSB in the cells. After 24 hours I will stain the cells again with the DNA DSB marker. Using fluorescence microscopy, I will check to see how many DNA DSB are left in the cells with and without Dsup in order to determine if the cells with Dsup were able to more efficiently repair their DNA.

Category 8 –Chemistry

S-14

An Analysis of the Effects of Different pH on the Enzyme Invertase

Vittoria Restelli

Central City Public Schools, Chelle Gillan

Each year 62 million Americans are diagnosed with a digestive disorder. To get better, people need to buy products to digest better, but the cost can end up being very high. This is why I performed my experiment: try to find alternative solutions to those digestive problems, starting with little adjustments to the alimentation, avoiding acidic foods or drinking water with a higher pH. For this experiment I created sucrose solutions, mixing tap water and sugar, and then I changed their pH by adding different amounts of ammonia and vinegar. Then I added the same amount of invertase solution in all of them. The day after I set up the solutions, with some test strips, I measured how much glucose had been produced in each of the 5 solutions. The solution that ended up producing more glucose was the pH 9 solution; there was an increasing trend in the amount of glucose produced from low to high pH up to pH 9, at which point the amount of glucose produced started decreasing. Knowing that the sucrose digestion takes place in the intestine, where the pH varies between a pH 5 and a pH 7, and the enzyme activity is the highest at a pH 9, we should try to increase the pH value in our intestine. We can do that by taking in some basic substances, like baking soda or water with higher pH.

S-15

The Effect of Different Soil Types From Merrick County Nebraska on Corrosion of Copper Wires

Brice Gavert

Central City Public Schools, Chelle Gillan

This study was conducted due to my fascination with electrical systems. My goal was to find which of the three main soil types in Merrick County cause the most corrosion to a powered electrical wire. I hypothesized that loam soil would cause the most corrosion because it is made up of a combination of other soil types, and heterogeneity in soil has been shown to increase corrosion. This type of research is important because irrigation units are often in the middle of fields, necessitating underground wiring, but underground wires are subject to corrosion. I collected three different soil types and set up plastic containers, five for each soil type: sand, clay, and loam. I cut 15 cm lengths of 6 AWG bare copper wire, determined mass, and inserted one wire into each soil sample and containers with no soil as a control. I connected each container to 11 volts of electricity. Water was sprayed in the soil to represent moisture in the natural environment. After one week I weighed the wires again. The Anova test showed that there was significantly more corrosion in both the loam and clay compared to the control, with P Values of $<0.001(a=0.05)$. Also, loam and clay showed significantly more corrosion than sandy soil, with P Values of less than 0.02. The differences in corrosion levels may have been caused by the higher number of places where separate soil types meet because loam soil is composed of many different soil types.

S-16

The Differences in Dissolving Rates of Advil And Equate Ibuprofen

Rose Zelinski

Central City Public Schools, Chelle Gillan

The purpose of this experiment was to find out which type of ibuprofen pill would dissolve the fastest because we use Ibuprofen for many different types of pain relief. Finding out the dissolve rates for different types of ibuprofen would help us to know which type to purchase to give us the fastest pain relief. My hypothesis was the type of pill will affect how fast the medicine dissolves. For my procedure I poured 50 mL of water into a 250 mL beaker. I then put a 250 mg Advil into the beaker. I poked the pill gently with tweezers every five minutes and I recorded how long it took for the pill to dissolve. I repeated this two more times with Advil and then three times with generic ibuprofen. Although the data showed a slight difference between dissolving rates of Advil and Equate ibuprofen, my hypothesis was not supported because a statistical test did not show a difference in the dissolving rates of the two types of pills. The mean for the Advil was 23:44 mins and the mean for Equate was 22:14 mins. If I were to test this again, I would change the type of solution the pills were dissolving in to more closely represent the contents of the human stomach. It was, however, very interesting just watching the pills dissolve in the water. This type of research is important because many people take over the counter and prescription drugs each day.

S-17

Belousov-Zhabotinsky Reaction

Jordan Whitlock

Hastings St. Cecilia, Madalyn Younger

Belousov-Zhabotinsky Reaction (BZR) demonstrates non-equilibrium thermodynamics. The BZR process is as follows: cerium(IV) ions are first reduced to cerium(III) ions before finally being oxidized to cerium(IV). The reactions of non-equilibrium thermodynamics are still being traversed; thus, the Belousov-Zhabotinsky Reaction is a classic representation of non-equilibrium thermodynamics. This project demonstrates multiple aspects in the subject of Chemistry: calculating concentration of mixture using molarity, understanding thermodynamics, and exhibiting a relatively unexplored field of non-equilibrium thermodynamics. This experiment focuses on repeating the BZR while implementing safe laboratory procedures with a strong oxidizer potassium bromate, 6.0 M sulfuric acid, melonic acid, 1,10-phenanthroline monohydrate and iron(II) sulfate Three solutions are made: concentrated A, B, and C. I mixed 67mL water, +2mL conc. Sulfuric acid +5.55g potassium bromate for solution A. For solution B, I dissolved 1 g of malonic acid in 10mL of water For solution C, I dissolved 1 g of sodium bromide in 10mL of water. I mixed 6mL of A, 1 mL of B, and 0.5 mL of C in an Erlenmeyer flask. The solution will turn reddish-brown, the color of bromine. After agitating the solution, the bromine color will disappear, leaving a clear liquid. Next, there is an addition of 1mL of 25mM phenanthroline ferrous sulfate until the Petri dish is fully covered. The resulting mixture produces an oscillating chemical reaction where blue rings form and spread outward through the solution. Rings are formed when disturbances occur, e.g., the presence of gas bubbles or dust particles entering the solution.

Category 9 –Engineering: Electrical/Mechanical

S-18

How Does the Number of Airplane Propeller Blades Effect the Airplanes Overall Efficiency?

Serese Janssen

Adams Central Jr./Sr. High School, Jay Cecrle

This project is about experimenting with propeller design to find the most efficient airplane propeller by changing the number of blades in an attempt to improve an airplane's efficiency overall as a result. This project is important for the future of propeller based aircraft, and for the world of small 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 number of blades attached. I predicted that a three blade propeller would be the most efficient. I predicted this because two blade propellers have been providing reliability throughout time, and four blades have been proven to gain faster speed and more airpower, and with the balance of the two and the four blades, the three blade was the perfect mediator. I designed four different propeller blades using SolidWorks then used a FlashForge Adventurer 3, 3-D printer to create the blades. I then sanded down the propeller to achieve a smooth surface. The propeller was then mounted to a 1.5 volt DC motor which was mounted to the glider and tested on a Vernier Air Trac. A set of digital timers was used to measure the velocity of the cart. The three-blade propeller had the highest velocity. More propeller need to be designed and tested, but for this experiment the three-blade propeller gave the best results.

S-19

Can You Collect Energy By Putting Propellers in Your Pipes?

Abram Johnson and Jayden Teichmeier

Adams Central Jr./Sr. High School, Jay Cecrle

When running our tests we found out that there was more energy created by an impeller that was made by us than one that was made commercially. This shows that the impellers that were made by us can be more efficient and generate more power than the impeller that is commercially sold. So this shows that there is an efficient way to make electricity while also not using up valuable resources. This gives us hope that if this project was used on a larger scale then the energy crisis around the world could be solved with the help of this experiment.

S-20

Is it Possible to Build a Functioning Solar Panel Out of Recycled Solar Cells?

Dylan Janzen and Nick Conant

Adams Central Jr./Sr. High School, Jay Cecrle

Solar Energy is the most abundant energy source in the universe. Using energy from the sun affectively will be the future of energy. Recycling broken solar panels can save a lot of money when it comes to the expensive production of solar panels. The project is interesting because the world will be complete clean energy in the near future. Our goal was to make a solar panel out of scrap cells that could function to a comparable efficiency of a regular panel. The best way to learn about solar panels was to watch videos of the production. Multiple videos provided solid understanding on how to construct solar panels. To start, solar scraps were acquired from broken solar panels. The best way to conduct electricity is soldering tabbing wire. It is soldered to the panels and is used to conduct electricity throughout the panel. This is a long and repetitive process. Once the solderings were finished, we used electrical tape to connect the tabbing wire on the positive and negative poles using tabbing wire. We connected it to a plexiglass surface and attached a multimeter. Our goal was achieved when the solar panel produced voltage. Many tests were run and the maximum voltage reached 3 volts. An all-day test was done, where we got numbers for morning (2.22), noon(2.56), and afternoon(2.88). The efficiency of our solar panel was just under 7%, which is comparable to the new panels (15%). Our main goal was to make a solar panel function and we succeeded with that. We were able to do this with minimal knowledge in the back of a classroom. With the right engineers and materials, this could be improved and utilized in the future.

S-21

How Do Different Levels of Voltage Affect the Electromagnetic Propulsion of a Railgun?

A.J. Sommer

Silver Lake High School, Kim Bonifas

Technology is moving forward at an increasingly exponential rate, and many new technologies are being developed. One example of this is the railgun. Railguns are an experimental device that can be used as a form of propulsion. The question for this project is how does different levels of voltage affect the electromagnetic propulsion of a railgun. It is predicted that the more voltage that is applied to the railgun, the faster the rod will go. The project includes 2 strips of aluminum tape, a metal rod, magnets, a transformer, and wires that connect to everything except the metal rod. For the project the transformer was set to the wanted voltage and the metal rod was placed on the electrified tape. Because of the Lorentz Force, the projectile would speed up based on the amount of voltage applied. The hypothesis was correct, and the 6 volt test was the worst with the 7.5 volt test in 3rd place, the 9 volt test in 2nd place, and the 12 volt test was the best.

S-22

The Effects of Weight on Drone Battery Life

Jeremy Sharp

Silver Lake High School, Kim Bonifas

Drones have positively impacted society greatly in the last 20 years. It has improved many things from farming to photography to surveillance. They use this technology with the cameras to look wirelessly above the eye level to see what it looks like from above. The question is: How does weight affect drone battery life? 25 g of weight had little effect on the drones whereas 100g could not even be flown by the Mavic Mini. Overall the drone with the best flight times was the Dji Mavic Mini.

Category 10 –Environmental Management

S-23

Will the Area Runoff Kill my Guppy?

Emily Chavez

Sandhills Public Schools, Zeta Greene

Are our farming operations and hog production confinement truly causing contaminations in our surface water? For a mile stretch in the area that was tested, there is lots of farmland. This could lead to possible runoff into the water. The pig farm is also a big part of the area so it was in question that it might change the conditions of the water. In this project, the levels of dissolved oxygen, nitrate, phosphate, and pH were tested from different areas along the river. The researcher chose this topic because concern began to rise. Living near a hog farm, many fertilized farm areas, and a river that plays a big part in where the researcher is located. Living so close to all these things, do they affect one another? What if the ammonia from the fertilized land or the ammonia laid down at the hog farm affect our river water? If it did happen to run off into the river, should ranchers or townspeople be concerned? If the water is contaminated with runoff it would affect the animals that benefit from the river water. So this project was to see if it harms us humans, the area, and other organisms that survive off the river.

Category 11 –Environmental Sciences

S-24

How does different Water Affect Living Organisms?

Bennet Wrightsman and Lucas Gabriel

Adams Central Jr./Sr. High School, Jay Cecrle

Water is important to the health of every living organism on this planet. There is water out there that is known to have negative impacts on life. This experiment was designed to see which type of water at our school has the best impact on living organisms. It was hypothesized that the purified water would be more beneficial than bottled water and fountain water from the school. The 3 different waters were first tested to show the differences between each of them. The tests done were the following: nitrate, bacteria, pH levels and phosphate. Next, 3 water Daphnia magna were placed in each type of water and then given food. All Daphnia magna died except for the ones in the bottled water. The results showed there was a a direct relationship with which water is more beneficial. The p-value was 0.040369 and an f-value of 4.458839 showing that our data was significant. It also shows that the biggest difference was between the control group and the fountain water. These results suggested that bottled water was shown as more beneficial to living organisms and allowed them to outlive the other Daphnia magna by many days.

S-25

Can We Control Phytoplankton to Combat Excessive CO2 Emissions

Chase Harper and Ryan Stritt

Adams Central Jr./Sr. High School, Jay Cecrle

We discovered the issue of declining phytoplankton which will lead to the demise of our planet. The purpose of our experiment was to determine whether the abundance of nutrients will affect the amount that phytoplankton will grow over a period of time. We set apart two weeks, one week for each trial, to test what amount of nutrients is best for phytoplankton to feed/grow in. After each trial we concluded that around 5 ml of F2 works the best for growing phytoplankton in one quart jars. From national geographic society, phytoplankton accounts for about half of the world's photosynthesis making them the world's leading oxygen producer. With our findings, we can multiply our results to get the right mixture for a big enough pool to help clean the air of excessive amounts of carbon dioxide leading to a more healthy planet. Our standard deviation was 1.35.

S-26

Remapping the Sandhills

Courtney Swisher and Rebecca Smith

Sandhills Public Schools, Zeta Greene

The purpose of this project is to conclude whether enough data could be collected to prove if the Sandhills will need to be remapped over time. To begin the project, we will observe and compare the time it takes to complete the formation of dunes from two separate creeks. It was hypothesized that if I measure the distance that creeks move sand particles to form dunes then the Sandhills will need to be remapped over time. Five trials were conducted in both fast and slow-moving velocities in the creeks. The trials were based on how long it took for a dune to cover 2 centimeters of a golf tee. The tees were placed in front of the dunes and we recorded the time it took for the tee to become submerged. Then we used a shovel to redirect the water flow and increase the velocity speed. After we collected that data, we then determined the velocity of the water in both creeks. The results of these experiments concluded that, on average, the times recorded for the slow and fast-moving dune formations between Sarben and Goose Creek are similar. This relates to how flowing creek water moves sand particles at a similar rate of speed over time. Therefore, the Sandhills will have enough sand particles moving over time to cause a need for a new map of the terrain to be constructed. The hypothesis was proven correct because of the similar data collected from the two creeks in the Sandhills.

S-27

Evaluating Which Type of Grocery Bag Can Sustain the Most Weight While Harming the Environment the Least

Josi Sharp

Silver Lake High School, Kim Bonifas

Plastic being decomposed into our environment is a growing concern. However, there are ways to reduce the amount of harmful substances from entering our environment. Eliminating the use of plastic grocery bags would benefit the environment greatly. The research project studied which type of grocery bag was the most harmful and tested the weight different types of bags could hold before breaking. To test the amount of weight a plastic bag, a paper bag, and a cloth bag could hold, weight was added to the bags until they broke. After studying which type of bag was the most harmful, it was concluded that plastic and paper bags were the most hurtful to the environment. Cloth reusable bags are said to be okay for the environment and decompose more quickly than the other two. As for weight, the cloth reusable bag sustained the most weight before breaking. In conclusion, the best type of grocery bag to use is cloth reusable bags.

Category 12 –Medicine and Health Sciences

S-28

The Effect of Sugar Free Drinks on Dental Enamel

Lauren Thompson and Kennedy Montague

Adams Central Jr./Sr. High School, Zac Foster

The purpose of our project is to show people that the sugar free drinks that they are drinking are ruining their teeth. Dental enamel erodes at a pH of 5.5. Our hypothesis is that the sugar free drinks will be below the erosion point and cause eroding of enamel. Our process started when we calibrated a pH tester and tested nine bottled water samples. Out of our nine bottles, we took the most basic, acidic and neutral(distilled) water and took the commercially available fruit punch flavoring packet and put it in 16 oz samples of each. After measurements were taken of our new drink we discovered that the pH of all of these ranged from 3.1-3.3 on the pH scale. This is clearly lower than the 5.5 pH erosion point. After gathering the results of the added powdered flavored packet we decided to also try out Propel Water, we picked the ones that said Zero Sugar and then repeated the process we used with the added flavor packet. We then compared those results with the pH of Simply Orange Juice. The pH was a solid pH number above our artificial sugar drink, at 4.1. If all enamel is eroded then the dentin can be broken leading to cavities. The people that are unaware of the sugar they could be constantly consuming it is possible that they can get cavities way quicker and two many cavities can lead to needing dentures earlier in life. In conclusion, we realized that many sugar free drinks are eroding your enamel under the illusion that these drinks are healthier. We hope people see that the artificial drinks labeled sugar are free and still harming their bodies.

S-29

The Effects of E-Cigarettes on Drosophila melanogaster

Irelyn Samuelson and Hannah Gengenbach

Adams Central Jr./Sr. High School, Jay Cecrle

The Effects of E-Cigarettes on Drosophila melanogaster. Our project is about the negative effects of E-vapor. This is an important topic because people think that vaping is safe. According to cancer.net, “Further analysis of the nationwide survey found that nearly 1 in 4 young adults views them as harmless and not addictive. Emerging news has underscored the dangers of using e-cigarettes, commonly called vaping, as has the report of rising rates of e-cigarette use among young adults.” We predict that the chemicals in E-cigarettes will have a negative effect on our Drosophila melanogaster. Due to previous research by HealthDay, we predict that vaping will trigger gene changes in cells. In one experiment, we exposed Drosophila melanogaster to E-vapor by transferring the heated vapor from a beaker into the vials containing the Drosophila melanogaster. In addition, we exposed the Drosophila melanogaster larvae to the vapor using the same method. In another experiment, we mixed the E-liquid in with the Drosophila melanogaster’s food. After completing our experiments, we found that the flies may have had a genetic mutation occur, which caused them to turn green. We performed an ANOVA and found that the p-value was zero ($p<0.05$), which tells us that there were significant differences. Our ANOVA also performed a Tukey HSD test. We found that for group 1 “Exposed Adults Offspring” ="1,2,3" and group 2 “Exposed Food Offspring” ="4,5,6", $F=13.5$, $p=0.021312$. As $p<0.05$, we reject the null hypothesis that there is no significant difference between groups. For group 1 “Exposed Adults Offspring”="1,2,3" and group 2 “Exposed Food Offspring” ="4,5,6" and group 3 “Exposed Larva”="4,5,7", $F=7$, $p=0.027$. As $p<0.05$, we reject the null hypothesis that there is no significant difference between groups. But when we look at differences within groups (1 vs 2, 2 vs 3, 1 vs 3), only “Exposed Adults Offspring” and “Exposed Larva” are significantly different by Tukey's HSD. Future research will be done to see if a genetic mutation has occurred. Our results were consistent with our initial hypothesis because we might have seen a genetic mutation. They were also consistent with results found in previous studies that have shown that e-vapors can cause genetic mutations. Vaping now may lead to unintended genetic changes in offspring. People should care about our results because e-cigarettes are currently very popular.

S-30

Determining if Increased Flexibility Increases Speed and Vertical Jump

Keaton Karr and Adrian Gomez

Silver Lake High School, Kim Bonifas

Sports are a very popular part of lots of high school students' lives. There are currently around eight million high school students in the U.S. that play high school sports. Many of these athletes want to perform at the highest level possible and flexibility is a commonly overlooked component of athletic performance. The question is does increased flexibility improve your vertical jump and forty yard sprint time? The hypothesis is that stretching will cause the test subjects to increase their sprint time and have a better vertical due to their increased mobility. To test this we will be gathering all of the test subjects forty yard dash times and vertical jump. Then after an eight week period we will retest everyone to see if there are any improvements. The results were that stretching did not seem to have any major effect on increasing the test subjects 40 yard dash and vertical jump. There was some slight increase but overall almost all the test subjects prior test results stayed the same.

S-31

Determining the Cognitive and Physical Effects of Caffeine in Coffee

Savanna Junek and Morgan Dinkler

Silver Lake High School, Kim Bonifas

This project is researching the cognitive and physical effects of caffeine in coffee. This topic is important to society because the majority of Americans drink coffee and most of them don't know if it's actually helpful. Determining whether or not coffee actually has cognitive or physical effects could impact people's lives by educating them. The results of this experiment will let people know if the effects of caffeine are just a placebo effect or actually helpful. To do this research, 30 different people will be tested. These people were picked strategically. All subjects will take a cognitive test two times. Everyone taking the test the first time will have no caffeine in their system. A set amount of subjects will have caffeine for the second trial and the others will have no caffeine again for the second trial. The hypothesis for this experiment is that caffeine will benefit the subjects in all parts of the experiment. After averaging the results from the experiment, it was concluded that an average increase of test scores after the intake of caffeine was 39.83 points. Overall the subjects showed an average increase on all parts of the experiment after drinking coffee

Category 13 –Microbiology

S-32

The Effects of Ultraviolet Light on Phone Bacteria

Kaylee Buchholz and Megyn Scott

Adams Central Jr./Sr. High School

It is no secret that our cell phones have lots of bacteria. Radiation from ultraviolet light has been proven, by scientists, to damage the DNA in bacteria cells. The goal of our experiment was to test if exposing cell phones to ultraviolet light would rid the phone of bacteria. Our hypothesis stated that if we put phones under the radiation of ultraviolet light, the amount of bacteria will decrease significantly because the radiation will kill the DNA in the cells. Three different phones were tested, with different amounts of exposure to ultraviolet light: 1 minute, 3 minutes, and 5 minutes. We tested the bacteria in six different sections of the phone. We swabbed three sections before exposure to light, then swabbed the other three sections after. The amount of bacteria on the phones after exposure was less than the amount before; however, the changes were not significant. The standard deviation of our data was overlapping, meaning that there was no significant difference between our data before and after exposure. The p-values of the different trials were all greater than 0.05, concluding there is not a significant difference. Our data showed that there was an indirect relationship between the amount of bacteria and exposure time. These results supported our null hypothesis. This suggests that UV-C light may kill bacteria, but not at a constant rate. There are many factors that affect bacterial growth and how much the light kills it.

S-33

The Effect of C4 Sport Pre-workout on Genotoxicity in E. coli Bacteria

Blake Jensen

Central City Public Schools, Chelle Gillan

The purpose of this experiment was to see if C4 Sport pre-workout is genotoxic. I chose this topic because of the large increase in popularity of this pre-workout in the past year. It is important for the people taking this supplement to know the possible harm that they are doing to their health. It was predicted that when exposed to C4 Sport pre-workout, E. coli bacteria would exhibit genotoxicity. E. coli is a good model for testing genotoxicity because of its fast reproductive rate. Using a 96 well plate, I placed and diluted the pre-workout sample in five separate columns. In other columns, I placed and diluted the positive and negative controls, the E. coli alone to obtain background mutation rate, and water as an additional control. I later put the bacteria in each well except for those with the negative control. I incubated the plate for two hours, and I added chromogen that changes color to indicate whether the substance is genotoxic. After incubating for another 30 minutes, I read the results visually. The results showed that the C4 Sport pre-workout was genotoxic. The data showed that the results of the samples matched those of the positive control, a substance known to be genotoxic. To improve this study I would test each concentration of the samples multiple times to increase confidence in the results. Another addition to this experiment could be to test the different ingredients of the pre-workout separately to determine which of them was genotoxic.

S-34

Cross-species transmission of Drosophila melanogaster Nora virus in other species of insect and the prevalence of Nora virus in insect populations in Central Nebraska

Ella Buhlke

Central City Public Schools, Chelle Gillan

This study was performed to determine the cross-species transmission of the Drosophila melanogaster Nora virus in other species of insects and the prevalence of Nora virus in native insect populations in Central Nebraska. There are millions of known viruses, and new ones are discovered every year. A major source of new viruses is epizootic and enzootic animal viruses, seen when viruses typically occurring in animals adapt and mutate to infect humans. COVID-19 is an example of one of these host-switching viruses, as it originated in bats. The Nora virus is a picorna-like virus whose only known pathogenic effect is a geotaxis defect. The cross-species transmission of this virus can be used to help scientists better understand host-switching in other viruses. It was predicted that the virus would infect the other species and be present in native populations. To test this hypothesis, Nora virus-positive males were allowed to defecate on various combinations of fly food and dietary-specific foods. Once the flies were removed, insects of each species were added to the vials. Insects were also collected from the field to determine native virus presence. All insects were then tested via RNA analysis by RT-PCR using ORF1 gene-specific primers for detection of infection. In my previous study, Drosophila yakuba and Drosophila mercatorum showed positive infection, and while testing is ongoing, already the species Galleria mellonella, Tenebrio molitor, and Gryllodes sigillatus have shown positive infection. Learning more about cross-species transmission has increased importance in today's world as the number of zoonotic viruses increases.

S-35

Using a Novel Device to Grow and Isolate Antimicrobial Compounds

Jerzie Schindler

Central City Public Schools, Chelle Gillan

This study was conducted to find a way to more efficiently grow microbes from which to isolate antimicrobial compounds. I predicted that by using an ichip device, microbes would grow and antimicrobial compounds would be identified. Samples of soil were taken from an ephemeral stream in Central City, Nebraska. An ichip was constructed from a micropipette tip box with a filter membrane attached to each side to allow nutrients to the bacteria. Soil sample dilutions of 10-4, 10-5, and 10-6 and agar were dispensed into each well of the ichip, along with controls of only agar. This was placed back in soil for 5 weeks of incubation. 100% of the biomass that was removed from wells of all dilutions exhibited growth when plated on standard Petri dishes. Isolates from individual colonies were re-plated, allowed to grow, and then dried. These were resuspended and extracts were spotted on a lawn of S. aureus to observe possible inhibition. The null hypothesis that no microbes would grow was rejected as several different strains of bacteria grew. However, the null hypothesis that no antimicrobial compounds would be identified was not able to be rejected because only one isolate showed any noticeable clearing zone on the S. aureus lawn, and this was not as large as the control of vancomycin antibiotic. This type of research is essential to help us identify novel isolates that have potential for antibiotic development as the antibiotic resistance crisis is ever growing.

S-36

Sanitation on Basic Surfaces

Avery Larsen and Kelli Tunender

O'Neill High School, Nic Simonson

Sanitation on basic surfaces was created due to the ongoing pandemic. We wanted to learn what method of sanitation was most effective. We started by deciding which surface was most likely to contain a high amount of bacteria. In the end, we chose a table in a classroom because it most likely contract bacteria throughout the day. We decided to use a plain paper towel, bleach, dish soap, and a microfiber cloth as methods of sanitation for our experiment. We hypothesized that bleach diluted in water would be most effective when it came to sanitizing. The experiment was conducted at the end of the day to ensure the surface would have bacteria. Before using the sanitation methods, one section of the table was swabbed placed in the Petri dish and sealed to prevent any contamination. The paper towel and microfiber cloth were wet only with water. The bleach and dish soap were diluted with one tablespoon of solution to 600 milliliters of water. The table was sanitized and allowed to air dry, then swabbed and placed in an incubator and allowed to grow for a period of four days. We concluded that the paper towel grew no bacteria and was the most effective; however, we are unsure it was accurate. The bleach and microfiber methods grew small colonies. The dish soap resulted in high bacteria growth. Based on the results, we concluded that the paper towel was most effective with bleach and microfiber also doing well.

S-37

Determining the Effects of Different Storage Containers on Fresh Fruits and Berries

Sydney Bartels and Ahsley Bonifas

Silver Lake High School, Kim Bonifas

Only 14% of American adults consume at least two servings of fruit per day according to fruitsandveggies.org. If citizens are informed about the different storage methods and which methods work the best, more people might be willing to expand their diet to include more fruits and berries, which in turn would lead to people eating a healthier diet. This project will determine the effects of different containers on fresh fruit and berries. It will show people which storage plan is best suited for their specific type of fruit or berries. It was found that no other research has been done on this specific topic. For this project, the fruit and berries will be left alone for seven days in the different storage containers: the original package the fruit/berries came in, a plastic bag with vents, a plastic bag with no vents, and a Produce Saver Food Storage Container. At the end of one week, students will rate the berries between one and five on freshness: firmness, color, and moldiness. It is hypothesized that the Rubbermaid Produce Saver Storage Containers will keep the fruit fresh the longest. This is the hypothesis because these storage containers have been designed and tested specifically for this purpose. The goal of this project is to inform people about storage methods revolving around containers, in the hope that people will begin to eat more fruits.

Category 14 –Plant Sciences

S-38

The Effects of Supplemental Mycorrhizal Spores on High and Low Yielding Soils With Glycine Max

Lynsie Lancaster and Jack Trausch

Adams Central Jr./Sr. High School, Jay Cecrle

Is it beneficial to add mycorrhizal spores to your crops to increase growth rates? This experiment is relevant because flooding is a major issue in rural areas of Nebraska. Many farmers lose acres to diseases or poor soil caused by the floods. One solution could be adding mycorrhizal spores to the soil. This could help the soil provide necessary nutrients for the plant and help increase yield and growth. This experiment was conducted to observe if adding mycorrhizal spores to soil would have any lasting effects on soybeans. To test this hypothesis, two types of soil, each having a different yield rate, had mycorrhizal spores added to each and had untreated plants grown in the same soil for comparison purposes. Growth rates of plants were measured weekly. The soybeans grew in a greenhouse for a total of 48 days. After the growth period was over, samples were sent in to be tested by Servitech. After the final measurements, an ANOVA was run and it determined there was a significant difference between groups (p-value=0.000015). A Tukey HSD Analysis was also run and it determined the only differences were between the soil types and not between soils with and without mycorrhizae. Servitech results showed the mycorrhizal spores increased potassium, phosphorus, and nitrates in the soil. The results relating to the pH of the soil varied. This shows that mycorrhizal spores can help flooded acres recover and produce soybeans and set up the field for success in the future.

S-39

The Effect of Different Types of Fertilizers on Field Corn (maize)

Evan Frink and Brody Eckhardt

Adams Central Jr./Sr. High School, Zac Foster

The purpose of this experiment was to see what the effect of organic and artificial fertilizers were on field corn. The different types of fertilizers we used were Tomato and Vegetable Starter Fertilizer, 9-24-3 Starter Fertilizer, and 10-34-0 Starter Fertilizer as the artificial fertilizers. The different organic fertilizers included Blood Meal Concentrate, Chicken Manure, and Cattle Manure. Our hypothesis is if artificial fertilizer is used while growing field corn (maize), then it will grow more efficiently than if organic fertilizer is used. We came to the conclusion that the artificial fertilizer was more productive in growing corn than the organic fertilizer, because of the standardized nutrient content. The average height of corn with artificial fertilizers was 9.39", while the average height of corn with organic fertilizers was 8.49". In conclusion we have chosen to accept our hypothesis that artificial fertilizer affects the corn more positively.

S-40

Double Trouble

Akeyli Bush

Central City Public Schools, Chelle Gillan

This project was about how using an increased amount of fertilizer affects plant growth. Fertilizer increases nutrients the plant needs. It is made of nitrogen, phosphorus, and potash. Osmocote uses a resin coated pill, which can be broken down. It contains 14% nitrogen, 14% phosphorus, and 14% potash. I wanted to test increased fertilizer because I wanted to see if adding too much fertilizer harmed plant growth. I hypothesized that if more fertilizer was added, more seeds would germinate, the stems would be longer and the plants would be a lighter green. Eight control and experimental plants were tested. The experimental plants were planted in soil with six fertilizer pellets instead of three. Germination data was taken once. Plant height and color were taken four times. The germination hypothesis was not supported because it was found that an increased amount of fertilizer had a negative effect. This may have been because fertilizer has a high salt index. When the salt concentration in soil is high, it harms microorganisms needed for the plant to flourish. The stem length hypothesis was not supported because there was a negative effect on stem length. This may have been because the plants were not able to develop a stable stem. The plant color hypothesis was not supported because there was a negative effect on plant color. This may have been because since the stem was not able to properly carry nutrients throughout the whole plant it was not able to grow in a healthy manner.

S-41

Smells Like Growth

Autum Hewitt

Central City Public Schools, Chelle Gillan

This project was about the effect of perfume in a plant's water source. Perfume is made of denatured alcohol, water and fragrance. I wanted to test perfume because it is an everyday object that both males and females use. I hypothesized that if perfume was added to the water, fewer seeds would germinate, the stems would be shorter and the plants would be the same color as the ones given water. Eight control and experimental plants were tested. Germination data was taken once. Plant height and color were taken four times. The germination hypothesis was supported because it was found that perfume had a negative effect on germination. This may have been because the alcohol in the perfume acted as an antifungal agent, killing off all the good fungi that helps the plant grow. The stem length hypothesis was supported because there was a negative effect on the stem length. This may have been because in addition to killing the beneficial fungi, the alcohol in the perfume made it difficult for the plant to absorb water. The plant color hypothesis was supported because there was a negative effect on plant color. This may have been because the alcohol changed the chlorophyll, causing the light to reflect a darker color. This type of research is important because it shows that alcohol stunts plant growth and with most plants, you don't want short ones. Although, if there is a need for smaller plants, using alcohol is a good idea.

S-42

The Effect of Gravel in the Soil on Wisconsin Fast Plants

Bailey Greving

Central City Public Schools, Chelle Gillan

This project was about how gravel in the soil would affect Wisconsin Fast Plants. I wanted to test gravel because I drive on it every day and I have heard that putting gravel in soil doesn't really make a difference in plant growth. I hypothesized if gravel is added to the soil more seeds would germinate, the stems would be longer and the plants would be a lighter green than plants growing in only soil. Eight control and eight experimental plants were tested. I took germination data once and plant height and color four times. The germination hypothesis was not supported by the data because it was found that gravel had a negative effect. This may have been because the soil was a little too wet because there was not as much soil to take in the water so it drowned the seeds. The stem length hypothesis was supported by the data because there was a positive effect on the stem length. This may have been because the plants were getting extra nutrients such as potassium that washed off of the gravel. The plant color hypothesis was supported because there was a positive effect on plant color. Plants are green because of the pigment in the chlorophyll and the presence of gravel probably did not affect the formation of chlorophyll. This type of research is important because we need to continue to find better and less expensive ways to grow plants.

S-43

Effectiveness of Organic Soil Amendments on Arbuscular Mycorrhizal Fungi and Plant Growth

Breanna Vaughan

Central City Public Schools, Chelle Gillan

The focus of the study was to determine the effect of chicken manure and biochar on growth and mycorrhizal fungi on soybean plants. I hypothesized that biochar and manure would affect colonization of soybean roots by arbuscular mycorrhiza (AM) and plant growth, and that there would be a correlation between AM and plant biomass and growth. Soybean seeds were grown at 25℃ in 600 g of soil with 60g of amendment(s); manure, biochar, soil/control, 70% manure/30% biochar, and 30% manure/70% biochar. Height was measured every other day. After four weeks, plants were harvested, a root sample was analyzed for mycorrhizal colonization and dry biomass was recorded. Strong correlation was shown between plant height and total biomass (r=0.8), shoot biomass and mycorrhizal colonization (r=1), and total biomass and mycorrhizal colonization (r=0.9), moderate correlation between root biomass and mycorrhizal colonization (r=0.6), weak correlation between root biomass and plant height (r=0.4), and strong correlation between shoot biomass and plant height (r=.9). Plants with biochar only soil amendment were significantly taller than plants with the biochar manure mixture on Days 26 and 28 (P=0.04 and 0.02). An extension that included more plants harvested at different time periods would better show how these amendments affect plants at different stages. This type of research is of great importance as it can increase crop productivity, which is urgently needed as the population is growing exponentially.

S-44

The Effect of Febreze on Wisconsin Fast Plants

Hallie Rutherford

Central City Public Schools, Chelle Gillan

This project was about the effect of Febreze on plants. Febreze is used to kill bacteria and make things smell good. It is made of hydroxypropyl beta-cyclodextrin. I wanted to test Febreze because I wanted to know how it affected plants when it accidentally gets on plants as you are spraying it on pillows and couches. I hypothesized that if Febreze was added to the water, less seeds would germinate, stem length would be shorter and plants would be a lighter green color than plants given only water. 8 control 8 experimental plants were tested. Germination data was taken once. Plant height and color were taken four times. The germination hypothesis was supported because it was found that Febreze had a negative effect. This may have been because there is a liquid in febreze called hydroxypropyl and it is a cyclic oligosaccharide that kills bacteria so it may also be harmful to plant cells. The stem length hypothesis was supported because there was a negative effect on the stem length. This may have been because the chemicals will interfere with the absorption of the water by the plant. The plant color hypothesis was supported because there was a negative effect on plant color. This may have been because the mixture of Febreze and water went through the xylem tissue and took away some of the nutrients that the plants need such as nitrogen. Nitrogen is a limiting nutrient that plants need large amounts of to make the leaves dark green.

S-45

The Effect of an Orange Peel on Wisconsin Fast Plants

Isabelle Erickson

Central City Public Schools, Chelle Gillan

This project was about the effect of orange peels in the soil on plants. Orange peels are used to flavor dishes, to make oils, air freshener, extra fertile soil, and decoration. They are full of nitrogen and nutrients. I wanted to test orange peels because there is a lot of research about how orange peels affect growing plants but not very much on its effect on seed germination. I hypothesized that if an orange peel is added to the soil more seeds will germinate, the plant stems will be longer and the plants will be lighter green than plants grown in only soil. 8 control and experimental plants were tested. The experimental plants were planted in an orange peel and soil mix. Germination data was taken once. Plant height and color were taken four times. The germination hypothesis was not supported because it was found that the orange peel had a negative effect. This may have been because the orange peel affected the seeds' food supply, limiting the nutrients available. The stem length hypothesis was not supported because there was a negative effect on stem length. This may have been because mold on the orange peel produced chemicals that broke down plant root cells. The plant color hypothesis was not supported because there was a positive effect. This may have been because nitrogen in the orange peel caused the plant to produce extra chlorophyll.

S-46

The Effect of Red Bull on Wisconsin Fast Plants

Landon Webb

Central City Public Schools, Chelle Gillan

This project was about adding Red Bull to the water and seeing the effect of it on a plant. Red Bull is used as an energy drink. It is made of citric acid, caffeine, and taurine. I wanted to test Red Bull because energy drinks are known to be harmful to the body so I thought I would test it on pants. I hypothesized that if Red Bull was added to the water more seeds would germinate, the plants would be taller a lighter green than the plants with only water. 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 Red bull had no effect on germination. This may have been because the Red Bull itself has some content of water so the plant even if only Red Bull was added it would have some amount of water. The stem length hypothesis was not supported because there was a negative effect on the stem length. This may have been because the acid could have interfered with the homeostasis causing it to have to work more on living than growing. The plant color hypothesis was not supported because there was a positive effect on plant color. This may have been because the high amount of sugar could have been absorbed through the roots causing it to be denser in the amount of nutrients storage.

S-47

It's Getting Hot In here

Lillyauna Longoria-Hanson

Central City Public Schools, Chelle Gillan

This project was about how microwaving the soil affects seed germination, stem length, and plant color. Wisconsin Fast Plants were used. They are a plant called Brassica rapa that grow very fast and are often used for experiments. People sometimes use potting soil to sterilize it. I wanted to test microwaved soil because I use a microwave for a lot of things and I thought this would be a cool experiment. I hypothesized that if the soil is microwaved less seeds will germinate, the stems will be longer and the color will be a darker green compared to plants grown in un-microwaved soil. Eight 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 microwaved soil had a positive effect. This happened because the microwave did not do much damage to the soil and the seeds still have everything they need to germinate. Also, it could have killed fungi that could infect the plants. The stem length hypothesis was supported because there was a positive effect on the stem length. This may have been because microwaving the soil could have killed certain fungi that would spread infections in the plants that make it hard for the plant to grow. The plant color hypothesis was supported by the data because there was no effect on plant color. This may have been because the chlorophyll was not affected by microwaving the soil.

S-48

The Future of Aquaponics

Autumn Emme and Chairity Montgomery

O'Neill High School, Nic Simonson

Our project was inspired by the number of individuals who make less than minimum wage, that's about 865,000 people or 1.5% of the global population. We wanted to create an inexpensive, sustainable way to grow food while avoiding factors like drought, hail, parasites, and animals so people could afford fresh food with the reassurance of knowing how it was grown. To begin, we first thought of a blueprint then we considered money and supplies. After that, we decided on two seeds. A short-term plant, globe radishes, and a long-term plant, cherry tomatoes. We bought our seeds, planted them, then watered them every day with 1/4th of a cup of fish water while tracking their growth. Once their roots were established, we applied velcro to our plastic tub, stuck the plants to them and the plant's growth increased significantly. After 40 days our aquaponic radishes were now five inches tall and our cherry tomatoes were four inches. However, our radishes in the soil were two and ¼ inches tall and our regular tomatoes were one inch tall. In conclusion, we've learned that if we submerge the plant's roots under water slightly with fish they grow almost two times as much as regular plants in soil grow. Aquaponics doesn't only save money but also has an environmental benefit by reducing the consumption of resources and producing higher yields. While the research for aquaponics is still developing, aquaponics shows so much potential to become the future of eco-farming.

S-49

Analyzing Soil Differences

Evan Kopecky and Hunter Wilson
O'Neill Jr./Sr. High School, Nic Simonson

The main objective for this project was to learn more about the soil and what it does. We achieved this objective exceptionally well and even got more out of it than we expected. We learned about all of the different minerals and nutrients in the soil, along with how they react with the seeds to make crops grow. Each nutrient has its own job and this really enlightened us about how they work together to make things grow. We were able to dive into how we could determine what the farmer needed to do so they could keep their fields alive and better the overall yield. In this case the field we dealt with was having trouble supporting the life of the soybeans due to an excess of Sodium Chloride, also known as salt. The solution to this problem would be, for one to grow corn during the next rotation. Corn is better suited to grow in environments high in salt content. Another solution is to begin irrigating the field more often. Irrigation will help move some of the excess of salt deeper into the soil where it won't effect the crops as much. Our last solution is raising soybeans with a salt excluder gene. Planting soybeans with this gene will raise the ability of the crop to grow in salty areas. Overall this project was a great experience and success. We learned much more that we originally expected and are grateful we had the experience.

S-50

The Best Method of Asexual Propagation

Jace Gregory and Bethany Owens
O'Neill Jr./Sr. High School, Nic Simonson

Propagation is regularly defined in dictionaries and encyclopedias alike as the breeding of specimens of a plant or animal by natural processes from the parent stock. After researching the many types of propagation and how to accomplish them, we came to the conclusion that there are approximately two main types of propagation for plants (leaf cutting and stem cutting), both of which are subcategories of asexual propagation, the other main category being sexual. Sexual propagation uses seeds to produce new plants and is essentially just regular old planting, making it fairly easy. It involves planting a fertilized seed, letting it germinate, assuring the seed gets the proper nutrients from sun and water, and waiting. The main difference between sexual and asexual propagation is that asexual propagation is basically "man-made" plant fertilization, meaning it is initiated by man to grow crops faster and get more offspring from a single parent plant. Through experimentation and testing we have come to the conclusion that our hypothesis was correct, and stem cutting is indeed the best method of propagation. The plants that were stem cut had the most root growth, were sturdier, and had more vibrancy overall. If allowed to continue growing, the stem cut plants would grow the fastest and most efficiently into large, healthy plants.

S-51

Methods to Keep Cut Flowers Fresh the Longest

Addison Schmidt and Grace Heuertz
Silver Lake High School, Kim Bonifas

Our project is about what keeps cut flowers fresh the longest. This project is based on what ingredients we use to keep them alive the longest. The one that worked the best was sprite, and the flower food was close. Then the worst was bleach. The bleach killed almost all the flowers the third day. I would recommend using flower food but the sprite did a lot better than we thought it would. So the overall conclusion is that the sprite did the best, and the bleach did the worst. By the end of our nine days most of the flowers were basically dead and still had some color to them. If we were going to do this again we might use different measurements or maybe even different ingredients.

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S-31	Dinkler, Morgan	**S-9**	Karr, Madison
S-39	Eckhardt, Brody	**S-49**	Kopecky, Evan
S-48	Emme, Autumn	**S-38**	Lancaster, Lynsie
S-2	Erickson, Crystal	**S-36**	Larsen, Avery
S-45	Erickson, Isabelle	**S-47**	Longoria-Hanson, Lillyauna
S-39	Frink, Evan	**S-6**	Monie, Blake
S-24	Gabriel, Lucus	**S-28**	Montague, Kennedy
S-29	Gengenbach, Hannah	**S-48**	Montgomery, Chairity
S-30	Gomez, Adrian	**S-50**	Owens, Bethany
S-15	Gravert, Brice	**S-13**	Pickinpaugh, Lauree
S-50	Gregory, Jace	**S-5**	Poore,Kaeden
S-42	Greving, Bailey	**S-5**	Pumroy, Kinnick
S-14	Restelli, Vittoria	**S-49**	Wilson, Hunter

S-44	Rutherford, Hallie
S-29	Samuelson, Irelyn
S-35	Schindler, Jerzie
S-51	Schmidt, Addison
S-32	Scott, Megyn
S-22	Sharp, Jeremy
S-27	Sharp, Josi
S-26	Smith, Rebecca
S-21	Sommer, A. J.
S-4	Stauth, Claire
S-7	Strampher, Katelyn
S-25	Stritt, Ryan
S-8	Swanson, Lana
S-26	Swisher, Courtney
S-19	Teichmeier, Jayden
S-28	Thompson, Lauren
S-38	Trausch, Jack
S-36	Tunender, Kelli
S-10	Vance, Trey
S-43	Vaughan, Breanna
S-4	Vergara, Paola
S-46	Webb, Landon
S-17	Whitlock, Jordan
S-24	Wrightsman, Bennet
S-16	Zelinski, Rose