



Nebraska Junior Academy of Sciences

***Central Regional
Science fair 2024
Abstract Booklet***

2024

DATE

Tuesday
March 5th,
2024

HOSTED BY



SCAN ME!

Nebraska Junior Academy of Sciences
Central Regional Science Fair 2024

Welcome to the 2024 NJAS Central Regional Science
Fair!

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

Neil Heckman & Nicole Muszynski, Science Fair Directors
Jordan Schutte, Science Fair Coordinator

Hosted by



Contents

- **Participating Schools - 4**
- **Hastings College Map - 5**
- **Schedule - 6**
- **Junior Division Entries**
 - Animal Sciences - 8
 - Behavioral & Social Sciences - 9
 - Computer Science - 9
 - Earth and Planetary Science – 10
 - Energy and Transportation - 10
 - Engineering: Materials/Bioengineering – 11
 - Environmental Science - 12
 - Medicine and Health Sciences – 12-13
 - Microbiology – 14
 - Physics & Astronomy – 14-17
 - Plant Sciences – 17
- **Senior Division Entries**
 - Animal Sciences – 19-21
 - Behavioral & Social Sciences – 21-24
 - Biochemistry - 24
 - Chemistry - 25
 - Energy and Transportation - 25-26
 - Engineering: Electrical/Mechanical – 26-27
 - Engineering: Materials/Bioengineering - 27-28
 - Environmental Management - 28-29
 - Environmental Sciences – 29-32
 - Medicine and Health Sciences – 32-35
 - Microbiology – 35-38
 - Physics and Astronomy – 38
 - Plant Sciences – 38-42
- **Index of Student Entries 42-45**

Participating Schools

Adams Central Jr./Sr. High School

Jay Cecrle & Zac Foster

Central City Public Schools

Chelle Gillan & Anna Detlefsen

Hastings Public Schools

Bailey Johnson

Sandhills Public School

Zeta Greene

Silver Lake High School

Kim Bonifas

Map of Hastings College



hastings.edu/maps

Schedule

Time	Teachers	Jr. Division Students	Sr. Division Students	Judges
8:00	Check-in at Morrison-Reeves Science Center (east entrance) #8 on the map Project Setup (must be ready by 9:00)	Check-in at Morrison-Reeves Science Center (east entrance) #8 on the map Project Setup (must be ready by 9:00) 2nd Floor	Check-in at Morrison-Reeves Science Center (east entrance) #8 on the map Project Setup (must be ready by 9:00) 1st Floor	Check-in at Morrison-Reeves Science Center (east entrance)
				Judge's Meeting 8:30 Room 219 2 nd Floor
9:00		Educational Presentations UNL Extension Office		
10:00	Teacher's Meeting Room 130 (next to main office)	Location: Walk over to Wilson Building (#13 on the map) Rotating Sessions A Auditorium (main floor) B Room 010 (basement) C Room 030 (basement)	Face-to-Face Judging	Face-to-Face Judging Sr. Division <hr/> Jr. Division
10:30		Face-to-Face Judging	Educational Presentations UNL Extension Office Location: Walk over to Wilson Building (#13 on the map) Rotating Sessions: A Auditorium (main floor) B Room 010 (basement) C Room 030 (basement)	
12:00	<u>Lunch</u> Hazelrigg Student Union Dining Hall #23 on the map (1 lunch ticket/per person) Seating in room A&B	<u>Lunch</u> Hazelrigg Student Union Dining Hall #23 on the map (1 lunch ticket/per person) Seating in room A&B	<u>Lunch</u> Hazelrigg Student Union Dining Hall #23 on the map (1 lunch ticket/per person) Seating in room A&B	<u>Lunch</u> (Optional)
1:00	Awards Presentation Chapel	Awards Presentation Chapel	Awards Presentation Chapel	

Junior Division Entries

Animal Sciences

J-1 Dog Bowl Spectrum

Tyla Held

Sandhills Public Schools – Zeta Greene

The purpose of my experiment was to see if the difference of my dog bowl affects how my dog eats because I want him to eat more. It was hypothesized that if I test the colors, yellow, green, blue, purple, black, white, and red; I believe he will choose purple. My experiment is still in progress. At this time I do not have enough data to report the results obtained and the conclusion.

J-2 Caught You on Camera

Elijah Brogdon

Sandhills Public School - Zeta Greene

The purpose of my experiment was to determine if the deer in my area would be more attracted to corn or salt. It was hypothesized that the corn in the lick tub would attract the deer in my area more times than the salt would. In order to conduct my experiment I have placed two cameras at two different locations. At each location I have a lick tub full of water. At location one I have a lick tub full of salt next to the water. At location two I have a lick tub full of corn next to the water. I will check the cameras every other day to see how many deer show up to each location. My experiment is still in progress. At this time I do not have enough data to report the results obtained and the conclusion.

J-3 Music to my Dog's Ears

Mattee Zutavern

Sandhills Public Schools – Zeta Greene

The reason I am studying this topic is because my dog is very energetic. We often participate in things where she needs to be on the calmer side, such as the Dog show at the Custer County Fair. I would like to know what music has the most calming effect on the things she does. I hypothesize that if my dog is exposed to music while also being exposed to food and water I think that the music will affect her behavior but not her eating habits. To conduct my experiment I gather 240 grams (2 cups) of Victor dog food and 360 grams (3 cups) of water. I then place the food and water in the center of the floor in the quiet room (my bathroom). To study my dog's behavior I set my phone up in the corner of the room and then begin playing the chosen genre of music for the day. After all that I bring the dog into the room and leave her in the room for 15 minutes with the music playing. After the 15 minutes are up I take the dog outside and weigh the food and water left. After I write down the weight I study and take notes of video footage taken. At this time I do not have enough data to report the results obtained and the conclusion.

Behavioral & Social Sciences

J-4 The Effect of Jumping Style and Shoe Mass on Broad Jump

Lane Beck

Central City Public School - Anna Detlefsen

Jumping has always been a part of me and there are multiple approaches a jumper can attempt during a competition. I wanted to compare the results to what I'll jump in the spring for track. I predicted that the jumping style would affect the average jumping distance. I taped an open reel tape measure to the rubber flooring in the weight room on a flooring seam to know where to jump from. I then completed a standing broad jump at the tape measure while someone else measured the jump distance off my back foot. I then stepped back five tiles and jumped off my left foot, right foot, a left-right approach and finally right-left approach, both jumping off two feet. I jumped five times using each style, then repeated the process for each shoe. The highest average combination was 2.96 meters jumping off my left foot alone with training shoes. The lowest average (1.97m) was from casual shoes and a standing broad jump. Results showed that the shoe mass and jumping style were significant at $p < 0.05$ according to the ANOVA and Tukey Kramer tests, which supports my hypothesis. These results show that jumping style does affect the average jumping distance, regardless of shoe mass. To expand on this I would test vertical jumps using all of the same techniques since vertical movement is also important in my track and field events.

Computer Science

J-5 Effectiveness of Apple AirTags At Different Distances

Claire Cecrle

Hastings Middle School - Bailey Johnson

This project is about testing Apple AirTags connection times from several distances away. The idea for this project came when my cat escaped and ran in an unknown direction. We were unable to connect to the Apple AirTag attached to my cat's collar, and we were unable to find her. I wanted to know how accurate the AirTag might be. I predicted that if an Apple AirTag is placed over 98 feet away from an iPhone, it will be unable to connect because the average distance it can connect is 30 meters (98 feet). With 3 Apple AirTags, I tested to see how long it would take for the devices to connect to my iPhone. Using 2 phones (one for the AirTags to connect to, and the other used as a stopwatch), I placed the AirTags from 50 feet, 100 feet, and 200 feet away from the iPhone. I then timed how long it would take for the AirTags to connect. The Apple AirTag was able to connect up to 200 feet an average of 21.1 seconds, 7.35 seconds at 100 feet, 3.66 seconds at 50 feet, and 2.38 seconds at 0 feet. The results from my experiment were not consistent with my hypothesis. My initial prediction was that the AirTag would be unable to connect from over 90 feet away. The results showed that the AirTag was able to connect from 200 feet away, although the further it was from my iPhone, the more the connection time was different and the more time it took to connect. These results suggest that Apple AirTags may be able to connect from further distances away than advertised. This data can help people in the future decide if they want to buy an Apple AirTag, depending on the radius of the object from the device.

Earth & Planetary Sciences

J-6 Monster Plow

Tristen Swisher

Sandhills Public School - Zeta Greene

The purpose of my experiment was to determine how deep the teeth of the harrow have to be in the soil. If I use a trailer pulled by an RC car through clay, gravel, and sand I think it will have a deeper trench in the clay site. I attached the trailer to the RC car and pulled 1 meter. Then measured how deep the trailer teeth dug into the soil. Recorded and put it in the logbook. I repeated the test 10 times for every site. My experiment is still in progress. At this time I do not have enough data to report the results obtained and the conclusion.

Energy and Transportation

J-7 Solar Energy on the Move

Cesar Chavez

Sandhills Public School - Zeta Greene

My project aims to defeat the idea of gas emissions and greenhouse gasses from the exhaust pipe of your everyday gas-powered car. It was hypothesized by myself that the best angle for use in the sun would be important if gas emissions come to dangerous levels, I believe that 60 degrees would be the best angle for a productive charge. To conduct my experiment I looked at the amount of charge received from the two angles of testing from my solar panel-powered car to see which angle would give you that powerful charge. My experiment is still in progress. At this time I do not have enough data to report the results obtained and the conclusion.

J-8 Kinetic Energy of Rubber Bands

Mason Sutton

Sandhills Public School - Zeta Greene

My purpose for this project was to find what rubber band has more kinetic energy. It was hypothesized that the cold rubber band will have more kinetic energy. For my science fair I wanted to know how temper changes the rubber bands kinetic energy, so I heated up some rubber bands and threw some other rubber bands in the fridge. Then I tested how far the rubber band car went by winding the rubber band up in the rubber band car and then took the distance of the car and wrought it down. My project is still in progress.

Engineering: Materials/Bioengineering

J-9 Evaluating the Tensile, Adhesive, and Hydrostatic Strength of Duct Tape

Jordan Bonifas & Lee Gibson

Silver Lake Public Schools - Kim Bonifas

Many people in the agricultural field use duct tape on a daily basis in many different applications such as how strong, how sticky, and how water resistant the tape is. This project determined the tensile, adhesive, and hydrostatic strength of six different duct tapes. Six different types of duct tapes were tested and ranked from best to worst. The six types of duct tape used were Gorilla tape, T-Rex tape, Iron Force tape, Dewalt tape, Duck tape, and Scotch 3M tape. The tape with the highest tensile strength was Gorilla tape. The tape with the highest adhesive strength was T-Rex strength. The tape with the highest hydrostatic strength was Gorilla tape. The brands Duck tape and Scotch 3M tape came in last in every test.

J-10 Determining What Stain Remover is the Most Efficient

Libby Soucek & Abby Dumler

Silver Lake Public School - Kim Bonifas

The purpose of this experiment is to determine the best out of three stain remover brands. Very often, agriculture workers will come back from work with a bunch of stains all over themselves. Whether it's grease, oil, or even mud. This project is to help determine which stain remover is best and whether it'd be better to use other materials other than cotton. Everyday resources will be used as a proxy to more farm related stains. It will be discussing the ratings after each project has been completed. The data will be put into graphs and be kept on a google doc. The hypothesis of this project is that the Tide brand will be the least effective in the experiment. The hypothesis also states that the Oxiclean brand will show the finest outcome, this proposition is backed up by the results of which have been conducted by other analysts. After the experiment was conducted the conclusion stated that the Oxiclean stain remover performed best on all stains and that each stain was the simplest to remove from polyester. The items will be sprayed with stain remover, and after five minutes washed in the washer. The questions of this project is: What stain remover is the most effective and do they work better on different fabrics?

J-11 Determining the Effect of Type of Storage Methods on Different Food Variables

Justin Sharp

Silver Lake Public School - Kim Bonifas

In this project, the most common household storage items such as aluminum foil, saran wrap, tupperware containers, ziplock bags, beeswax wrap, and simply just leaving a food variable in open air for comparison, will be tested on which item will keep a food warm the longest over a certain period of time. Many may disagree, but the hypothesis for this experiment is that the aluminum foil will retain, or keep the food variables heated the longest. The food variables in this project are boiled hot dogs and frozen pizza cooked in the oven. The selected variables were tested with a professional Wi-Fi meat thermometer every 2 minutes for 20 minutes. The project was tested twice, once for each food variable. In both times the project was tested, the results came out almost the same, aluminum foil being the best storage method. There were close ties with saran wrap tying with the aluminum foil in the first trial, while in the second, the ziplock bag was tied, once again, with the aluminum foil. So with current knowledge that was gained from the data, the aluminum foil was, in fact, the best storage method when keeping a food variable warm for a short period of time.

Environmental Sciences

J-12 Filtration nation

Sophia Glidden

Sandhills Public School - Zeta Greene

The purpose of this experiment is to find out whether sandhill sand can purify different types of water such as; colored water, polluted water, and normal plain tap water.

It was hypothesized that if I test different types of surface water such as polluted water from the driveway and colored water, then it is believed that the sand will make the colored water closer to clear.

In order to conduct my experiment I pour 200 mL of water into a mason jar with a sand filter in order to see if the sand layer purified any pollutants out of the different types of water I tested to see if sandhills sand is a major part of the good water we have in Nebraska.

My experiment is still in progress. At this time I do not have enough data to report the results obtained and the conclusion.

J-13 Decomposing Masters

Hunter Bray

Sandhills public School - Zeta Greene

The purpose of my experiment was to find all the temperatures for the right amount of decomposing stuff to run in the garden.

It was hypothesized that the worms would have more heat than the control and the starter.

In order to check my equipment and materials to see the temperature of my control and my independent variables would be very creative. I use the probe and the computer to check the temperature in degrees Celsius for doing all of it. In the lick tubs were my control and the red wiggler worms and the plant starter. I would mix the stuff in the tubs to restart everything because you always would have to mix it before you did another test to see if it was running the right test. On day 6 we checked and the worms were not having as much temperature as they were when they had at the beginning. I have not finished all the testing so I can't say that the worms will not grow up in temperature again so they could still go up in temperature and if they still keep on going.

My project is still in progress. At this time I do not have enough data to report the results obtained and the conclusion.

Medicine and Health Sciences

J-14 How Effective Are Different Brands of Sunscreen

Kaylee Karr & Brooklyn Himmelberg

Silver Lake Public School - Kim Bonifas

Since there are many types of sunscreens, it is important to know which one will work the best to keep your skin healthy. So this project is based on how effective different brands of 30 SPF sunscreen are at protecting you from the sun, and the three brands chosen for this project were Neutrogena, Aveeno, and Banana Boat. The hypothesis stated that Neutrogena would be completed first, followed by Aveeno, and lastly Banana Boat. It was correct about Banana Boat, but was wrong about the other two brands. Since the experiment was conducted three times, the results differed each time. Even so, the order they were in hardly changed, with Banana Boat typically lasting the longest, followed by Neutrogena and then Aveeno.

J-15 A Comparison of the Effectiveness of the Most Commonly Prescribed Topical Antibiotic Against Topical Over-the-Counter Acne Treatments in Decreasing the Amount of Bacteria on a Middle School Population's Faces

Amelia Buhlke

Central City Public School - Anna Detlefsen

This project's purpose is to determine if topical over-the-counter acne treatments are equally as effective as topical prescription antibiotics. Antibiotic resistance is one of the world's most critical health issues, killing 48,000 people in the United States annually. Today, many teens use antibiotics long-term to treat acne, which can lead to antibiotic resistance and lifelong health concerns. Many choices for non-antibiotic acne treatments are currently available with or without a prescription. Although adolescents are concerned about the side effects of antibiotic treatments, studies show most are unaware of antibiotic resistance. My project will evaluate if topical over-the-counter acne treatments can be equally as effective as prescription antibiotics in decreasing the amount of bacteria on a middle school population's faces. I hypothesized over-the-counter acne treatments would not be equally effective as the prescription antibiotic. Fourteen junior high students' faces were swabbed and the samples were plated on auger. Inoculated disks with the six acne treatments, one out of each main drug group, and the control were placed onto the plates; the samples were then incubated for 24 hours, and the zone of inhibition was measured. Results showed that 3 of the 5 acne treatments tested were equally as effective as the prescription antibiotic at $p < 0.05$ according to the ANOVA and Tukey Kramer tests, which rejects my hypothesis. These results show that non-antibiotic acne treatments yield the same effect as prescription antibiotics for acne-prone teens; therefore, teens won't have to risk developing antibiotic resistance while treating their acne.

J-16 Finding the Balance in School Lunches

Molly Hemberger

Silver Lake Public Schools - Kim Bonifas

This project will talk about the nutritional value of school lunches. School lunches, especially public schools, have a bad reputation for getting people sick or they just don't know if it's safe to eat. This project will answer the nutritional part of this question. Nutrition is so important for the body, without the right amount of nutritional value, the body will react. Some kids may experience tiredness, loss of focus, and lack of physical energy with no nutrition. Today's project will answer the many questions kids and parents may have.

J-17 How Different Cleaners Work on Classroom Tables

Graham Karr & Alivia Pankoke

Silver Lake Public School - Kim Bonifas

The topic of our science fair project is what different household surface cleaners clean more efficiently. This can provide cleaner areas for human and animal health. To determine this we would use a blacklight flashlight to see what the tables looked like before we cleaned them. Afterwards, we put glow powder on the unclean, classroom, and tables. Then we would use each of the products in different areas of the tables. Finally, we would use a blacklight flashlight to see the finished product. To get the data we ranked each of the cleaners 1-10 (ten being the best). We understood that Windex was the leading brand, followed by Clorox, and finally Hammer Wipes.

Microbiology

J-18 Bacterial Surface Removal

Heath Larsen

Sandhills Public School - Zeta Greene

The purpose of my experiment was to find out If Essential Oils reduce Microorganisms on different surfaces? I hypothesized, if I tested Essential Oils, Bleach and Multi-Surface Cleaner on unclean surfaces I thought that Essential Oils would reduce bacterial growth the most.

In order to conduct my experiment my method was to put my 3 different solutions in 3 different glass spray bottles. I sprayed my surface with my solution and wiped it with paper towels. I skipped this step with my controls. My controls were the surface swabbed with no solution sprayed before. Next I dipped a cotton swab in a beaker with distilled water in it and rotated the swab in my hand making an "s" pattern on my surface. I made the same "s" pattern in the petri dish filled with agar. I then closed my petri dish and with a permanent marker I marked the date, the surface and the surface number. I then placed the petri dish inverted in an incubator at 27 degrees celsius. After that I repeated the steps until all my surfaces had been swabbed after being sprayed with all the solutions. At 24, 48, 72, and 98 hours I observed my dishes and counted the microorganism colony growth. I specifically looked for white smooth, white rough, pink and yellow bacterial colonies as well as fungal growth. My experiment is still in progress. At this time I do not have enough data to report the results obtained and the conclusion.

J-19 Bacteria VS Ground Meat

Paizley Zutavern

Sandhills Public School - Zeta Greene

The purpose of this experiment is to determine at what temperature ground meat is safe to eat. It was hypothesized that raw meat would have the most bacteria and 165°F meat would have the least amount of bacteria. To conduct my experiment, first I shaped my hamburgers. Next, I swabbed the inside of the burger for bacteria and rolled that in a petri dish. Then, I cooked the burger to an internal temperature of 100°F, 145°F, and 165°F and swabbed for bacteria each time. I also used turkey, ground bison, and sausage. After collecting the bacteria, I placed the petri dishes into an incubator. My experiment is still in progress. At this time I do not have enough data to report the results obtained and the conclusion.

Physics and Astronomy

J-20 The Effect of Air Pressure on Bounce Height

Gavin Root

Central City Public School - Anna Detlefsen

I chose this project because I wanted to find out if the air pressure in a basketball affected how high it bounced. I predicted the basketball with the highest air pressure would bounce the highest because the gasses are compressed so much. I taped a yardstick to a bench with the zero mark on the ground. I then held the ball even with the top of the stick and dropped the ball while filming with my phone in slow motion. The bounce height was pulled from the film footage. I repeated this 10 times for each air pressure. The results showed when the ball was filled with 8 psi the average bounce was 71.4 cm, at 7 psi the average bounce was 68.1 cm, for 6 psi was 67.1 cm, for 5 psi it was 63.8 cm, for 4 psi it was 57.2 cm and for 3 psi it bounced 50 cm. An ANOVA was conducted on this data with a $p=1.21E-17$; air pressure was a statistically significant factor in bounce height. I concluded that when the air pressure was the highest it bounced the highest. My prediction was supported; air pressure does have an effect on basketball bounce height. Next I will see how the surface that the ball bounces on affects how high the ball bounces when dropped from 1 meter.

J-22 The Effect of Serving Style and Air Pressure on Volleyball Serving

Sofie Negus

Central City Public School - Anna Detlefsen

I chose this specific subject for my project because I have wondered if air pressure of a volleyball affects my serving success while serving in three different styles. I predicted that lower air pressures will have a higher accuracy than higher air pressures because the higher air pressures have more air which will cause the ball to go farther than it would at a lower air pressure. First, I found three volleyballs of the same brand, and I changed them to three different air pressures. I served the volleyball with the air pressure 3.25 psi as a standing serve, jump serve, and underhand serve five times each. I recorded whether the serve was in- or out-of-bounds, with in-bounds being a successful serve. I repeated the process at 4.5 psi and 5.75 psi. I found the most successful air pressure to be 4.5 psi and least successful to be 3.25 psi. The most successful serve style was jump serving and least was underhand serving. Two single-factor ANOVAs were completed on my data with no statistical significance for either the serving style ($p=0.11$) or ball air pressure ($p=0.37$). Once completed, the data rejected my hypothesis: the lower air pressures do not have a higher accuracy. If I was to continue this project, I would collect the speed of the volleyball when serving. I've always wondered if the air pressure of a volleyball would affect serving speed.

J-23 The Effect of Outdoor Temperature and Bat Type on Hitting Distance

Journi Schindler

Central City Public School - Anna Detlefsen

I chose this specific subject for my project because I wanted to determine which bat had the best performance in different outdoor temperatures. I predicted that the Demarini was going to perform best in the warmer temperature because I hit better in warmer weather than I do in colder weather and I hit my homerun with a Demarini. On the warmer day I hit 10 balls off the tee with the Demarini and measured the distance. I then rested 10 minutes before hitting with the other bats. I repeated this procedure for the other two bats. On the colder day I also did the exact same thing, hit 10 bats off the tee, measure the distance, and then rest 10 minutes. The results showed the Rawlings Mantra performed best in both warm and cold weather, the Easton Stealth Flex performed second best and the Demarini CF performed the worst out of the three bats. Two single-factor ANOVAs were run on the data with a $p=0.30$ for high temperature and $p=0.53$ for low temperature; air temperature was not a statistically significant factor in hitting distance. My prediction was rejected; the Demarini CF did not perform the best in warm weather. If I were to expand on this project I would include live pitching instead of only hitting off the tee because to be more accurate and realistic. I might also test different pitch speeds or styles.

J-24 The Effect of Soaking Time on Popcorn Popping

Kalyn Talbott

Central City Public School - Anna Detlefsen

I chose this project because I have wondered if moisture affects popcorn kernels before you pop them. I predicted that the kernels soaked for 5 minutes would have more unpopped kernels because the others don't have as much moisture in them. I tested this project by getting the StirCrazy air popper and poured one tablespoon of vegetable oil in it. Then I put the popcorn kernels in, timing until the first kernel popped. When it was done popping, I counted the unpopped kernels. For the next batches, I put the kernels in a glass of water for 2:30 and 5:00 minutes. I put more oil in the popper and popped each batch separately. The results showed that the kernels that were not soaked had an average of 2 unpopped kernels and popped at 2:11, those soaked for 2:30 minutes had an average of 9 unpopped kernels and started popping at 2:13, and those soaked for 5 minutes had an average of 14 unpopped kernels and started popping at 2:25. An ANOVA was completed for time until popping ($p=0.013$) and for number of unpopped kernels ($p=0.0097$). Soaking time had a significant effect on both time to pop and unpopped kernels. My results supported my hypothesis. The kernels that soaked for 5 minutes had more unpopped kernels and took longer to start popping. Another project I would do is how much volume popcorn takes up in a bowl.

J-25 The Effect of Cup Size on Drink Temperature

Kindrey Fruit

Central City Public School - Anna Detlefsen

I chose this specific project because I wanted to see how the size of a cup affects the temperature of my drink. I thought that the cup size does not have an effect on the temperature of the drink because the containers are entering and leaving the refrigerator at the same temperature. I started by selecting three different sized cups, filling them with water, and putting them all in the fridge for 20 minutes. After 20 minutes I took out the cups at the same time, and I instantly inserted the thermometer into the water. I recorded the temperature every two minutes for 10 minutes. Then, I repeated the process for all cups. The 24 oz cup had an average temperature change of 3°C, the 16 oz cup had an average temperature change of 2°C, and the 8 oz cup had an average change of 2.67°C. An ANOVA was conducted on the data with a $p=0.70$; cup size was not a statistically significant factor in drink temperature. My data supported my hypothesis: the size of the glass does not have an effect on the temperature of my drink. If I were to expand on this project, I would use different types of cups as well as a more variety of sizes.

J-26 The Effect of Bat Length on Hitting Distance

Sophie Moser

Central City Public School - Anna Detlefsen

I chose this specific subject for my project because I have wondered if the length of my different softball bats affects how far the ball will travel when I hit it. I predicted that the longest bat would make the ball go the farthest because the force that would come from the bat would make the ball go farther and it would hit the ball harder. To test this I took three different softball bats with the mass of 30 in, 32 in, and 34 in. I then set a tee on home plate and took 10 swings with the first bat. After each swing I measured how far the ball traveled. After all of my swings were taken with the first bat, I repeated the same process with the other two bats. The 30 in bat had an average hitting distance of 164 feet, the 32 in bat had an average of 172 feet, and the 34 in bat had an average of 174 feet. A single factor ANOVA was completed with $p=0.45$; bat length does not have a statistically significant effect on the distance a ball is hit. I concluded the length of the bat does affect how far the ball goes. The data supported by my hypothesis, the 34 in bat did have the farthest hitting distance. If I were to expand this project I would include trials with different bat brands and compare hitting distance of all the different bats.

J-27 The Effect of Type of Container on Water Temperature

Eli Ferris

Central City Public School - Anna Detlefsen

I have always wondered if the material of a container has an effect on the temperature of the liquid inside of it. I predicted that the metal hydro-flask would keep the water the hottest because it has layers of metal to protect the water from the heat transfer. I first filled up each container with equal amounts of hot water and recorded their starting temperatures. Then I took all of the containers outside on a cold day and checked the temperature of the water in each container every ten minutes for one hour. I repeated this two more times. The plastic water bottle had the highest average temperature difference of 74°F and the mug had the second highest average temperature difference of 73.7°F. The plastic cup had the second lowest average temperature difference of 72.3°F. Finally, the hydro-flask had the lowest average temperature difference of 56.3°F. A single factor ANOVA was conducted on my results with $p=2.17E-5$; container material had a statistically significant effect on drink temperature. Once completed, the data supported my hypothesis: the metal hydro-flask did keep the water the hottest. If I were to expand this project, I would add more different types of containers, and make each trial longer. I could also try to do it on different temperature days.

J-28 The Effect of Distance and Site Range on Accuracy

Hailey Brandes

Central City Public School - Anna Detlefsen

I chose to shoot archery for accuracy for this project because it sounded fun to do and something that I could do on my own. My prediction was that I would be the most accurate with close range sight at 15 meters as the other distances I wanted to test were farther away and harder to see. I drew a line in the dirt then measured out 15 meters. Then, I used the close-, medium-, and far-ranged sights nine times each. Then I moved back another 5 meters, repeating the shooting process with all three sights. Finally, I repeated at 25 meters. My results showed I was least accurate with the 25 meter distance and the close-range sight with a score of 0. I scored highest at 25 meter distance and the far-ranged sight I got an average score of 4.4 out of 5. Results showed that 2 of the 3 distances tested had results at $p < 0.05$ according to the ANOVA and Tukey Kramer tests, which rejects my hypothesis. The data showed I shoot more accurately at further distances with the far-range site and with close-range sites at closer targets, supporting my hypothesis. Next I would like to test if I can shoot better with a bare bow or a compound bow or how different ages of shooters affect how far they can shoot.

Plant Sciences

J-29 Taste and Appearance of Dehydrated Fruit

Araya Gomez & Ava Sorensen

Silver Lake Public School - Kim Bonifas

The best fruits to dehydrate according to food prep guide.com are strawberry, banana, apples. The fruits will be tested and compared to find the answer to the question. Even though there are a lot of tasty fruits, these are the best three. Here are the reasons why strawberries, bananas and apples are the best. Strawberries are good to dehydrate because they are sweet, satisfying, and great on the go. They are not messy and take at least 5 hours to dehydrate for best quality. They will not snap or shatter unlike other fruits or vegetables. One of the best fruits to enjoy quickly is a banana because they are crunchy and appetizing. They will leave a flavorful taste in your mouth after eating. Last but definitely not least, apples. They are one of the best tasting dehydrated fruits in the world! They are a wonderful and gratifying choice. It has a very lush flavor and is crisp. These are all mouth watering options, and volunteers will be comparing them to each other. To find out which fruit really tastes the best. In conclusion our research has shown that apples are the best fruits to dehydrate. Although strawberries were not far behind. The bananas did not do as well only about four percent of the volunteers preferred it. This research has taught us that it is hard to dehydrate a fruit in the perfect way.

J-30 Mash, Fried, Catalyzed

Josie Morrow

Sandhills Public School - Zeta Greene

The purpose of my experiment was to find out if there were different kinds of catalase enzymes in a different variety of potatoes I tested. It was hypothesized that there were going to be different amounts of catalase enzymes in the varieties of potatoes I tested. In order to conduct my experiment I had to cut up different potatoes and place them into a tube filled with hydrogen peroxide, vinegar, and water to see how many bubbles were going to be produced. The bubbles indicated how much enzyme was in that potato. My experiment is still in progress. At this time I do not have enough data to report the results obtained and the conclusion.

Senior Division Entries

Animal Science

S-1 How Negative Temperatures Affect Cattle

Kallan Cox

Sandhills Public School - Zeta Greene

The purpose of my experiment was to discover if cattle consume more feed during negative temperatures or go off feed. It was hypothesized that cattle would consume more feed during the winter. In order to conduct my experiment I had a pen of 89 bulls. I fed them a total of about 4,000 pounds of feed everyday at 9:00 am. Then I recorded the temperature each day. At around 8:30 am the next day, I recorded how much feed was left over. In my results I discovered that when the temperature was around 30 degrees Fahrenheit the cattle consumed around 40 lbs of feed. When the temperature dropped to around 20 degrees Fahrenheit the cattle consumed about 44 lbs of feed. When the temperature dropped to -10 degrees Fahrenheit the cattle consumed 50 lbs of feed. I concluded that the colder the temperature gets the more feed cattle will consume.

S-2 Equine Owners Preference On Feed and Supplements for Their Horses

Karah Bartels

Silver Lake Public School - Kim Bonifas

This project is determining if equine owners have a preference for feed and supplements for their horses. This is a topic of interest to me as there are many different equine feeds and supplements on the market, such as Blue Bonnet, Purina, Stanley, Buckeye, Nutrena, Triple Crown, and Vitalize, just to name a few. There are many good reviews on these feeds, so it is just an owner's preference on what they would like and need for their particular horses. Horses can be allergic to plant particles just like people can but they can also be allergic to other substances that are floating in the air. This is called allergic inhalant dermatitis or atopy. Horses can also be allergic to different types of grain or types of forage such as alfalfa, prairie hay, oat hay, and other types. The hypothesis for this project is that most owners will respond by saying that the main supplement owners feed benefits a horse's joint health and that the first through fifth ingredients are as follows: complex carbs, fats, minerals and vitamins, simple starches, and proteins. The conclusion for this project was that most owners agreed the main supplement fed is for joint health. However, the first five ingredients changed; they read as follows: complex carbs, complex carbs, vitamins and minerals, fats, and lastly, simple starches. A lot of the owners who responded said that they feed differently depending on the season and what type of work their horses are doing.

S-3 The Effects of Color on Canine Perception

Ava Pavelka & Caylin Boelhower

Adams Central - Zac Foster

Our project is on how color affects a dog's behavior. It is important to know what colors dogs engage with the most, to better understand your companion, and see how you can best enrich their lives. Our hypothesis is that if dogs can see blue and yellow, then they will engage with those colors more, because those colors are brighter than all other colors and more appealing to them. To conduct this experiment, we placed an identical red and blue toy in front of a dog. We called the dog to select a toy, and recorded what color of toy the dog chose. We repeated this process several times, and with a different red and blue toy, with a treat attached to it. We also played tug-of-war with our dogs, with a yellow and green toy, and timed how long the game lasted with each color, and recorded the data. We performed this experiment with several different dogs of different breeds and ages to acquire the most accurate answer. The result of our experiment was that dogs were more engaged with the blue and yellow colored toys, than the red and green. These results are consistent with our hypothesis, as we correctly predicted that the dogs would be most interested in blue and yellow. These results are more likely to be engaged with blue and yellow toys than other colors. This is something that people can take into consideration when purchasing toys for their canine companions.

S-4 Hot Backs

Colton Leach

Sandhills Public School - Zeta Greene

My purpose of my project is I was wondering what saddle pad would be the best for your horse. It was hypothesized that a wool pad would be the most affected.

Hey I was wondering what would be the best saddle pad for my horse in the summertime. I was thinking that a wool pad would be the best and would absorb the most sweat. So the plan is to take the temperature before I ride and after I ride and see which one would be the best. The pads that I would use are a wool pad and two wool pads together and a sweat pad. To see what the difference in the three pads are is what I'm thinking. My experience is still in progress. At this time I do not have enough data to report the results obtained and the conclusion.

S-5 The Effectiveness of Different Types of Windbreaks on Cattle Health During Winter Weather

Beau Bonifas

Silver Lake Public School - Kim Bonifas

The objective of this research project was determining the usage and effectiveness of different windbreaks for cattle during calving season and winter weather. A survey consisting of four different questions was sent to local cattle producers asking about their windbreak solutions during winter weather conditions and calving season. The survey received around 80 responses from cattle producers across south central Nebraska. The results showed that all of the producers with the highest death loss totals from the survey began calving in the two coldest months of the year: January and February. This suggests that when researching effective windbreaks, the extreme cold temperatures and winter precipitation must be taken into account.

Almost all of the producers with the highest death loss totals from the survey utilize pastures as their calving location. This suggests that when researching effective windbreaks, outdoor locations and the usage of trees and other natural forage as a windbreak should be studied further. Only one respondent chose no windbreak use at all. This shows that cattle producers know the value of a windbreak, and they are willing to invest their resources, time, and money towards finding suitable windbreaks that will help keep their cattle herds healthy. Overall, more ranchers utilize natural forage as a windbreak (62.8%) than any other type. The conclusions from this research can help ranchers to figure out what kind of windbreak will be the most effective for their herd.

S-6 What seed mix does birds like the most?

Hunter Douglass

Sandhills Public School - Zeta Greene

In order to conduct my experiment I measured out 100 grams of 2 different feeds. I Sat the bird feeders out at 6:50 AM and checked the weight at 3:50 PM. Then I recorded my data and refilled bird feeders. this is all I have so far my experiment is still in progress

S-7 The Effect of Sodium Nitrate on Caenorhabditis elegans Fitness

Olivia Wymer

Central City Public School - Chelle Gillian

This study was performed due to my interest in nitrate levels and pediatric cancer rates. My goal was to determine how sodium nitrate affects Caenorhabditis elegans brood count, as a measure of fitness. C. elegans are nematodes that can be maintained at a low cost and can develop in 2 to 4 days. They are simple, transparent, and have a fast lifecycle. Due to these facts and their genetic similarities to humans, C. elegans has been shown to be a good model for humans. I hypothesized that sodium nitrates would affect C. elegans fecundity, as measured by the number of progeny produced. C. elegans were treated with three different sodium nitrate concentrations and were observed throughout the reproductive cycle. C. elegans adults were transferred to a new plate each day to determine the

brood produced by individual worms accurately. Data collected showed a significant difference in the number of progeny produced at different sodium nitrate concentrations, with significantly less offspring produced at the highest level of sodium nitrates. A possible explanation for why brood counts were lower in the 100 mM concentration is that the sodium nitrate might have interfered with the development of the reproductive organs of *C. elegans* or been toxic to the eggs. To continue the study, I would like to narrow down the sodium nitrate concentrations between 10 and 100 mM and look at the effect of fecundity. I would also determine whether sodium nitrate affects egg production by counting eggs laid.

S-8 Fitness in Horses

Kora Winkelbauer

Sandhills Public School - Zeta Greene

The purpose of my experiment was to track recovery times on larger and smaller horses after doing various tasks. It was hypothesized that the 800lbs horse would take a longer recovery time than the 1100 lbs horse due to heart size.

In order to conduct my experiment I took an 800 lbs horse and 1100 lbs horse and fully tacked them. After doing this I measured both of their heart rates and recorded them. I then exercised each horse for 20 minutes. Right after exercise I dismounted and checked the horses heart rates. After recording I allowed each horse a recovery time of 15 minutes. When the 15 minutes was up I recorded the heart rate again to see which horse had the higher heart rate after 15 minutes of exercise.

This experiment is still in progress. At this time I do not have enough results to obtain a conclusion.

Behavioral & Social Sciences

S-9 How Students and Teachers Feel about the Cell Phone Policy in High School

Blake Cantrell

Silver Lake Public School - Kim Bonifas

This project is how teachers and students feel about their cell phone policy in their school, while also a cell phone can be a distraction for students during class. During this project it will show whether having your cell phone on you during class, or school activities will cause having a bad future and bad grades. The first step into this project is to gather students that have cell phones. The second step is to give both the teachers and students a survey of questions to answer about how much they are on their phone, what their school cell phone policy is, and what their GPA is. The third step is to see if the students, teachers agree to the same questions. The fourth step is to start taking data and see if the students could lay their cell phone on the front of their desk and still have the same grade with the phone being on them. During this project data that was found, teachers, students are on their cell phones a lot during class, while this is a distraction it causes schools to have a cell phone policy such as putting it in your locker until lunch. The Graphs show which student struggles the most with having their cell phone with them, and how they feel about their schools cell phone policy.

S-10 Determining Public Perceptions of GMOs and Organic Foods

MaKenna Karr

Silver Lake Public School - Kim Bonifas

GMOs and organic foods generate opposite reactions. GMOs are met with opposition the majority of the time, while organic foods are met with enthusiasm. This research project will determine public perceptions of GMOs and organic foods with a 10-question survey distributed to random and anonymous people in the South Central Nebraska area to evaluate the knowledge and beliefs they have about GMOs and organic foods. The question for this project is do people know about GMOs and organic foods? The hypothesis for this project is that people will know more about organic foods. The study showed that out of the 85 responses that the survey received, 82% of

surveyors have heard of a GMO. 20% of surveyors said that a product being a GMO does affect whether or not they purchase the product. 82.40% of surveyors believe that GMOs are edible. 74.12% of surveyors correctly answered what GMO stands for. 7% of surveyors believe that GMOs have a positive effect on their health. 96.50% of surveyors have heard of organic foods. 38.80% of surveyors said that food being organic does affect whether or not they purchase it. 71.80% of surveyors have seen an organic farm. 52.90% of surveyors purchase organic foods. 47% of surveyors believe that organic foods have a positive effect on their health.

S-11 Neuroscience Perception of Taste and Color Relations

Aleece Mattley & Jayleigh Kramer
Adams Central - Zac Foster

Our project is about the relationship between color and taste. We thought that we would find that people do have associations between color and flavor because people often say colors to represent flavors, like "I like red flavored." We tested this hypothesis by making yellow grape flavored rock candies and having thirteen test subjects of various ages and both genders try them and tell us what they think the flavor is. We followed suit with another similar experiment using blue watermelon flavored candies. We found that most people seemed to associate flavor and color because very few people found the yellow candy to be grape flavored, only four, and no one found the blue candy to be watermelon flavored. Our results seem to be consistent with what we thought would happen because only four out of the thirteen people that we tested were able to correctly name the flavor as grape, and that was the most we had correct out of both experiments. These results show that people do seem to associate flavor and color, which means that when you see food of a certain color you probably think that it should be a specific flavor, or at least not flavors that are not usually that color.

S-12 Peripheral Vision Effect On Basketball Performance

Lane Conway & Paxton Sorensen
Silver Lake Public School - Kim Bonifas

In this project, we will evaluate the effects of peripheral vision on sports performance. The results of this project would show what is the best way to enhance an athlete's peripheral vision. It would impact today's athletes by improving performance in just a short period. We are interested in this project because we would like to improve all people's athletic performances and our own. This Project will include the testing of peripheral vision on sports performance. We will be using a variety of different vision blockers to no vision blockers to see which provides the athlete with the best and most optimal sports performance. Nobody has done this exact project; many people have opinions that peripheral vision helps sports performance. Some of the things found were that better peripheral vision helps reduce injury and help improve athletic performance. The results of this project would benefit society by increasing any athlete's overall performance and preventing injury. Our hypothesis for this experiment will be that having vision correctors such as glasses or contact lenses will be the leading project with the best result for the athletes. From this project, we learned that not having your peripheral vision has a small effect on your performance in basketball. The subjects in the project with the vision blocker goggles missed one or two shots compared to what they made without the vision blockers, which is not a significant difference but can still play an important role in your basketball performance.

S-13 The Effect of Caffeine On Sleep, Anxiety, Heart Rate, and Blood Pressure

Emma Schmidt & Mckenna Pankoke
Silver Lake Public School - Kim Bonifas

This project is about determining if heart rate, blood pressure, sleep, and anxiety are affected by drinking a certain amount of caffeine. In this project research has been conducted by previous scientists. The results showed that some people's blood pressure was affected by caffeine. Also shows that many people have different reactions to caffeine like their heart rates. Some of their heart rates were a lot higher with caffeine and some remained nearly the same or even lower without caffeine. They also differed on how they affect them physically like the amount of sleep they get at night and the increase of anxiety they feel throughout the day. Many people felt that anxiety

overall was worse and had an increase of it when they had caffeinated drinks in their system. There were some who also said that it helped calm their nerves when drinking caffeine. That's the same with sleep two people said that they got better sleep and the rest said sleep was worse with caffeine. This can conclude that caffeine has an effect on everybody differently.

S-14 Peripheral Vision Effect On Basketball Performance

Emma Schuele

Central City Public School - Chelle Gillian

Anxiety rates in children ages 3-17 have increased in recent years, so there is a need for easily implemented stress relief strategies. Therefore, I tested the effect of music on stress. Music influences our everyday lives, and has done so for many centuries. It uses both sides of the brain, with the left side of the brain being used for languages and speaking, and the right side of the brain being used for musical and artistic expression. Problem-solving is an important part of everyday life and as a society, we are currently faced with problems of increasing complexity, so there is a need to increase creativity to help solve these problems. The question I asked was if music has the ability to decrease anxiety and increase creativity levels. I compared listening to music to just sitting in silence. There were twenty participants in this study, and each session was approximately thirty minutes. The type of music played was popular music, and it was all instrumental to avoid distractions from singing. The paired t-test showed a significant effect on the anxiety scores, but not the creativity scores. Lower anxiety scores after listening to the music were observed, so further investigation to confirm the results is warranted. It is important to integrate music into our lives. Whether it is listening to our favorite song on repeat, or just hearing a jingle that gets stuck in our head, music will always be an important part of our lives.

S-15 Did This Catch Your Eye

Shelby Schueki

Sandhills Public School - Zeta Greene

The purpose of my experiment was to determine which packaging color was picked the most. It was hypothesized that red would stand out the most and would be picked the most out of other colors. I pulled data from four different tests online and combined them to compare different colors of packaging to each other. I looked at different types of sales to figure out the color that sold the best. My experiment is still in progress. At this time I do not have enough data to report the results obtained and the conclusion.

S-16 Farmer and Consumer Perspectives on Traditional and Alternative Meats

Sophie Schmidt & Kamille Karr

Silver Lake Public School - Kim Bonifas

What are farmer and consumer perspectives on traditional and alternative meats? This project examines farmers' and consumers' perspectives on traditional meat and alternative meat. To find this data, a survey was sent out to several farmers and consumers, getting their opinions on different aspects of traditional and alternative meats. This data will be collected and typed in a Google Sheet, then analyzed using charts and graphs. The outcome will show what type of meat farmers and consumers like to eat, whether it being traditional or alternative meat. The results should show that both farmers and consumers choose traditional meat over alternatives because traditional meat is widely known around central Nebraska, so many more people consume traditional meats around here. When sending the questionnaire out, many different perspectives were shown. When asked what they preferred, around ninety percent chose traditional meat and the other ten percent chose alternative meat. Three-fourths were familiar with alternative meats, while one-fourth of the farmers and consumers had not heard of it. When asked if they had tried both alternative and traditional meats, sixty percent said yes and forty percent said no. The option they had preferred between the two was traditional meat and the reason they had chosen it was the taste, and they trusted a farmer more than a lab. Results from the survey showed that many farmers and consumers will still choose to consume traditional meats, the reasons behind them give more perspectives as to why they will continue to eat the meat.

S-17 The Effect on the Structural Anatomy and Flying Patterns of Blue Light Exposure on Drosophila Melanogaster

Nora Snell

Adams Central - Jay Ceclre

Too much of anything is not a good idea, regarding your phone, computer, or TV, all emit blue light. Blue light exposure can affect humans in many ways as well as different organisms when tested on like Drosophila, or fruit flies. Eye strain, disrupted sleep cycles, insomnia, retinal damage, are just some of the various ways blue light is harmful. Researching the fruit fly and the structural anatomy, I realized that parts of the fly can be hurt by too much exposure. Fertility, reproduction, flying patterns, and food intake are all factors that can weaken upon blue light exposure. I left three vials filled with fruit fly food out in normal and observed them after a weekly process under white light. I did that same thing with three more vials, but put them under a blue light lamp for extended periods of time. I observed these same flies under blue light once more for graphing, filming for about a minute and 30 seconds each. All flies were among different age groups including larvae (young drosophila). I graphed their movement concerning flying patterns using fly tracking software. My results and research remained consistent with my initial hypothesis. Anatomy and the body of many of the flies put under blue light were damaged. 1Flying patterns were disrupted and obnoxious opposed to healthy flies that were in normal light. Following other flies around the vial, falling, and running into the vial, were events that occurred as well as dampened sexual reproduction (flies dying). Showing harmful side effects prevailed to be correct. These results could be very beneficial in further research in comparing how these outcomes are similar or different to us humans. (Homo sapiens and Drosophila)

S-18 Does Different Music Affect People's Memory?

Katelyn Strampher

Silver Lake Public School - Kim Bonifas

Is music bad for people's memory? Well, this science fair project will explain just that. Music has been around for more than 35,000 years and it has evolved significantly over the years. There are also many types of music people listen to every day for everyday activities like exercise, dancing, reading, or even school work. For this science fair project, multiple questions needed to be answered, but one stood out the most: is music bad for memory? And if it is, what alternatives can people try to allow them to be comfortable with how they study or learn?

Biochemistry

S-19 Does Different Music Affect People's Memory?

Anna Parks

Silver Lake Public School - Kim Bonifas

This project is going to tell what egg substitute works the best for chocolate chip cookies. The project will also help people who can't have eggs, finding substitutes that they like and work for them. Also, the egg prices are going up and it's getting harder to find eggs in many places. It could be important for society because some people have egg allergies and there are some religions that don't eat eggs like Hinduism and Jainism.

Chemistry

S-20 The Effect of Metal Types on Corrosion for Medical Implants

Sarah Musil

Central City Public School - Chelle Gillian

As the U.S. population over the age of 65 continues to grow, medical implants have become more widely used (Caplan, 2023). One of the issues doctors are having with implants is their lifespan and how to improve implants so people don't have to come back for replacement implants. I wanted to know if implant material has an effect on how long an implant lasts. I tested four different materials, titanium, stainless steel, copper and nylon-6, in three different solutions, which were hydrochloric acid, distilled water, and saline. I checked the pH and conductivity of each solution and the mass of each material weekly for four weeks. This was done for all three solutions and four materials. It was predicted that with each different type of material the pH and conductivity of the solution would be different. I also hypothesized that the mass of the material sample before and after being submerged in the solution would be different. It was determined that there was a difference in pH, conductivity and mass between the copper, titanium, stainless steel and nylon. The data supported the hypothesis that the type of metal would have an effect on the corrosion rate. Further research could be done that included bacteria, to get a more accurate look at how each metal would react inside living organisms.

S-21 The Effect of Polymer Barriers on Delayed Release Pills

Alyssa Wood

Central City Public School - Chelle Gillian

The purpose of this experiment was to see if I could make a pill that releases bath tablets at different times, to simulate delayed release pills. I chose this project because I want to be a pharmacist, and it gave me insight of what a pill would look like dissolving when it is ingested and helped me to understand how delayed release pills are made. I was attempting to learn how a delayed release pill would work since they are very big in the pharmaceutical industry. I tested how fast different types of water soluble products dissolved with only one layer on the bath tablets. I then designed a pill and ran 4 tests, each time varying the number of layers wrapped on each bath tablet and measured the time dissolved. The data showed that the yellow reached its target time (30 seconds) 7 times, purple (90 seconds) 2 times, and blue (180 seconds) 2 times. My Anova tests showed that the dissolving times were not significantly different from the target times since they were above the P-value of 0.05. Some of the bath tablets dissolved before their target time, but a reason for this could be that water could have gotten into the pill unit before I sealed it shut. To continue this experiment I would add more trials, try different water soluble products, and seal the ends of the pill unit with a bag sealer.

Energy & Transportation

S-22 The Effect of Running Surface on Running Speed

Kaden Van Pelt

Central City Public school - Chelle Gillian

Because the NFL is trying to determine whether or not to revert back to natural grass from AstroTurf, I decided to test if one playing surface was better for athletic performance. My hypothesis was that the running times would be faster on the AstroTurf field because the surface doesn't give as much and allows you to gain more traction. Five different runners ran three 40 yard dashes on both the AstroTurf and natural grass fields. Each runner took a 30 minute break for recovery after each trial. The runners alternated which field they started on, beginning with AstroTurf, then switching to natural grass. After running the experiment and analyzing the data, I found that there is not a significant difference in straight ahead running speed between AstroTurf and natural grass. Since my

hypothesis was that the AstroTurf field would produce faster results, the data does not support it. Some recommendations I'd have for further research would be to add in hybrid fields along with AstroTurf and natural grass. Lambeau Field in Green Bay is an example of an NFL stadium with hybrid turf and it would be interesting to see if running on this field would have a different effect. This study is important because it will help to weigh the pros and cons and make decisions on if it's worth it, with all of the non-contact injuries sustained on AstroTurf fields, to stick with it or switch back to natural grass.

Engineering: Electrical/Mechanical

S-23 What is the Best Type of Penetrating Oil?

Clay Plambeck & Casey Conway
Silver Lake Public School - Kim Bonifas

This project is about determining the best penetrating oil. This project is essential so that people know what the best penetrating oil brand is. This project is going to determine the best penetrating oil. Other research has been done by Lloyd Bender in Testing Different Types of Penetrating Oil. This project's hypothesis is that WD-40 will be the best type of penetrating oil used in the experiment. The hypothesis was incorrect and the WD-40 specialist turned out to be the best penetrating oil.

S-24 Mg 0.1 :ZnO 0.9 -Si Heterojunction Solar Cells Produced in a H₂ :Ar 1-x Ambient

Caleb Rowe
Central City Public School - Chelle Gillian

The purpose of this experiment was to see how the sputtering conditions of a Mg 0.1 :ZnO 0.9 -Si solar cell affect the photovoltaic properties of the cell. I chose this topic because I find solar cells fascinating, and I hope to be able to contribute to the field of photovoltaics. It was predicted that, with H₂ incorporation, sheet resistivity of the film would be reduced. I reached this hypothesis through an extensive examination of the literature. As shown in studies such as that of Gottardi (2011), incorporation of H₂, even as little as 3%, has an effect on the conductivity of a ZnO film, and additional H₂ incorporation increases the conductivity by multiple factors of 10. To extend the study conducted by Gottardi, rather than using a ZnO n-layer, a Mg 0.1 :ZnO 0.9 -Si target was used. The cells were placed in a radio frequency (rf) sputtering system for 30 minutes at room temperature with a 100% Ar ambient, and with a 90% Ar-10% H₂ ambient respectively. The data shows a difference in the base max power, base I_{sc} and base V_{oc} of the cell sputtered in the Ar-H₂ ambient. A possible explanation for this is the formation of Zn-OH which has a known lower resistance than pure ZnO. To extend this study it would be interesting to use targets of varying percent compositions of Mg, use different methods of H₂ incorporation such as water vapor, sputter films with varying substrate temperatures.

S-25 Magnesmooth: Magnetizing the Ingenuity of Transportation

Dominic Stutesman
Adams Central - Jay Ceclre

In the modern day, transportation is everything. It's how we get to our daily destinations on time and quickly. Shock absorbers are being used on all vehicles on the road today. However, some modern shock absorbers are often labeled "rough riding" or "unstable." First, shock dyno tests were performed on the pistons that I designed last year. It was hypothesized that the more voltage in an electromagnet, the stiffer the shock will react, and the less voltage, the softer the shock will feel. Next, I designed my own Electromagnetic Shock Absorber assembly to test with. My goal with the EMS testing was to see how the different weights and voltages would differ. Ten different tests were run with a self-designed Electromagnetic Shock Absorber assembly. Each test sector was designed with more weight and more voltage to test the differences between the different weight-to-time ratios. All of the trial testing of the EMS (Electromagnetic Shock Absorber) was highly consistent. Significant differences

($P < 0.05$) were seen between all groups indicating that weight and voltage affect piston travel time. I was highly impressed by how consistent the times were on the EMS results with the fluid I designed. These results supported the hypothesis. The more voltage you have in the electromagnets, the stiffer the shock will be, and the less voltage that you have, the less the shock will react to bumps and feel softer.

S-26 Designing a 3d Printed Key Holder

Landon Duester

Silver Lake Public School - Kim Bonifas

The main purpose of this project is to create a key holder that can assist the elderly in everyday life. This project may also help any who suffers from any kind of tremor or is disabled and unable to use a key. To figure out how to solve this problem for the people who struggle with this daily, a 3D printing software called TinkerCAD will be used. The printer used in this project is the MakerBot Mini 5th-gen which is a small and the perfect printer for this project. Each prototype takes about 3 to 4 hours to print, this is dependent on how many you are printing out once. All the elderly and disabled people who used the key said that the key holder helped them in their daily lives. With such simple designs and ideas, many people's lives have become easier.

S-27 Magnetic Motors

Thatcher Teahon

Sandhills Public School - Zeta Greene

The purpose of my engineering experiment is to get free energy without burning any fossil fuels. It was hypothesized that I can build a project that could make a device that could make free energy. How I built my project was I got a sheet of wood 1ft by 2ft and cut it into a Y shape. With a hole in the middle the size of the bearing I got. Then I made the syringes but put magnets on both sides of the insides of the syringes. Then glued the bearing into the hole of the Y. Then glues the syringes on the arms of the Y. Then I cut spokes out of a bike tire and bent them to fit in the syringes and on the bearing. My experiment is still in progress.

S-28 Big Bass In A Big Space

Grayson Hood & Travis Zubod

Adams Central - Jay Ceclre

Our objective for our project was to build a rotary subwoofer for an affordable price, this interested us because we've experienced bass from a conventional car subwoofer, and wanted to be able to produce that sound in a bigger environment. We built the rotary subwoofer with a 3d printer, an electric motor, a conventional subwoofer and some other hardware that we needed to finish the build. It didn't end up holding strong as we would the fan blades breaking and white noise created by the subwoofer mechanism. We found that our design could produce frequencies higher than infrasound which means that if we finalized our design we could set a crossover frequency to a conventional subwoofer higher than 20 hertz.

Engineering: Materials/Bioengineering

S-29 Testing Whether Chemical, Physical, or Hybrid Sunscreen Will Protect You Best Against UV Rays

Isabelle Weston & Riese Eckhardt

Adams Central - Zac Foster

In our project we tested chemical, physical, and hybrid sunscreen. The reason we chose this project is because we believe that you should protect your skin the best way you can. Our hypothesis is if you use chemical sunscreen, then you will be safer from UV rays and sun sickness. We believe this because chemical sunscreen is the most commonly used sunscreen. To test the different sunscreens we used a UVA sensor, and a black light. Then, to mimic

the skin we placed the sunscreen on a sheet of wax paper, and then placed it in front of the black light. The sunscreen that had the lowest UV readings, and performed the best was the hybrid sunscreen. This was unexpected because hybrid sunscreen is not as common as physical, and chemical sunscreen. Our results could persuade companies to make more hybrid sunscreens, so that people would be safer from the sun.

S-30 Determining Which Household Water Filter Clarifies Water The Best

Jeremy Sharp & Connor Donnelly

Silver Lake Public School - Kim Bonifas

There are many ways to get clean drinking water but one way is mostly used in almost every U.S household. Some countries or places on earth don't have access to clean drinking water so there are many options to help make water safe for drinking. Many companies make filters in the form of a pitcher so that you can put it into the fridge to get it cold. The normal tap water was 260 PPM before filtration. The Zero Water filter did the best with only 002 PPM after filtration. The next best one was the Pur brand and then the Brita filter that did the worst.

S-31 Which helmet is the best at preventing concussions

Trey Slechta & Maddux Pumroy

Adams Central - Zac Foster

Our research on head injuries is particularly in football. This research is testing how well football helmets deal with the stress of hits in football. This is important because every day there are concussions caused by huge collisions between players. When we started our research we thought we would find that the Speed Flex was the most effective helmet. From our research, the F-7 and the Speed Flex were very similar in results but we did find the Speed Flex as the best and the Schutt air helmet the worst. We tested the helmets with an accelerometer inside the helmet while we dropped each helmet 3 times in 3 spots from 3 feet each time. We found results to vary during our tests by human error, acceleration fluctuation with each hit, or a bit of both.

In conclusion, our results showed that these helmets help prevent concussions well but sometimes they have huge acceleration numbers that could be seen as vulnerable. Our results were similar to our hypothesis but we found that the speed flex was not as significantly better than the other helmets. These results mean we need to keep making strides in helmet development for the safety of our athletes.

Environmental Management

S-32 The Effect of Land Management Technique on Soil Aggregation, Water Infiltration, and the Microbiome

Akeyli Bush

Central City Public School - Chelle Gillian

The goal of this project was to determine the effect of land management technique on soil aggregation, water infiltration, and the microbiome. The soil was sampled from a field with a cover crop, no cover crop, and perennial cover. Soil aggregates are crucial for soil health due to their importance in holding water, maintaining soil structure, and the ability to increase microbial activity. Water infiltration is extremely important because it demonstrates the soil's ability to hold water. No significant difference in soil aggregate stability was shown. The cover crop had a higher infiltration rate than the other treatments. The microbiome results varied among the aspects tested. The perennial cover soil had higher fungi to bacteria ratios. The soil from both cultivated fields had the typical 1:1 ratio. The soil with no cover crop showed the highest biodiversity and resilience, with the cover crop having the lowest biodiversity and resilience. All of the treatments received low carbon ratings, with the lowest in the cover crop soil. Potassium and nitrogen levels were highest in the no cover crop. One of the most interesting things I found was how in depth microbial analysis can go and how much information they can show. For example, it shows how diverse the organisms in the sample are. This type of research is very important because the population is growing at a rapid rate. It is extremely important to understand the factors that influence soil, so farmers can continue to produce enough food for the population.

S-33 Soaps and Their Varying Effects on Removing Motor Oil.

Brody Knehans & Austin Greenough
Silver Lake Public School - Kim Bonifas

This project is about seeing what soap works best for getting oil off people's hands. The way we did this project was, that we got some used motor oil from my dad to be specific I got it out of our lawn mower. Then we brought it to school. Then we asked people if they wanted to do our project and the people agreed we took their hands and put some oil on their hands then we told them to rub the oil on the face of their hands. Then we used a hair dryer to speed up the drying process. Then they picked a soap they wanted to use first. Next, they washed their hands with selected soap. Then we had two to three people help us judge their score. We scored using a 1-10 method then we averaged the scores.

S-34 Fire Ecology in the Subsoil in the Sandhills

Ross Martindale
Sandhills Public School - Zeta Greene

The purpose of my experiment was to determine how a fire would affect the soil's water absorption. It was hypothesized that the absorption in the burned area would be lower than in the non-burned area. For my experiment, I decided to put three gypsum blocks into the ground at different depths: 36 inches, 24 inches, and 18 inches. I then threaded them into a piece of PVC pipe, then tied it to a T-post. I tested different sites: steep hills, rolling hills, meadow, and clay. I would test each of them with the reader every day. My experiment is still in progress. At his time I do not have enough data to report the results obtained and the conclusion.

Environmental Sciences

S-35 The Effect of Alpha Lipoic Acid on Swine Semen Viability Post Thaw

Levi Webb
Central City Public School - Kim Bonifas

The purpose of this experiment was to try to find an additional way to increase the lifespan of swine semen. Semen from three different breeds (Yorkshire, Duroc, Berkshire) that was obtained from Warren Bros Genetics was used. I added four different amounts of alpha lipoic acid (0.25mM, 0.50mM, 1.0mM, 1.25mM) to the semen and also had a control with no alpha lipoic acid. I ran 5 trials on each boar semen sample. When considering the trials, the treatment levels and the three breeds, this results in a total of 60 tests. The semen samples were placed in a freezer for 24 hours at -18°C and then put into an incubator at 17°C to thaw for 24 hours. After the semen samples thawed in the incubator, I used the Eosin-Nigrosin dye method to determine the viability. The different amounts of alpha lipoic acid affected the sperm significantly, by reducing the amount of live sperm. A possible reason that there were significantly less living sperm in the groups with the alpha lipoic acid, could be that the acid broke down the sperm cell membrane, as it is known to be involved in lipid metabolism (Selehi et al.,2019) and a major component of the cell membrane is phospholipids. To extend the study, I would like to test another substance on the swine semen or take more time and use the recommended freezing and thawing process for boar semen.

S-36 Which Toilet Paper is Best for Your Septic Tanks

Emma Strampher
Silver Lake Public School - Kim Bonifas

This project will determine what toilet paper is best for your septic tanks so it won't clog up. This will also help with absorption and what toilet paper is degradable and that is also affordable. People don't want to pay thousands of dollars because their septic tank is clogged. Today our economy's prices are extremely high and the resources we

need are too expensive. This will also help with an alternative to being clean and not having to pay thousands of dollars to unclog your septic tank.

S-37 The Effect of Microplastics on Daphnia magna

Julia Buss

Central City Public School - Chelle Gillian

Microplastics hurt animals who ingest them, especially those in aquatic environments. This experiment was conducted to gain further knowledge about the effect microplastics have on aquatic freshwater organisms. I predicted that the microplastics would have an effect on the *Daphnia magna*, specifically on their heart rate, presence of males, and survival rate. The experiment lasted for fifteen days, with 3 microplastic levels: 1mg, 4mg, and 8mg. I also had one control level with 0 microplastics, and an additional control using sediment particles with the same amounts. My null hypothesis was not rejected, with my data showing an increase in survival rate in all groups between the first and second day, except the 8 mg microplastics group. The number of living *Daphnia* in the microplastics treatments was much lower than in the sediment particle groups, but there was not enough difference to be statistically significant. If I were to conduct my experiment again I would increase the amount of microplastics and choose a different variable than the presence of males to measure the stress of the *Daphnia* more accurately. I would also like to see the effects of microplastics on *Daphnia* when combined with another type of natural particle or chemicals. Much is still unknown about the effect of microplastics, because the effects in nature differ from what is found in lab tests, due to the many variables in nature.

S-38 Pregnancy Rates in Cattle

Ella Held & Cora Martindale

Sandhills Public School - Zeta Greene

This project was conducted to determine whether or not fires affect pregnancy rates in cattle. To prove that they do we had to gather preg-checking data, cow/calf data, and heifer data. We hypothesized we would prove that fires affect pregnancy rates in cattle in a negative way. We had to obtain information on other reasons for a high open percentage when preg-checking cattle. Some of these other contributors to the high percentages include the health of cows, milk production, as well as the feed used, vaccinations, weather, and many more factors. We brought in open rate data from both the Martindale and Held ranch and the average for the Martindale ranch was 8% with the year after the fire being 23%. The Held ranch average was 7% for the years before the fire, and the year after the fire 20%. Using this data we can conclude that this year the fire's open pregnancy rates were up by a large amount. Bringing together outside factors in the high open pregnancy rates and comparing them to the pregnancy rates after a fire, we saw a drastic difference between them. Therefore we can conclude that our hypothesis was correct, fires do affect pregnancy rates in cattle.

S-39 The Effects of Clothianidin on the Immobility and Mortality of Daphnia Magna

Dakota Sage

Central City Public School - Chelle Gillian

My objective was to test different concentrations of clothianidin—a type of neonicotinoid—on *Daphnia magna*, because in 2021, the Mead-Nebraska area was exposed to high amounts of neonicotinoids by the AltEn ethanol plant. The plant used neonicotinoid-coated corn seeds to make ethanol, which produced a byproduct known as wet cake. After being prohibited by the state from continuing to sell it, the company stored the neonicotinoid-laden wet cake and wastewater outside. Neonicotinoids are a group of insecticides that first became popular in the 1990s and have continued to increase in popularity in agriculture. They work by interacting with nicotinic acetylcholine receptors (nAChRs), which are receptor polypeptides that respond to the neurotransmitter acetylcholine. Neonicotinoids overstimulate the receptors, which can result in paralysis and death of invertebrates. I used *D. magna*, which are zooplanktonic invertebrates that are commonly used in ecotoxicological studies. I hypothesized that clothianidin would affect the immobility and survival of *D. magna*. I tested 4 levels of clothianidin (control, 40 μ L, 80 μ L, 120 μ L) and took data every other day for 10 days. I ran an Anova test and descriptive statistics

afterward. No significant difference in daphnia survival was found, but on two of the days, there were significantly more immobile individuals in the higher concentration of clothianidin. The increased immobility in those treatments may be explained by hindrance of muscle function due to interference with the nAChRs, as these receptors are important in the transference of nerve impulses to muscles.

S-40 The Effect of Microplastics on Daphnia magna

Kennedy Montague & Abigail Fish

Adams Central - Jay Ceclre

The world has been polluted with small particles of plastic called microplastics for thousands of years. This brings up the questions, what kind of harm are these small particles going to do to humans? This question led us to experiment with the effects of microplastics on Daphnia magna, water fleas. Our hypothesis was if freshwater organisms and their ecosystem are infested with microplastics, then the organisms will face severe bodily damage and the ecosystem will begin to collapse. Before we began our project, we had to pulverize pellets of plastic using a coffee grinder into a powder, small enough that the Daphnia magna could ingest. To test this, we put five Daphnia magna in beakers that were polluted with three different plastics, CA, PVC.1, and PVC.2. As we went along with our experiment, we observed the Daphnia magna under microscopes and took pictures. We did have some problems with our experiment. We saw that the Daphnia magna that were in the beakers contaminated with PVC.1 and PVC.2 started dying off faster than the ones in beakers with CA plastics. At first we believed that they were starting to adapt to the microplastics. As we kept looking into it, the microplastic CA that came already powdered, was too small for the Daphnia magna to ingest, but the plastics we pulverized, the other two, eventually killed the Daphnia magna. This brought up multiple questions. We wanted to look more into these questions, and we decided to do another experiment. This time we used pellets of plastics that were much bigger in size and exposed them to Daphnia magna. Using pellets of plastic killed the Daphnia magna in a span of a week. After our two experiments, we learned that the powdered microplastics won't have as much of an effect on Daphnia magna, but larger pellets of plastic will cause the Daphnia magna to die off more rapidly.

S-41 The Effect of House Age on Water Quality

Jasmine Sumsion

Central City Public School - Chelle Gillian

The purpose of this study was to determine if drinking water contaminant levels were affected by the house age. Although the city is responsible for providing clean water to residents, they are not responsible for checking to see if the distribution pipes in peoples' homes are up to code. I wanted to evaluate whether people were receiving contaminated water through aged piping. It was hypothesized that house age would affect water quality. Samples were taken from inside taps in house age groups 1885-1931, 1932-1981, 1982-2023. Samples were also taken from city well #7 as the control. Water was run for 5 minutes and was tested for conductivity and pH. Water was then collected and a sample was sent to the University of Nebraska Lincoln to test for aluminum, magnesium, calcium, copper, iron, manganese, potassium, sodium, nitrates, nitrites, and uranium. The other samples were tested for bacteria, nitrates, copper, iron, calcium, chloride, manganese, pH, and conductivity in my high school lab. There was a significant difference in pH levels, with water from the city well having significantly lower pH than any of the house groups, but none of the other factors showed a significant difference. There was more copper found in the age group 1932-1981, a time when copper pipes/soldering was commonplace in interior plumbing. Bacteria was found in two houses, but it is likely that the bacteria came from the tap itself. Next, I would now like to see if there is a correlation between pipe material and contaminate material.

S-42 Creating a BioReactor to Grow Chlorella Vulgaris

Chase Harper

Adams Central - Jay Ceerle

Phytoplankton is one of the most vital microorganisms to all of our ecosystems acting as a biological carbon pump, removing approximately 30-50 billion metric tons of carbon dioxide annually. These life supporting organisms are on the major decline with losing 40% since 1950. The purpose of this experiment is to determine if adding Miracle Grow to water with added phytoplankton will boost the overall production rate of the phytoplankton. My hypothesis for this problem is that if there was added miracle growth in the surrounding water, then the phytoplankton will take up the nutrients and increase in numbers in a controlled environment. Setting up the experiment, there were 4 makeshift bioreactors with one to one water to miracle grow in three and one control with no Miracle Grow. Then added in 25ml of pregrown phytoplankton into each as well as air supply/heating pads. After 1.5 weeks of monitoring and stirring, they were harvested. The bioreactors with the added miracle grow created approximately .31g-.33g while the jar with no miracle grow added, created .29g. These results backed up my hypothesis since the bioreactors with the miracle growth created more than the control. Overall, implementation of this experiment to a controlled environment year around, would save our dying ocean ecosystems by creating a safe atmosphere to harbor more natural phytoplankton cultures, help our carbon dioxide pollution, as well as create more resources to be harvested for biodiesel

S-43 A Study to Determine Correlation between Nitrates and Uranium in Central Nebraska Rural Wells

Paul Johnson

Central City Public School - Chelle Gillian

This experiment was conducted because of rising health concerns due to water quality in Nebraska. Studies by the National Library of Medicine (2018) and Environmental International (2020) showed that consuming nitrates and uranium causes adverse health effects. I predicted that where high levels of nitrates are present there will also be high levels of uranium. During the summer of 2023 19 private wells within Merrick, Hall, Platte and Nance Counties were tested for water quality. Water was tested on site for pH, temperature, conductivity, and salinity. After returning to the school lab, the water was tested for E. coli using the Colilert IDEXX bacteria food test. In the high school lab I used CHEMetrics tests to determine the levels of nitrate, copper, iron, ammonia, and calcium hardness and the Hach test for chloride. Then samples were sent to the University of Nebraska at Lincoln to be tested for pesticides, nitrate-N, arsenic, chromium, uranium, zinc and other elements. The results showed almost no correlation between the uranium and nitrates. A possible explanation for the lack of correlation could be ground mineral composition or the small data pool. To continue this study it would be interesting to run correlation tests on different contaminants in connection to nitrates and uranium to see if the other substances have any effect on the occurrence of nitrates and uranium. It is important to conduct studies like this to monitor the state of drinking groundwater in Nebraska for the health and safety of the people using it.

Medicine and Health Sciences

S-44 Investigating the Effects of Monosaccharides, Disaccharides, and Polyols on Blood Glucose Levels

Kaytra Collins & Annabelle Trausch

Adams Central - Jay Ceerle

Investigating the effects of monosaccharides, disaccharides, and polyols on blood glucose levels. We examined the effects of glucose, a monosaccharide, sucrose, a disaccharide, and sorbitol, a polyol, on blood glucose levels. We wanted to investigate which sugar, or sugar substitute would have the least effect on blood glucose levels. We predicted that consuming sorbitol will not cause your blood sugar to spike like glucose or sucrose will. This is because sorbitol is an artificial sweetener. Artificial sweeteners do not enter the bloodstream and do not raise blood sugar directly. To conduct our experiment, we had five male and five female participants. First, we took each participant's fasting blood glucose levels. Next, they drank a Kool-Aid mixture with each specific sugar. Thirty

minutes after they finished their drink, we took their blood glucose levels again and measured the difference. After conducting our experiment, we discovered that sorbitol, a polyol, had the least effect on our participant's blood glucose levels (p-value <0.01). Our results supported our hypothesis, with sorbitol having the smallest effect. These results show that if anyone has issues with high glucose levels, like a diabetic, sorbitol would be a good alternative to sucrose or glucose.

S-45 The Effect of Major and Minor Piano Scales on the Frequencies of Human Brainwaves

Cheyenne Veach

Central City Public School - Chelle Gillian

This study was performed due to my interest in pursuing a career in music therapy. The goal was to determine if major or minor scales help humans relax and get rid of stress. I hypothesized that scales would have an effect on frequency of different brain waves produced; furthermore, major scales may increase the frequency (make the brain active) whereas minor scales may decrease the frequency (calm the brain down) due to the frequency of sound waves the notes produce. A Muse 2 brain sensing headband was connected to the Mind Monitor brain wave recording application. Baseline data of heart and breathing rate was gathered for each participant before and after each trial. The headband recorded participants' Alpha, Beta, Gamma, Delta, and Theta brain waves on the app while they listened to the C Major, F Major, A Minor, and D Minor scales on the piano. There was also a thirty second recorded time of silence. Data showed no significant difference in the brain wave frequencies during major and minor scales. A significant difference was not found between the frequencies of brain waves according to the key of scales played, though there were some differences in means of the brain wave frequencies and large ranges of frequencies. A possible explanation for the lack of significance and the large range in brain wave frequency could be the small number of trials conducted. To continue the study I would like to increase the number of trials and test a smaller age range.

S-46 Brown Fat

Shaylee Milleson

Sandhills Public School - Zeta Greene

The purpose of my experiment was to determine if cold temperatures would burn brown fat. It was hypothesized that when I collect data on cold temperature exposure to lose brown fat, then it is true and cold does burn brown fat. In order to conduct my experiment, I would measure around my waist and hips to start off. I would write down the numbers and then get a Ziploc bag. After I grabbed the bag, I would fill it with ice. Once it was filled with ice, I would put the bag of ice on the waist and hips for 15 minutes. After the 15 minutes is up, I would remove the bags and remeasure the areas and write down the data. My experiment is still in progress. At this time I do not have enough data to report the results obtained and the conclusion.

S-47 Investigating the Effects of Levetiracetam on Seizures in Shaking-Sensitive *Drosophila melanogaster*

Berkley Jacobitz & Peyton Hartman

Adams Central - Jay Ceclre

Levetiracetam, otherwise known as Keppra, is an anti-seizure medication. It is used to prevent seizures in people who have epilepsy. Due to the fact that Keppra is a preventative medication, we wanted to find out how the medication would affect the seizures themselves. To test how Keppra affects seizure severity and duration, we used shaking-sensitive fruit flies (*Drosophila melanogaster*) as a simple representation of an epileptic neurological system. If the fruit flies ingest the medication, then their seizures should decrease in severity and duration. We separated the flies into six different vials: three vials of normal food and three vials of 1.26 mg of Keppra mixed into their food. Then, we let the flies ingest the medication for seven days. Finally, after seven days, we separated the flies into individual vials without anesthetizing them and induced seizures using a vortexer. We recorded their movement right after the vortexer and uploaded the video into the software ImageJ, where we analyzed the flies'

movement. We found that there is no significant difference in the severity of the flies' seizures (T-test = 0.11) and duration (T-test p-value = 0.1); however, we have reason to believe that with more test subjects, we could see a significant difference in both severity and duration of the seizures. Our data also showed that the flies that consumed Keppra had less twitching after their seizures, meaning that they recovered from them faster (T-test p-value = 0.01). In conclusion, we found that Keppra did not significantly affect the severity or duration of the seizures, but it did affect how fast the flies got over the seizures and returned to normal locomotor behavior.

S-48 The Effect of Lower Body Training on the Risk of Obtaining a Knee Injury

Deja Fothergill

Central City Public School - Chelle Gillian

This experiment was conducted to determine the effect of lower body training on the risk of obtaining a knee injury. I chose this topic to research because the number of anterior cruciate ligament injuries tends to increase every year. It was predicted that the training would have an effect on the distance jumped, showing decreased risk of knee injury. I first gathered five participants for each group (no training and 30-day training) and assessed them in a distance jumping test. Over the course of 30 days, the training group participated in multiple exercises to help strengthen the ligaments within the knee area. After 30 days, I assessed the two groups in the exact same distance jumping test where I then compared the before and after results. The tests showed an increase in the distance jumped by those who participated in the 30-day training. Those who did not participate in the 30-day training had little to no increase with the distance jumped. I found that the lower body training exercises had a significant impact on distance jumps and therefore possibly the risk of obtaining a knee injury. If this research were to be extended, I would recommend that the same experiment take place again but, with men instead of women and I would widen a range of ages rather than using just high schoolers.

S-49 Heart Rate Under Caffeine Influence: Experimenting with Daphnia magna

Ryann King & Emilia Uhrmacher

Adams Central - Jay Ceclre

Caffeine is a big part of people's lives, we should better understand how it affects our health. If Daphnia magna consumes caffeine, the heart rate will increase. We utilized four solutions with different concentrations of caffeine. We extracted 10 Daphnia from a holding tank. One Daphnia was added to each slide and left to sit for ten minutes. During the ten minutes, they sat in the caffeine solutions or in distilled water. This experiment was replicated four times, once with the control (water) and three with our caffeine solutions. Finally we recorded the Daphnia under the microscope and recorded for ten seconds. We used a clicker to count the amount of heart beats per minute. As the caffeine concentration increased, the beats per minute (bpm) of the Daphnia increased. The standard deviations were relatively high, indicating wide variability in the bpm of the Daphnia. Increasing caffeine concentrations caused a significant increase in heart rate of the Daphnia between all experimental groups and the control group (ANOVA Test $P < 0.01$). The F-statistic is 18, which indicates a significant difference between groups. Increasing caffeine concentrations caused a significant difference in heart rate of the Daphnia across all experimental groups and the control group. These results are consistent with another experiment that found that caffeine will always increase Daphnia's heart rate. After a certain level of caffeine is passed, the heart rate will no longer increase, but will remain consistent with the other groups. Caffeine has a direct effect on Daphnia's heart rate. Due to our results, we conclude that caffeine will have a similar effect on human hearts.

S-50 Cold Phalanges

Aaron Hall

Sandhills Public School - Zeta Greene

The purpose of my experiment was to make sure your hands are always as warm as possible while cold water kayaking .

It was hypothesized that the snowmobile gloves would be the warmest and I thought that the latex gloves would be the coldest but they ended up being one of the warmest.

For my procedure I put the glove on then put the thermometer in the same slot as my middle finger and then held my hand in the water but not far enough for it to come into the top then took the thermometer out and recorded the temperature.

The snowmobile gloves were the warmest and the ski gloves were the coldest, which really surprised me.

In conclusion if I were you I would wear snowmobile gloves unless you want your fingers to fall off.

S-51 The Effect Neural Stimulation Has On Flexibility

JJ Foster & Brodie Luksan

Adams Central - Jay Ceclre

We are both inflexible athletes who want to improve our flexibility, so we wanted to see if electrical stimulation helped to improve that. We predicted that if we use electrical stimulation and thermotherapy on different participants of different flexibility, then the flexibility of these participants will increase because these methods help to relax and stretch the muscles of the applied spot. We tested the hamstring flexibility of six different boys with different flexibilities. We then applied the electrical stimulation on their hamstrings for 15 minutes. After the 15 minutes was up, we would then test the participants again to see if there was any change in their flexibility. We found that the most effective technique was to add heat while using electrical stimulation. We also found that electrical stimulation was more effective for people who struggled with flexibility than it was for people who were already considered flexible. When we did a T-test on the inflexible people the p-value was 0.01. When you compare that p-value to the p-value we got when we did the flexible group, you can tell there was a significant difference. The p-value we got for the flexible participants was 0.27. As we looked into it, the Inflexible people benefit more from this because electrical stimulation influences the mobility of the soft tissues that surround joints in the lower body. These results suggest that someone who struggles with hamstring flexibility would benefit from consistent use of electrical stimulation and thermotherapy.

S-52 The Effects of Different Drinks on Heart Rate

Isabella Whitten

Silver Lake Public School - Kim Bonifas

In this project, we will study the effects of different drinks on heart rate. Students from multiple grades and staff members will drink a certain amount of each liquid. I will use a heart rate monitor to measure the heart rate before and after they have consumed the liquid. These results will show how much their heart rate went up or down or if it stayed the same. In my opinion, if the participant drinks the substance a lot, it won't have a great effect on them, if they don't drink the substance a lot, it will affect them and their heart rate.

In conclusion, this project helped me figure out how the drinks affected the participants. The drinks with more sugar had a slight effect on the participants because many people drink sugary drinks often, and the drinks with higher caffeine levels had some effect not as great of an effect as I had imagined. The more natural drinks had no effect because they are more naturally derived than others.

Microbiology

S-53 The Effectiveness of Antibacterial Cloths on Removing Bacteria from Table Surfaces

Landen Purvis

Central City Public School - Chele Gillian

The goal of this study was to determine whether antibacterial cloths are effective at killing bacteria when compared to non-antibacterial cloths. I also wanted to see if the cost of the cloth affected the amount of bacterial colonies that grew. I hypothesized that the type of cloth would affect the amount of bacteria that is left on a surface after the surface is cleaned; additionally, I thought the most expensive brand, Norwex, would eliminate the

most bacteria. The science lab tables which I washed for this experiment were split into four sections. Each cloth was used to wash a randomly chosen section of the table. Immediately after washing, the surface was swabbed and a Petri dish was inoculated. The Petri dishes were incubated for 3 days and I counted the number of colonies that grew. The data showed a significant difference in the number of bacterial colonies when compared to an unwashed table. However, a significant difference was not found between antibacterial cloths and non-antibacterial cloths. This data doesn't support my hypothesis and also shows that high-priced antibacterial cloths may not be worth your money. A possible explanation for these results would be that all the cloths were sterilized with bleach before washing the tables, which had the potential to kill all the bacteria, as opposed to the cloth itself. If I were to continue this study, I would clean the clothes in a washing machine as intended by the producers of these clothes.

S-54 Validation that the 5-second rule is a misconception

Jordyn Pracht & Augusta Wiens

Adams Central - Zac Foster

Many people follow the five second rule in their lives. This caused us to want to discover if this "rule" was safe. After we ran our initial background research we felt more intrigued to find out if this was a misconception. When running our first experiment we took as many precautions to keep us healthy and to keep the results as accurate as possible. Then we dropped each food on the floor for five seconds then swabbed it and put it on an agar plate to grow in our HVAC system for 4-5 days. After the bacteria had grown we observed that this "rule" is a misconception all of the foods had more bacteria on them then the control variable did. This had solved our initial question but this also made us wonder if this "rule" only didn't work if it was five seconds so we tested each food at two seconds. After following the same procedure that we used to test five seconds we discovered that it was still a myth. However, the two seconds showed averagely less than the five second rule. This made us conclude that it might be safer to eat food off the floor if it was on it for less than five seconds but it would still possibly cause sickness, and that the five second rule was not safe.

S-55 Analysis of Viral Load in a NV+ D. melanogaster Model of Fecal Oral Viral Shedding

Adelaide Buhlke

Central City Public School - Chelle Gillian

Drosophila melanogaster has been used as a model organism for research since the early 1900's. Studies involving D. melanogaster have examined anything from the basics of heredity to physiological systems. Because of their prominence in the scientific community, it's important to adequately understand D. melanogaster's mechanism of viral shedding and replication as it is excreted and ingested through the fecal-oral route. Results will communicate rates at which viral load fluctuates in D. melanogaster, data that could affect all studies involving D. melanogaster or Norovirus. This study used qRT-PCR to examine the viral load of Norovirus positive (NV+) D. melanogaster specimens when exposed to different frequencies of medium replacement. There were 25 total cages, each with 20 female D. melanogaster reared at 75°F. Groups of 5 cages were allotted different amounts of time on the food (d0, d3, d6, d12, d24). Dead D. melanogaster were collected and frozen for qRT-PCR analysis, but results were skewed due to major variability in the data; therefore, no statistical significance was produced. Trend analysis of the qRT-PCR testing showed that the longer D. melanogaster were allowed to reside on the same sample of food, the higher the viral load of NV. Accurate analysis of data is crucial to better understanding when NV is being shed from the gut of D. melanogaster through the fecal-oral route. Future research will analyze the route in relation to a more extensive and specific medium replacement regimen. Viral shedding of male NV+ flies is also important to investigate.

S-56 Bacteria In Juice

Ember Chavez

Sandhills Public School - Zeta Greene

The purpose of my experiment is to find out if unpasteurized juice will grow more bacteria than pasteurized juice and when it will become unsafe to drink. It was hypothesized If I test unpasteurized and pasteurized juice for bacterial growth and compare the plates showing growth, I think the unpasteurized juice will have the most bacteria, especially those with yellow colonies. In order to conduct my experiment I had to take pasteurized and unpasteurized juice and swab a S shape pattern in a petri dish. Then I left them in the incubator for 5 days. Observed the growth everyday. And finally I counted the colonies and kept track of the growth. My experiment is still in progress. At this time I do not have enough data to report the results obtained and the conclusion.

S-57 The effect of artificial sweeteners on the genotoxicity of E. coli.

Jerzie Schindler

Central City Public School - Chelle Gillian

I conducted this study to determine whether artificial sweeteners are genotoxic, because there was a 200% increase in the use of artificial sweeteners in the US between 2000-2012 (Sylvetsky, 2017). I used the mutation rate of E. coli to determine genotoxicity. I predicted that the artificial sweeteners would have an effect on the mutation rates of E. coli because the American Cancer Society has stated that aspartame has shown an increased risk of some blood-related cancers (leukemias and lymphomas) and other types of cancer. I ran an SOS-Chromotest on three different sweeteners. The SOS-ChromoTest measures the activity of the SOS system that functions to repair DNA. The more active the system the more potential DNA damage. The test produces an SOS-Induction Factor (SOSIF), where a factor above 2.0 is genotoxic. The data collected showed no genotoxicity, as none of the SOSIF for any of the sweeteners were above 2.0. A possible explanation for this could have been that the test did not accurately simulate conditions in the human body, such as how the liver metabolizes substances. There is a genotoxicity test that includes S9 activation, which more closely resembles metabolism in a human's body. To extend this study it would be interesting to test a higher concentration of artificial sweeteners with the S9 activation. This type of research is important, because many food additives have not been thoroughly tested before being placed on the market.

S-58 The Effect of Bacillus subtilis on the Biodegradation of Clothianidin

Ziara Larson

Central City Public School - Chelle Gillian

Water contamination is a common form of pollution especially prominent in locations that are heavily farmed. The contamination depletes water-based ecosystems, and can cause harmful insecticides to travel through water systems. Insecticide is a term used for chemicals used to kill insects to keep them off of crops. Clothianidin is one type of insecticide and is one of the main insecticides in wet cake, which is a byproduct of pesticide-treated seed corn that has been used to make ethanol. Wet cake is typically sold to farmers to be used as a fertilizer, but AltEn, an ethanol plant in northeast Nebraska, was found to be storing wet cake with toxin levels above the legal threshold. 84,000 tons of wet cake was left, illegally, outdoors after AltEn was shut down. Following this incident, the soil, air, and water in the area became contaminated. Clothianidin was found in multiple home water systems in the nearby town of Mead. This is where the inspiration for my research project came from. I learned about biodegradation, a process that involves using bacteria to degrade toxic chemicals, in my biology class. Compared to other methods, this is the most cost efficient and effective way to dispose of this chemical waste. Using this information, I worked to find a specific bacteria that would be able to degrade neonicotinoids, which is the group of insecticides that clothianidin is in . After reading an article that specified bacteria that have biodegradation abilities, I found one that would be possible to work with in my high school lab. Bacillus subtilis is an aerobic, non-toxic bacteria that is capable of biodegradation. My hypothesis was that Bacillus subtilis would be able to successfully biodegrade clothianidin.

S-59 The Validity of the Five- Second Rule

Catherine Lehn

Adams Central - Jay Ceerle

A number of different bacterial species can be found on the floor, which can prove to be problematic when food is dropped onto it. I investigated if the classic 'five second rule' holds true by exploring whether the time food spent on the floor affects the quantity of bacteria that gets transferred to the food. I applied E. coli grown in Luria nutrient broth to a sterilized square foot of tile. I measured by spectrophotometry the amount of bacteria on the food (apple slice, cookie, and bread) before contact with the tile and after contact with the tile at different time intervals. There was a statistically significant difference ($p < 0.01$) in the amount of bacteria on each food after it came into contact with the tile compared to before it came into contact with the tile. There was not a statistically significant difference in the amount of bacteria that was on the food relative to the amount of contact time (1 sec, 5 sec, 10 sec). There was also not a statistically significant difference in the amount of bacteria collected on the different types of food. I was able to demonstrate that bacteria is transmitted upon immediate contact as opposed to increasing over time.

S-60 The Effect of Cooking Appliances on the Time it Takes Hamburger to Reach a Safe Internal Temperature

Madison Chrisman

Central City Public School - Chelle Gillian

The purpose of this experiment was to see if different cooking appliances affect the time it takes for hamburger to reach a safe internal cooking temperature. I chose this experiment because of food-borne illness issues and all the new cooking devices that are supposed to cook food faster. It was predicted that the cooking appliances would have an effect on the time it takes hamburger to reach a safe internal temperature. Three different cooking appliances were used in this experiment: an oven, airfryer, and instapot. 80% lean 20% fat ground beef was formed into patties 11.43 cm long and 2.54 cm thick. Each appliance was preheated to 350°F and a hamburger patty was placed into each. The temperature of each hamburger was measured at 5, 10, 15, and 20 minutes until the internal temperature reached 165°F. This was repeated 3 times. The data showed no significant difference in the time it took to reach a safe internal temperature for hamburger since an Anova test found the P-value to be 0.35 ($\alpha=0.05$). These results were unable to reject the null hypothesis. For future research, bacteria growth should be measured to see if these appliances actually thoroughly cook the meat.

Physics and Astronomy

S-61 The Effect of Total Spin, True Spin, and Spin Efficiency on Vertical and Horizontal Break

Luke McHargue

Central City Public School - Chelle Gillian

I chose this project because I love baseball, and especially pitching. I wanted to find out which statistic would be the most accurate in predicting pitch location. For this project, I tested the effect of total spin, true spin, and spin efficiency on vertical and horizontal break using Rapsodo technology. I hypothesized that total spin, true spin, and spin efficiency would have an effect on vertical and horizontal break. To test this, I took pitching data from five different collegiate pitchers and uploaded it to a spreadsheet. I then ran a correlation test between total spin, true spin, and spin efficiency (independent variables) and vertical and horizontal break (dependent variables). This made a total of six tests. My research showed that there was not a significant correlation between total spin, true spin, or spin efficiency and vertical and horizontal break. This tells us that other factors, such as spin direction, probably have a larger effect on pitch location. If I were to do a similar project, I would test spin direction in addition to the other independent variables. I would also use a bigger sample size, such as the entire MLB. This research is important because it can help baseball players, coaches, and recruiters all around the world understand what goes into pitch location.

Plant Sciences

S-62 The Effect of Trash Bags on Plants

Londyn Fisher

Central City Public School - Chelle Gillian

This project was about the effect on trash bags on Wisconsin Fast Plants. Wisconsin Fast Plants generate offspring in 40 days and are related to cabbage. Trash bags are made of polyethylene. I wanted to test trash bags on plants because of the amount of trash, and therefore trash bags, in garbage dumps. I hypothesized that less seeds would germinate, the plants would be shorter and that they would be a lighter green color than the plants with regular soil. I had eight experimental and eight control plants. The experimental plants were planted in soil that contained small pieces of trash bags. The germination and stem length hypothesis were not supported because it was found that trash bags had no effect on germination and stem length. This may have been because low-density polyethylene doesn't break down for 20 to 30 years. The plant color hypothesis was supported by the data because there was a negative effect on plant color. This may have been because the trash bags prevented water from getting to the plant roots. The lack of water in leaves influences the effects of chlorophyll and makes the leaves a lighter color.

S-63 The Yield of Tomato Plants Versus Different Watering Techniques

Addison Schmidt & Katy Soucek

Silver Lake Public School - Kim Bonifas

This project is going to determine the yield of tomato plants over a seventeen week time period. The hypothesis for the experiment is that the drip irrigation method would be the most effective. For this project we planted Roma tomato seeds, 3 in each pot. Then started the different watering system techniques as soon as they started to sprout. After that, we collected data over a seventeen week time span. Finally, we put all of our data into google sheets to make graphs and charts. The results from this project determined that our hypothesis was incorrect. The best irrigation method was the surface irrigation system which sprouted 64 flowers on the Roma tomato plant. The height of the plant was 64 inches tall. This proves that the surface irrigation system is a better method than the drip irrigation system and the sub irrigation system.

S-64 The Effect Of Thrive Fertilizer On Wisconsin Fast Plants

Landen Villa

Central City Public School - Chelle Gillian

This project was about the effect of Thrive fertilizer on Wisconsin fast plants. Thrive fertilizer is used for growing plants. It is made of potassium nitrate, potassium phosphate, potassium sulfate, magnesium sulfate. I wanted to test the thrive fertilizer because I wanted to see how big of a difference the fertilizer really had from Wisconsin fast plants. The question being asked was "What is the effect of the thrive fertilizer of the Wisconsin fast plant?". I thought the fertilizer would cause more seeds to germinate, the plants to be taller and be a darker green color. Four control and experimental plants were tested. The experimental plants were planted in soil mixed in with Thrive fertilizer. Germination data was taken once. Plant height and color were taken four times. The germination hypothesis was supported by the data because it was found that Thrive fertilizer had a positive effect on germination. This may have been because there are more nutrients available to the plant than the normal fertilizer we added to the control plants. The stem length hypothesis was not supported by the data because there was a negative effect on the stem length. This may have been because Thrive fertilizer contained less nitrogen than the control fertilizer. Nitrogen is one of the most important minerals that factor into plant growth. The plant color hypothesis was not supported by the data because there was a negative effect on plant color. This may have been because of a lack of nutrients.

S-65 The Effect of Strong Magnetic Fields on Wisconsin Fast Plants

Josiah Hagemeyer

Central City Public School - Chelle Gillian

This project was about the effect of magnetism on plants. Wisconsin Fast Plants were used. Wisconsin Fast Plants are plants that were genetically developed by Professor Emeritus Paul H. Williams to be used for research. Magnetic fields are used for producing electricity and are made of moving electrical charges in metals. I wanted to test magnetic fields because I wondered if they would have an effect on the resources absorbed by the plant. The question being asked was "Do magnetic fields affect the growth rate of plants?". I hypothesized that exposing the seeds to a stronger magnetic field would cause more seeds to germinate, greater stem length, and a darker color because magnets cause water molecules to group in smaller groups. Seven control and experimental plants were tested. They were planted in Styrofoam quads. Germination data was taken once. Plant height and color were taken four times. The germination, stem length, and color hypotheses were supported by the data. More seeds germinated, the stem length was increased, and the experimental plants were darker. This may have been because magnetic fields break groups of water molecules down to 5-6 molecules per group instead of 12 or more molecules per group. This makes the seeds able to absorb water faster, which increases the germination rate. More water causes gibberellins to activate which increases the stem length of the plant. The plants were a darker color because they needed more energy to keep up with the increased amount of water they were absorbing.

S-66 The Effects of Increased CO₂ on Zea Mays Plants

Greeley Fitzke

Adams Central - Jay Ceclre

I examined the effects of increased CO₂ on Zea mays plants in an "environment" that consisted of the plants being under a clear plastic bag. Three plants that were just covered with the plastic bag and three plants that were placed under the plastic bag while also being supplied with an increased amount of CO₂. If corn is exposed to more CO₂, then the plant's height will be greater, because of the exposure to CO₂, because more CO₂ speeds up the process of photosynthesis. Five out of the six pairings P-value ($P > 0.05$) explained that there was little to no indication that the groups may have a difference. On the other hand, the pairing between Experimental Day 1 and Control Finals P-value indicated that there was some confidence that the groups are different. With further measurement we may be able to have more confidence that the Experimental Day 1 and Control Final may show more of a difference. My hypothesis, increased concentration of CO₂ will have a significant difference between Zea mays plants in atmospheric conditions, is supported.

S-67 The Effect of Ice Melting Salt on Wisconsin Fast Plant

Trent Detlefsen

Central City Public School - Chelle Gillian

This project was about the effect of ice melting salt on the germination of Wisconsin Fast Plants. Wisconsin Fast Plants are plants that were genetically modified by researchers at the University of Wisconsin in order to conduct research faster. Ice melting salt is used for removing ice from paved surfaces like sidewalks or streets. It is made of calcium chloride, potassium chloride, magnesium chloride, and/or urea, also known as carbonyl diamide. I wanted to test ice melting salt because in states farther north than us like in Minnesota or Montana they use lots of ice melting salt on their roads. I hypothesized that if ice melting salt is added to the soil, less seeds will germinate, the stem length will be shorter and the color will be lighter. Four control and eight experimental plants were tested. The experimental plants were planted in soil that contained ice melting salt. Germination data was taken once. Plant height and color were taken four times. The germination and stem length hypotheses were supported because it was found that ice melting salt had a negative effect. This may have been because while the cells were developing the salt was pulling water out of the cells causing them to die. The plant color hypothesis was supported because there was a negative effect on plant color. This may have been because without enough water the plant would have had trouble making chlorophyll, which determines the plant's green color.

S-68 Is Conventional Till Better Than No-Till?

Trevor Kral

Silver Lake Public School - Kim Bonifas

This project was made because of the farmers in my area. The farmers in my area like using No-Till so I'm going to put it to a test. I put 8 total plots: 2 dryland conventional and 2 dryland no-till. I did the same for the Irrigated 2 irrigated conventional Till and 2 irrigated No-Till. I saw that the Conventional Till on all plots emerged unevenly versus in the No-Till none of that happened. As a result of the Conventional Till emerging unevenly there were inconsistent sizes of the ears. This will definitely help the farmers in our area improve their bushels to the acre. I hope farmers in my area will take this research into acknowledgement. In the end No-Till is better to use on all of your corn ground in South Central Nebraska.

S-69 The Effect of Matches on Fast Plants

Parker Santin

Central City Public School - Chelle Gillian

This project was about the effect of matches on plants. Matches contain potassium chlorate, sulfur, fillers, and glass powder. I hypothesized that more seeds would germinate, the stems would be taller and the plants would be a lighter color than plants without matches in the soil. The experimental plants were planted in soil with match tips mixed in and one matchstick in each corner. The germination hypothesis was not supported because it was found that matches had a negative effect. This may have been because of some of the harmful chemicals that the plant absorbed while germinating, such as potassium chlorate, potassium dichromate, and too much phosphorus. Too much of these can be detrimental to plants' health. The stem length hypothesis was not supported because there was a negative effect on the stem length. This may have been because of the harmful chemicals in the match tips. Nutrients like phosphorus can be good for plants, but I think that an overload of phosphorus and chemicals in plants causes them to not be able to grow. Excess phosphorus can interfere with the uptake of other essential nutrients, such as iron and zinc, which can lead to deficiencies and affect plant growth. It can also cause reduced root growth leading to shallow and weak root systems. The plant color hypothesis was supported because there was a negative effect on color. This may have been because the plants were not able to grow and as a result, they stayed a lighter yellow color.

S-70 What is the effect of Stevia artificial sweetener on Wisconsin Fast Plants?

Jagger Schindler

Central City Public School - Chelle Gillian

This project was about the effect of matches on plants. Matches contain potassium chlorate, sulfur, fillers, and glass powder. I hypothesized that more seeds would germinate, the stems would be taller and the plants would be a lighter color than plants without matches in the soil. The experimental plants were planted in soil with match tips mixed in and one matchstick in each corner. The germination hypothesis was not supported because it was found that matches had a negative effect. This may have been because of some of the harmful chemicals that the plant absorbed while germinating, such as potassium chlorate, potassium dichromate, and too much phosphorus. Too much of these can be detrimental to plants' health. The stem length hypothesis was not supported because there was a negative effect on the stem length. This may have been because of the harmful chemicals in the match tips. Nutrients like phosphorus can be good for plants, but I think that an overload of phosphorus and chemicals in plants causes them to not be able to grow. Excess phosphorus can interfere with the uptake of other essential nutrients, such as iron and zinc, which can lead to deficiencies and affect plant growth. It can also cause reduced root growth leading to shallow and weak root systems. The plant color hypothesis was supported because there was a negative effect on color. This may have been because the plants were not able to grow and as a result, they stayed a lighter yellow color.

Junior Division Index of Entries

Last Name	First Name	Project #	Page #
Beck	Lane	J-4	9
Bonifas	Jordan	J-9	11
Brandes	Hailey	J-28	17
Bray	Hunter	J-13	12
Brogdon	Elijah	J-2	8
Buhlke	Amelia	J-15	13
Cecrle	Claire	J-5	9
Chavez	Cesar	J-7	10
Dumler	Abby	J-10	11
Ferris	Eli	J-27	16
Fruit	Kindrey	J-25	16
Gibson	Lee	J-9	11
Glidden	Sophia	J-12	12
Gomez	Araya	J-29	17
Held	Tyla	J-1	8
Hemberger	Molly	J-16	13
Himmelberg	Brooklyn	J-14	12
Karr	Graham	J-17	13
Karr	Kaylee	J-14	12
Larsen	Heath	J-18	14
Morrow	Josie	J-30	17
Moser	Sophia	J-26	16
Negus	Sofie	J-22	15
Pankoke	Alivia	J-17	13
Root	Gavin	J-21	14
Schindler	Journi	J-23	15
Sharp	Justin	J-11	11
Sorensen	Ava	J-29	17
Soucek	Libby	J-10	11

Sutton	Mason	J-8	10
Swisher	Tristen	J-6	10
Talbott	Kalyn	J-24	15
Zutavern	Mattee	J-3	8
Zutavern	Paizley	J-19	14

Senior Division Index of Entries

First Name	Last Name	Project #	Page #
Bartels	Karah	S-2	19
Bonifas	Beau	S-5	20
Buhlke	Adelaide	S-55	36
Bush	Akeyli	S-32	28
Buss	Julia	S-37	30
Boelhower	Caylin	S-3	19
Cantrell	Blake	S-9	21
Chavez	Ember	S-56	36
Chrisman	Madison	S-60	38
Collins	Kaytra	S-44	32
Conway	Lane	S-12	22
Conway	Casey	S-23	26
Cox	Kallan	S-1	19
Detlefsen	Trent	S-67	40
Donnelly	Connor	S-30	28
Douglass	Hunter	S-6	20
Duester	Landon	S-26	27
Eckhardt	Riese	S-29	27
Fish	Abigail	S-40	31
Fisher	Londyn	S-62	38
Fitzke	Greeley	S-66	40
Foster	JJ	S-51	35
Fothergill	Deja	S-48	34
Greenough	Austin	S-33	29
Hagemeier	Josiah	S-65	39
Hall	Aaron	S-50	34

Harper	Chase	S-42	32
Hartman	Peyton	S-47	33
Held	Ella	S-38	30
Hood	Grayson	S-28	27
Jacobitz	Berkley	S-47	33
Johnson	Paul	S-43	32
Karr	MaKenna	S-10	21
Karr	Kamille	S-16	23
King	Ryann	S-49	34
Knehans	Brody	S-33	29
Kral	Trevor	S-68	41
Kramer	Jayleigh	S-11	22
Larson	Ziara	S-58	37
Leach	Colton	S-4	20
Lehn	Catherine	S-59	37
Luksan	Brodie	S-51	35
Martindale	Cora	S-38	30
Martindale	Ross	S-34	29
Mattley	Aleece	S-11	22
McHargue	Luke	S-61	38
Milleson	Shaylee	S-46	33
Montague	Kennedy	S-40	31
Musil	Sarah	S-20	25
Pankoke	Mckenna	S-13	22
Parks	Anna	S-19	24
Pavelka	Ava	S-3	19
Plambeck	Clay	S-23	26
Pracht	Jordyn	S-54	36
Pumroy	Maddux	S-31	28
Purvis	Landen	S-53	35
Rowe	Caleb	S-24	26
Sage	Dakota	S-39	30
Santin	Parker	S-69	41
Schindler	Jerzie	S-57	37

Schindler	Jagger	S-70	41
Schmidt	Addison	S-63	39
Schmidt	Emma	S-13	22
Schmidt	Sophie	S-16	23
Schuele	Emma	S-14	23
Schukei	Shelby	S-15	23
Sharp	Jeremy	S-30	28
Slechta	Trey	S-31	28
Snell	Norah	S-17	24
Sorensen	Paxton	S-12	22
Soucek	Katy	S-63	39
Strampher	Katelyn	S-18	24
Strampher	Emma	S-36	29
Stutesman	Dominic	S-25	26
Sumsion	Jasmine	S-41	31
Teahon	Thatcher	S-27	27
Trausch	Annabelle	S-44	32
Uhrmacher	Emilia	S-49	34
Van Pelt	Kaden	S-22	25
Veach	Cheyenne	S-45	33
Villa	Landen	S-64	39
Webb	Levi	S-35	29
Weston	Isabelle	S-29	27
Whitten	Isabella	S-52	35
Wiens	Augusta	S-54	36
Winkelbauer	Kora	S-8	21
Wood	Alyssa	S-21	25
Wymer	Olivia	S-7	20
Zubod	Travis	S-28	27