



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Raya Abu-Tarif; Alesha Qureshi; Jude Tahrawi</b>	<b>Project Number</b> <b>J1201</b>
<b>Project Title</b> <b>The Effect of Age on Lung Capacity</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective of this project is to determine how age affects lung capacity.</p> <p><b>Methods</b> 1 liter soda bottle, 1 camera, 1 balloon, chemical- Bromothymol blue, Straws- 3 for each person, 75 cotton balls , Digital Timer, Test Subjects-People with different age ranges: 25 people in all, pH strips 75- Brand: lab supplies, 1 Ruler, Gloves- 4 pairs, Goggles-3 pairs, Distilled water Temperature: 90.7 F, mL measuring cup, 1 pair of adult scissors, 1 toothpick</p> <p><b>Results</b> We found that people who were younger took a shorter amount of time than those who were older. However, those in the age range of 17-25 years took the shortest amount of time to change the color of the solution, they also got the best and most consistent pH. We also found that the people that were really young and really old were taking multiple breaths in between. But those in the middle of those two age ranges didn't take many breaths, meaning that they could hold their breath for a longer period of time. Overall, we found that the age range 17-25 years took the least amount of time while still getting very good results for their pH that were consistent.</p> <p><b>Conclusions</b> Our hypothesis was that as people age their lung capacity decreases. Our independent variable was the people's age. Our dependent variable is the amount of time taken to change the color of the chemical solution. Our controlled variable was the amount of the chemical and water in each trial. Our hypothesis was proven correct because the amount of time it took for older people to get the perfect pH took longer than someone who is younger. This proves that it becomes harder for older people to exercise and move around. Therefore, as you age your breathing pace lessens but it still produces good air quality.</p>	
<b>Summary Statement</b> After testing the time and pH of different people we found that as you grow older it takes longer for you to produce good quality air.	
<b>Help Received</b> We built the testing device on our own, however we got information from the website sciencebuddies.org to do the experiment	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Sae Ackerstein</b>	<b>Project Number</b> <b>J1202</b>
<b>Project Title</b> <b>Warming Seas, Warmer Seals: How Different Seal Species Thermoregulate</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> In order for the seal population to endure global warming, these animals are likely to need to adapt to warmer water temperatures. As the water temperatures increase, these seals may have to increase their capacity to cool off so they will not overheat. I wanted to see which of the three species I observed (Hawaiian Monk Seal (Tropical), Bearded Seal (Arctic), and Ringed Seal (Arctic)) would be able to do this the best based on thermal imagery.</p> <p><b>Methods</b> In December of 2018, I went to Dr. Terrie Williams office at Long Marine Laboratory at The University of California, and used an infrared camera to take pictures of three different seal species, a Ringed Seal, a Bearded Seal, and a Hawaiian Monk Seal. The infrared camera captures the surface temperature of the object you point it at and by using this device, I was able to identify major areas of each seal that lose or retain the most heat. Using two apps called Flir One and Flir Tools, I took pictures of the seals and then analyzed them.</p> <p><b>Results</b> There is a correlation between the size of the seal and the amount of heat loss. The Monk Seal is the largest seal, weighing 192.5kg with an average maximum temperature of 25.62 (C). In contrast the smallest seal, the Ringed Seal, weighs 29.9kg and has an average maximum temperature of 18.08 degrees (C). The difference between the maximum and minimum average temperatures within an individual seal decreases as the seal gets smaller, The Ringed Seal is smallest, showing about 5 degree difference; the Hawaiian Monk Seal is largest and has around a 7 degree difference.</p> <p><b>Conclusions</b> The Hawaiian Monk Seal displays many of the highest temperature data points, including the highest and third-highest, and the data shows very little range between temperatures. This suggests that the Hawaiian Monk Seal would be able to adapt the most easily, based on my hypothesis that seals with the ability to release more heat will find adaptation to climate change easier.</p>	
<b>Summary Statement</b> I used thermal imagery to compare temperatures in various body parts of three species of seal in an effort to understand the species relative ability to adapt to warming ocean temperatures.	
<b>Help Received</b> I developed this project independently but received advice and access to the three seals from my mentor, Dr. Terrie Williams of the UCSC Long Marine Laboratory.	



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<b>Name(s)</b> <b>Amogha Akkati</b>	<b>Project Number</b> <b>J1203</b>
<b>Project Title</b> <b>Effects of Exercise: Changes in Carbon Dioxide Output</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> My goal was understanding how carbon dioxide in your breath was affected when you did exercise and when you were calm. The question is what happens to carbon dioxide levels in exhaled air before and after physical exercise.</p> <p><b>Methods</b></p> <ol style="list-style-type: none"><li>1. Fill one clear plastic bottle half full with distilled water and add one teaspoon of the 0.04% bromothymol blue solution to observe a green color.</li><li>2. Cut about two inches from one side of the tube for the aquarium pump. Insert the safety valve in between both pieces of tube.</li><li>3. Cut a two-inch piece off a straw. Use this as the outlet tube of the respirometer.</li><li>4. Using the aquarium pump tube, the straw, and the modeling clay, set up the respirometer. Make sure that the inlet tube reaches all the way to the bottom of the bottle. The outlet tube should stay above the indicator solution.</li><li>5. Fill the second bottle with the same amount of water as the first one and again add one teaspoon of bromothymol blue solution. Make sure the solution has the same color as the previous one and set the bottle aside as a control for color comparison.</li><li>6. Use the Science Journal app to monitor the color change of the indicator solution. In this project, people can use the app to record the color change in the solution once the pH indicator turns from neutral to acidic. Open the Science Journal app on a phone and select the light sensor. Clearly label the experiment and recordings.</li><li>7. Lean the phone against a box or books with the light sensor facing sideways towards the respirometer. Then place the respirometer in front of the light sensor. Put the flashlight in front of the respirometer so it shines through the indicator solution directly onto the light sensor. Do not move the flashlight or the phone while recording data.</li><li>8. Confirm that the sensor readings are stable. Then, press the record button and take a deep breath; start exhaling through the inlet tube into the indicator solution for as long as it is possible. Try to exhale from the lungs and be careful to not block the sensor with the tube. Inhale through the nose when necessary, and then continue blowing into the solution.</li><li>9. Stop recording once the maximum sensor readings level off and are stable for more than 15 seconds. The sensor readings should start to stabilize once the indicator solution has changed color from green to yellow.</li></ol>	
<b>Summary Statement</b> My project explains how exercise effects Carbon Dioxide output in exhaled air in different conditions using a respirometer.	
<b>Help Received</b> None. I designed, built, researched, and performed the experiments myself. My parents monitored me while I was doing this experiment.	



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<b>Name(s)</b> <b>Ameera Alkwadri; Jasmine Hassan</b>	<b>Project Number</b> <b>J1204</b>
<b>Project Title</b> <b>Testing the Correlation between Hypothyroidism and Type 2 Diabetes in Down Syndrome Patients</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective of this project is to see if there is a link between Hypothyroidism and type 2 diabetes in patients with Down syndrome.</p> <p><b>Methods</b> In order to test how Hypothyroidism relates to type 2 diabetes we surveyed 24 subjects, 12 with Down syndrome and 12 without. We hypothesized that if patients with Down syndrome have hypothyroidism then they are likely to develop type 2 diabetes. We surveyed patients within the same age group to check if a relationship exists between Hypothyroidism and type 2 diabetes in patients without Down syndrome.</p> <p><b>Results</b> Our results showed that of all subjects surveyed, 25% of subjects without down syndrome had type 2 diabetes and hypothyroidism, and 33% of the same group had type 2 diabetes without hypothyroidism. Within the group that had Down Syndrome 25% of the subjects had type 2 diabetes and hypothyroidism, and 0% had type 2 diabetes without hypothyroidism. Even though the percentage of patients who had type 2 diabetes that did not have down syndrome was higher than the patients that had down syndrome, in all patients with down syndrome the patients had both type 2 diabetes and hypothyroidism.</p> <p><b>Conclusions</b> Based on our data it was proven that all Down syndrome patients who had type 2 diabetes had hypothyroidism. Therefore we can conclude that hypothyroidism is a contributing factor to type 2 diabetes in patients with Down syndrome.</p>	
<b>Summary Statement</b> This project was to prove that a link exist betweentype 2 diabetes and hypohyroidism in patients with Down Syndrome.	
<b>Help Received</b> We did this project on our own. Our teacher, Mrs. Alshanableh helped with guiding and motivating us. Our mothers drove us to where we needed to be and supported us throughout the project.	



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<b>Name(s)</b> <b>Gabriel Berger</b>	<b>Project Number</b> <b>J1205</b>
<b>Project Title</b> <b>Ears vs. Eyes</b>	
<b>Abstract</b> <b>Objectives</b> The purpose of this project was to find what humans react to faster, sound or light and how the pitch or color affects the reaction time. <b>Methods</b> To administer the tests, the coding language Scratch was used to make a program and said program was administered on many different people who were both male and female, ranging from 11-73. When the program was initiated by the subject, the test would invoke a random stimulus (sound or light) at a random frequency, begin a timer and wait for the subject to hit the spacebar. When the spacebar was hit, the timer would stop and the program would record the test type (sound or light), the frequency and the time results. After this, the lists of results would be exported into a folder for analysis later on. <b>Results</b> After administering the test on twenty different people, I found that the sound average reaction time was faster than light and that frequency didn't have a meaningful effect on the reaction time for both sound and light. <b>Conclusions</b> After thoroughly looking at the data, it can be concluded that the hypothesis was wrong due to a lack of trends and patterns in said data.	
<b>Summary Statement</b> My project is about human reaction time and what factors affect it.	
<b>Help Received</b> I consulted with my Dad about any problems I had while building my program on Scratch.	



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<b>Name(s)</b> <b>Madison Bigham</b>	<b>Project Number</b> <b>J1206</b>
<b>Project Title</b> <b>Does Psyllium Affect the Amount of Sand in the Horse's Digestive System?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> My goal in completing this project was to determine the effectiveness of psyllium in reducing the amount of sand in horse s digestive system.</p> <p><b>Methods</b> I collected manure samples from two horses prior to administering psyllium and subsequent to the administration of psyllium. This process occurred over a two week time frame and was tested twice, therefore resulting in four weeks of testing. I used plastic bags and water to separate the sand from the manure, and utilized a gram scale to measure the sand.</p> <p><b>Results</b> My results indicated an increased amount of sand in each horse s manure samples subsequent to the administaration of psyllium. There was a 17.2 gram increase of sand for horse one and an eight gram increase of sand in horse two. His proved that psyllium is effective in reducing the amount of sand in the horse s digestive system.</p> <p><b>Conclusions</b> In conclusion, I found through my investigation that Psyllium is effective. I discovered that it will reduce the risk of sand colic by decreasing the amount of sand in the horse s digestive system. Therefore, Psyllium should be used by all horse owners to diminish the probability of the horse colicing due to sand.</p>	
<b>Summary Statement</b> In this project I tested the effectiveness of psyllium by reducing the amount of sand in a horse s digestive system by collecting manure samples.	
<b>Help Received</b> I received help from my science teacher as well as my parents, my topic and procedure was reviewed by my vet for my horses.	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b>  <b>Logan Burns</b>	<b>Project Number</b>  <b>J1207</b>
<b>Project Title</b>  <b>Can We Improve Sleep by 25% for Only 25 Cents?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> 33 percent of American adults and 80 percent of teenagers do not get enough sleep. Yet, poor sleep is a major risk factor for breast cancer, colon cancer, prostate cancer, and many other health problems. Improved sleep is tied to increased melatonin production in the body, but other than taking melatonin supplements, most people do not have an easy way to increase melatonin in their bodies. The objective of this project is to determine whether a simple and inexpensive sleep mask improves the quality and quantity of sleep.</p> <p><b>Methods</b> My project measured sleep quality and quantity for 14 participants over two weeks. The participants did not wear an eye mask during the first week but did wear one during the second week. I created a control group of four participants that did not wear an eye mask at all during both weeks. I used Google Forms to create a questionnaire in order to learn about each participant's sleep and other habits and also the weekly sleep logs each participant kept. After I received the completed questionnaire and sleep logs from everyone, I used Google Sheets to analyze the data.</p> <p><b>Results</b> For adult participants, who were the main target of my research, total average weekly sleep hours improved by 5.7 hours, which is 12.5 percent, but the control group sleep hours only improved by 12 minutes. Total weekly sleep hours for the four children who participated in the survey increased by only 30 minutes. For both adults and children, sleep quality improved by 18% versus only 4% for the control group. Participants who did not drink alcohol had the biggest increases in hours slept. Participants who slept next to someone who snores had almost no increase in sleep hours, but the people who they slept next to (the people who snored) who also wore the mask increased their sleep hours by 30%!</p> <p><b>Conclusions</b> Rather than using expensive and possibly harmful melatonin supplements, a simple eye mask works very well in improving sleep hours and sleep quantity. Plus, an eye mask only costs 25 cents on Alibaba. In the future, this research can be expanded to include more people and more time wearing the mask. Some people said it took a few days to get used to the mask and the results would have probably been better if I had more time. Also, someone should invent a better sleep mask that doesn't fall off as much.</p>	
<b>Summary Statement</b>  I showed that sleep quality and quantity can be dramatically improved using an inexpensive eye mask	
<b>Help Received</b>  My parents helped me set up my questionnaire in Google Forms and also paid for the eye masks. They also helped me with the layout of my project board.	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b>  <b>Jason Caminiti</b>	<b>Project Number</b>  <b>J1208</b>
<b>Project Title</b>  <b>The Effects of Music on the Cardiovascular System</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The object of this study was to find out if music can change heart rate and blood pressure.</p> <p><b>Methods</b> To conduct this experiment I needed an Equate Digital Blood Pressure Monitor, IJOY Bluetooth headphones, an iPhone timer, a MacBook Air computer, and music. The subjects sat down and did nothing for five minutes. And then had their blood pressure and heart rate read. After that, they listened to music for 3 minutes and then had their heart rate and blood pressure read again. The same was done with the other types of music. For my control, I used no music and then tested the subject heart rate and blood pressure.</p> <p><b>Results</b> I found that Classical music decreases heart rate and blood pressure the most and rap music increases heart rate and blood pressure the most which was different from my hypothesis.</p> <p><b>Conclusions</b> Classical music decreased the heart rate and blood pressure the most because it had a very slow tempo. And rap music increased the heart rate and blood pressure the most because of the fast tempo. The slower the tempo the more your heart rate and blood pressure will change, and the faster the tempo, the more your heart rate and blood pressure will increase. The classical music's tempo I used for this experiment was 38 bpm which is very slow, and for rap, the tempo was 163 bpm which is extremely fast. The information gained from my project can be used by every person who has high blood pressure or heart rate and wants to bring them down. Also if somebody is stressed out, slow music can bring down stress levels.</p>	
<b>Summary Statement</b>  I found that classical music decreased the heart rate and blood pressure the most, and rap music increased the heart rate and blood pressure the most.	
<b>Help Received</b>  I designed and conducted the experiment by myself, and my mom, who is my science teacher, helped me with this project as well.	





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<b>Name(s)</b> <b>Faith Day</b>	<b>Project Number</b> <b>J1209</b>
<b>Project Title</b> <b>The Effect of Tongue Type on the Ability to Taste PTC Paper</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective of this experiment was to determine the relationship between tongue type and the ability to taste the chemical PTC.</p> <p><b>Methods</b> 71 volunteers were given a piece of PTC paper and rated the taste or the absence of taste. The results were recorded and added on to a google spreadsheet. The materials of this experiment were PTC paper, google spreadsheet and chromebook, phone camera, food dye, tweezers, cotton swabs, petri dish, and water.</p> <p><b>Results</b> Those with tongue type one will have small gustatory cells and will either barely taste or not taste PTC paper. Those with tongue type two will have large gustatory cells and will taste PTC paper strongly.</p> <p><b>Conclusions</b> In this experiment, it was proven that tongue type does affect the ability to taste PTC paper. When the gustatory size increases the ability to taste the chemical will become greater. When the gustatory cells are small, then the taste will be lesser.</p>	
<b>Summary Statement</b> In this experiment, I tested the relationship between the size of human bitter taste receptors ( papillae/ gustatory cells) and the interprutaion of the chemical paper PTC.	
<b>Help Received</b> My project mentor is Mr. Dan Dummett. I also received advice from teachers; Mr. Chris Thibodeau and Mrs. Meghan Salter.	



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<b>Name(s)</b> <b>Chloe Dorman</b>	<b>Project Number</b> <b>J1210</b>
<b>Project Title</b> <b>The Perfect Toy: Which Toy Do Dogs Prefer?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> This project looks at which type of toy a representative sample of dogs prefer.</p> <p><b>Methods</b> Soft toy, rope toy, hard toy, template for spacing, measuring tape, sample of dogs from local dog park. After recording the breed and height of the test subject, the dog was positioned three feet from the evenly spaced toys and allowed to select their preferred one.</p> <p><b>Results</b> After sampling a statistically significant number of dogs, the soft toy was preferred over the hard and rope toy. The size and breed of the dogs was not a significant factor in the results. This was primarily due to the texture of the toy, which was supported by studies of dog behavior in relation to color and other senses.</p> <p><b>Conclusions</b> This project gives dog owners guidance about the type of toy their dogs might prefer. By sampling a statistically significant sample of dogs, these results are applicable to the 89.7 million dogs in the United States.</p>	
<b>Summary Statement</b> I was able to determine toy preferences in dogs.	
<b>Help Received</b> My father assisted with calculating a statistically significant sample size and my science teacher assisted with the important variables to control for.	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Raya Farber; Zoe Stern</b>	<b>Project Number</b> <b>J1211</b>
<b>Project Title</b> <b>Now You See It, Now You Don't</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective of this study is to determine the effect of color on the appearance and timing of afterimages.</p> <p><b>Methods</b> White paper, construction paper in multiple colors (red, orange, yellow, green, blue, and purple), Raspberry Pi board, Raspberry Pi Sense HAT (with RGB LED light matrix), computer, glue, scissors, stopwatch, data sheets, subjects (human) - 10 sixth graders, 10 adults (ages 25-70). We tested subjects with colored circles as well as LED lights to evaluate the experiencing and length of time of afterimages.</p> <p><b>Results</b> Several subjects were given light and paper tests in various colors. Based on length of time of afterimages, red appears to create the longest lasting afterimage compared to the other colors.</p> <p><b>Conclusions</b> When given the light test, participants saw an afterimage for an average of 7.88 seconds. When given the paper test, participants saw an afterimage for an average of 11.15 seconds. These afterimages mostly matched the expected colors from the R,G,B cones that weren't fatigued. We think the paper images persisted longer because our procedure called for the subject to stare at it longer, more fatiguing the eye.</p>	
<b>Summary Statement</b> Our project is about the effect of color on the appearance and timing of afterimages.	
<b>Help Received</b> The actual tests were run independent of help. Support from our STEM instructor, Liat Baranoff, was provided to set up the Raspberry Pi unit. She also helped us calculate the data.	



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<b>Name(s)</b>  <b>James Glenny</b>	<b>Project Number</b>  <b>J1212</b>
<b>Project Title</b>  <b>The Vitruvian Kid: A Study of Mathematical Relationships in the Human Body</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> During the Renaissance, Leonardo da Vinci studied "de Architectura," by Vitruvius, seeking out ways to perfect his art, at which time he created one of his most famous drawings, The Vitruvian Man. Da Vinci, as an artist and even scientist worked to perfect human bodies in his work and used what is known as The Golden Ratio or The Divine Proportion. I studied these ratios and wondered, Could there be perfect human body ratios for kids? I used da Vinci's research largely to set an expected adult outcome. With consent of parents, I gathered kids ages 7-17 of both genders and recorded body measurements such as the circumference of the neck, wrist, head and waist. I also recorded the length of the arm span, height of the person, and a few other parts. Setting da Vinci's adult human body ratios as the expectation, I hypothesized that the majority of kids' body ratios would meet the expectations of the adult Golden Ratio. I was correct as I discovered that children's bodies ages, 7-17 do meet many of the ratios of an adult body and therefore grow proportionally with time. Males most closely matched the Golden Ratio that da Vinci obsessed over, as expected, since the historic research is male based. I did make some new discoveries that younger children, ages 7-12, have a few unique body ratios of their own, not liken to adult ratios, and were consistent to one another within their age group. This experiment has implications for art, health and explaining unconscious beauty. "The Vitruvian Man" was drawn over 500 years ago. The human diet and physical activity levels have changed dramatically, yet body ratios remain nearly the same. Taking simple measurements of children is a simple health diagnostic tool and could aide in medication management if understood further. Interestingly, 500 years later we still have an unconscious attraction to certain body types and symmetry. Understanding ratios of children can also be used for economic gain in marketing products. Lastly, art benefits from understanding children's ratios. During da Vinci's time, many pictures of children looked more like miniature adults instead of children.</p> <p><b>Methods</b> Materials I used included a measuring tape, a seamstress measuring tape, a pencil, a recording sheet and children volunteers, ages 7-17 with parent consent.</p> <p><b>Results</b> Every gender and age (7-17) had a arm span:height ratio approximately 1:1. Children had neck circumference: waist circumference , wrist circumference: head circumference, and wrist circumference: waist circumference ratios, with a 25% variance compared to standard expectations. Lastly, females, 13-17 had the largest difference in ratios to the standard v males 13-17.</p>	
<b>Summary Statement</b>  The Vitruvian Kid is a mathematical study of human body ratios in children for health, art and economic benefit.	
<b>Help Received</b>  I designed the experiment myself and completed the measurements of my subjects on my own. I had help from my dad in setting up formulas under Excel for calculating my results.	



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<b>Name(s)</b> <b>Serene Hayyeh; Sumaya Nagy</b>	<b>Project Number</b> <b>J1213</b>
<b>Project Title</b> <b>Chili Plaster Pain Relief</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> Nowadays consumers are buying organic materials rather than synthetic chemicals. We are aiming to relieve common pains such as arthritis, back pain, muscle pain, and gout pain using natural remedies. A compound mixture containing chili powder without any chemicals added will be used as a topical pain relieve to alleviate the pain without resorting to synthetic chemicals.</p> <p><b>Methods</b> In this research, we investigated if the capsaicin in chili powder can be used as a form of a natural topical pain reliever. Our independent variable was capsaicin paste application. The dependent variable was to measure the healing/pain relieving effect of the paste and the amount of time it took to relieve the pain. The Controlled Variable was to test on the same body part, amount of time to measure effectiveness, and amount of paste. We made a compound mixture containing chili powder capsaicin without any chemicals added. We also made a compound mixture with the same color and without capsaicin to act as a placebo. We predicted that the capsaicin mixture will act as a natural pain reliever on patients suffering from joint pain. We tested ten participants twice, once with the capsaicin cream, and another with the placebo. We tested both mixtures on the forehead first to make sure the subject did not develop an allergic reaction.</p> <p><b>Results</b> After testing both mixtures; the one with the active ingredient capsaicin, and the placebo, results showed that most subjects felt considerable pain relief after the capsaicin ointment than they did with the placebo. 70% of the subjects tested had a lower pain scale by the end of the hour with the paste that had the active ingredient. 30% of the subjects reported a lower pain scale after the one hour with the placebo. Most of the subjects remarked that they would rather use a natural pain relief than a chemical one.</p> <p><b>Conclusions</b> Results supported our hypothesis by showing that most subjects felt considerable pain relief after the capsaicin ointment than they did with the placebo. Using the chili plaster nowadays is becoming more economical to consumers. It is made of organic ingredients and it does not have any side effects. If you are looking for natural alternatives to topical pain relievers, then chili plaster is inexpensive and easily available. If we were to follow up on this project, we would like to test the medicinal effects of other natural ingredients as topical pain relievers, like turmeric and chamomile.</p>	
<b>Summary Statement</b> Our project is about finding natural alternatives to topical pain relief using capsaicin for patients with arthritis.	
<b>Help Received</b> People whom we could not have done this project without are our mothers, Maha Yasin and Fatima Nagy for guiding us and providing us with the materials needed, and our science teacher Rula Alshaneh for guiding us and helping us through out the project.	



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<b>Name(s)</b> <b>Kaylee Kautz</b>	<b>Project Number</b> <b>J1214</b>
<b>Project Title</b> <b>Spherical Food</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> Objective: I use a process called reverse spherification to make juice flavored spheres. The objective is to determine which flavored sphere tastes the best.</p> <p><b>Methods</b> Materials and Methods: When I make the spheres, I use two different chemical combinations: calcium lactate with sodium alginate and calcium chloride with sodium alginate. I made four different flavors of spheres, using the two chemical combinations. With my science teacher s permission, my classmates tested the eight spheres. Each flavor was designated by a letter and everyone ranked which sphere they thought was the best. Comments were also requested.</p> <p><b>Results</b> Results: The spheres that were made with the calcium lactate tasted the best overall. The strawberry flavor, however, was the overall winner. Most of the comments indicated that many of the spheres seemed too salty.</p> <p><b>Conclusions</b> Discussion: In conclusion, the calcium lactate makes a better tasting sphere than the calcium chloride. I hope that I am given another opportunity to do redo my taste test with other flavors so that it proves that the spheres made with calcium lactate taste better. I would like to change the components in the spheres to reduce the saltiness and make the spheres better to eat.</p>	
<b>Summary Statement</b> When making spheres, you use two chemicals to create a gel like bond around a liquid juice.	
<b>Help Received</b> Lori Bloathner, David Voit, Doug Modlin	



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<b>Name(s)</b> <b>Leila Kessler</b>	<b>Project Number</b> <b>J1215</b>
<b>Project Title</b> <b>Dog Aid: Chew Deterrent Wound Dressings</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective of this project is to utilize a dog's high sense of smell as the solution to creating an improved method of treating their wounds and injuries. By combining natural essential oils with traditional wound dressings, I wanted to create new devices or methods that are more effective than "dog cones" at preventing dogs from aggravating their injuries and prolonging recovery times.</p> <p><b>Methods</b> Peppermint and Lemon Essential oils, plaster, adhesive bandages, and aluminum sheets. Added essential oils to bandages and created casts to test the effectiveness of scents, even with temptations that dogs are not willing to resist.</p> <p><b>Results</b> Several dogs were tested using their preferred treats to see how resistant they would be toward the specific scents. These trials were repeated in order to see just how persistent each dog was. When each dog could no longer withstand the scent's aroma, they would no longer attempt to get to the treat.</p> <p><b>Conclusions</b> The trials taken in testing have proved that dogs can show resistance, even when they are tempted with an aliment of their liking. It is to be concluded that dogs can show the same amount of resistance when faced among a wound that they want to chew at.</p>	
<b>Summary Statement</b> My project is corely based on finding ways to stop dogs from chewing at their wounds because it can slow down the healing process, or stop it entirely.	
<b>Help Received</b> Michael Kessler and Mrs.Price.	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Madeleine Larson</b>	<b>Project Number</b> <b>J1216</b>
<b>Project Title</b> <b>Gender and Bitter Taste Perception</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective of the study is to determine whether females perceive bitter taste differently than males.</p> <p><b>Methods</b> Used Google spreadsheet to record the data. Tested with cocoa beans, coffee beans, PTC paper, and arugula using human test subjects.</p> <p><b>Results</b> After 179 people were tested with my items, the testing showed a major difference in bitter taste perception between males and females. The largest difference occurred with the cocoa beans and the smallest with the arugula.</p> <p><b>Conclusions</b> Proving my hypothesis correct, females taste bitter flavors stronger than males. If foods have gone bad or rancid there is a greater chance of a woman tasting that it is bad due to a female's stronger sense of taste. The reason for the difference in flavor perception is not known, but my hypothesis is that when humans were hunters and gatherers the women were the gatherers and they needed to know what plants were safe to eat. Therefore, I have come to the conclusion that females perceive bitter taste stronger than males.</p>	
<b>Summary Statement</b> I tested 179 subjects with bitter foods and found the average bitter rating with males and females, coming to the conclusion that girls perceive bitter taste stronger than boys.	
<b>Help Received</b> Dan Dummet, Chris Thibodeau, Natalie Wasley, and Union Hill school.	





# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b>  <b>Isabelle Luna</b>	<b>Project Number</b>  <b>J1217</b>
<b>Project Title</b>  <b>Effects of Various Feed Container Patterns on Dairy Goat Consumption</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The reason I chose this project is because of my love for animals and wanting to help strengthen the relationships between them and humans. Understanding animal behavior is one of the keys to this goal.</p> <p><b>Methods</b> The materials I used in my project consisted of Goat grain obtained from my local feed store, white and black feed containers and white duct tape to make the patterns on my buckets. These materials were all purchased at local stores such as Walmart. With these materials, I created different patterns on each of the 6 buckets for the goats to choose from. The goats were isolated from the feed container area so they did not all run in together and affect their individual decision making process.</p> <p><b>Results</b> The black bucket was the most preferred bucket. The least was the checkered pattern bucket. The goats did not make an immediate decision, they thought about it as well as checked their surroundings before choosing.</p> <p><b>Conclusions</b> The black bucket was the most preferred over the buckets with patterns. What is interesting, is the goats did not simply come into the pen and choose a bucket. They had to get comfortable with me first so that they trusted me. They then made sure the other goats were calm and seemed to agree with their choice. This leads me to believe that the goats made a conscious decision rather than acting on instinct or impulse.</p>	
<b>Summary Statement</b>  The goats made a cognitive decision and chose the solid black bucket over the patterned ones.	
<b>Help Received</b>  my Parents provided resources and my Grandfather allowed me to use his herd of goats for testing. Dr. Gale O'bannon, a local Veterinarian gave me advice on making sure the goats were safe during my tests.	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Soquel Macdonald</b>	<b>Project Number</b> <b>J1218</b>
<b>Project Title</b> <b>Deer Crossing</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> I wanted to find out if deer would cross a road more quickly if mountain lion scent (urine) was present in a limited concentration in the middle of the road. My hypothesis was that with the mountain lion scent deer would cross the road more quickly but with the same frequency as without the scent.</p> <p><b>Methods</b> Capsules, cotton balls, mountain lion urine, water, drill, two game cameras, two roads with natural deer traffic. Using two sites, one with mountain lion urine capsules in the road (experiment) and one with water capsules in the road (control), I compared deer captured on game camera per 48 hours. I also compared the time it took each deer to cross the camera's field of view (as a surrogate for time it takes to cross the road). Each experiment lasted 48 hours, followed by a 24 hour break, and then experiment and control sites were switched and the experiment repeated for a total of four times.</p> <p><b>Results</b> The average number of deer per 48 hours for the combined controls vs. experiments was <math>6.3 \pm 5.9</math> vs. <math>3.0 \pm 2.2</math> deer (<math>p = 0.34</math>). The average seconds in the field of view for combined controls vs. experiments was <math>6.2 \pm 3.6</math> vs. <math>7.6 \pm 3.3</math> seconds (<math>p = 0.27</math>).</p> <p><b>Conclusions</b> My results did not support my hypothesis, suggesting fewer deer per day and slower crossing in the experiment arms, rather than the opposite. According to my statistical analysis these differences were possibly due to chance. If the mountain lion scent truly caused the differences I observed, I think this may have happened because the scent had the effect of either scaring the deer away or causing them to proceed slowly and cautiously.</p>	
<b>Summary Statement</b> Deer do not cross roads more quickly when in the presence of mountain lion scent.	
<b>Help Received</b> Dusten Macdonald, Nick Albert(fish and game warden), Heidi Macdonald, Mr.Haller, Darren Ward (Biology professor)	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b>  <b>Nicholas Meksavanh</b>	<b>Project Number</b>  <b>J1219</b>
<b>Project Title</b>  <b>Virtual Reality: Fun or Harmful?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The purpose of this experiment is to measure the short-term effects of virtual reality on the body, specifically our biology related to heart rate and blood pressure. The goal is to find evidence on whether this new technology will have a positive or negative effect on users when we become immersed in this environment.</p> <p><b>Methods</b> Two videos were presented to 22 volunteers, thrilling and calming experiences. For every other volunteer, videos shown were rotated to eliminate any order biases. Before the VR sound box headset was placed on each volunteer, their blood pressure and heart rate were measured by a wrist electronic sphygmomanometer and recorded in the journal. The 1st video was played and after each minute, heart rate and blood pressure were measured and recorded again. This is repeated for the 2nd video.</p> <p><b>Results</b> It can be concluded that peoples heart rate and blood pressure rises from their baseline while watching both types of virtual reality video. Everyone in the experiment had increased heart rate while watching both virtual reality video, especially people under 18 years of age and self-identified gamers. However, heart rates were lower for people over 18 years of age than any other demographic groups. But they exhibited higher increases in blood pressure during the experience, especially among males in this group.</p> <p><b>Conclusions</b> With every new consumer product there are potential harmful effects that directly or indirectly affect people. More and more households are using this new technology daily. But there is still very little research done on its effects. While new technology is fun and exciting there could be potential negative short-term and long-term effects on us if used for extended periods of time. The results from my science project provides insight into the effects of virtual reality on our biology, mainly how it affects the heart and blood pressure in a negative way. Using virtual reality for just two minutes volunteers showed signs of stress due to intense immersion, especially among females under 18, female gamers, and adult males who already have high blood pressure conditions. Our body reacts to change in our environment quickly and in virtual reality it is even quicker. Using these products may have longer term damaging effects as well if users are immersed for extended periods or repeatedly.</p>	
<b>Summary Statement</b>  I showed that being immersed in any virtual reality environment has short-term negative affects on our heart and blood pressure.	
<b>Help Received</b>  My aunt, Dr. Tran, explained to helped me understand heart rate and blood pressure measurements. My parents provided me with the virtual reality goggles, virtual reality headset, and sphygmomanometer.	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Gabriela Munoz</b>	<b>Project Number</b> <b>J1220</b>
<b>Project Title</b> <b>Effects of Background Light Intensity on Eye Fatigue</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective of this project is to test which surrounding light intensity would cause greater eye fatigue while on electronics.</p> <p><b>Methods</b> In this project, three subjects read the Snellen Chart using their right, left, and both eyes to measure eye fatigue. Each subject read line by line until he or she could not read anymore letters. Then, each subject read for 30 minutes on their electronic device. Three different background light intensities were used: 100%, 50% and 1%. To evaluate eye fatigue, the subjects were asked to reread the Snellen Chart using their right, left, and both eyes.</p> <p><b>Results</b> The amount of eye fatigue was determined by the percent accuracy calculated when reading the Snellen Chart. When both eyes were evaluated there was less eye fatigue at the lowest light intensity. However, when the individual eyes were tested, there was less eye fatigue at the highest light intensity. In addition, the analysis shows that our eyes work more efficiently in brighter or dimmer light but have, on average, the most eye fatigue in between light intensities.</p> <p><b>Conclusions</b> The hypothesis was that the dimmest background light intensity would affect eye fatigue the most while using electronics. The data did not support my hypothesis as the analysis shows, on average, the most eye strain was caused by reading at the in between intensity. Based on the data, the recommended intensity to read at is at least 49.6 lux. I did this experiment because I wanted to see if there was another way to decrease eye fatigue that individuals could control and not be dependent on electronic companies.</p>	
<b>Summary Statement</b> This project was done to evaluate which surrounding light intensity would cause greater eye fatigue while using electronics.	
<b>Help Received</b> I performed and designed the experiment myself. My science teacher, Marcia Nogueira, and Dr. Lorena Barron helped review my results.	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>John Page</b>	<b>Project Number</b> <b>J1221</b>
<b>Project Title</b> <b>Got Juice? Analyzing Drinks for Athletes</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> My objective for this project was to find out which drink(s) best enhances one's athletic performance.</p> <p><b>Methods</b> Indoor basketball court, stopwatch for timing, clipboard, a chart to record the suicide drill times. For each participant, they drank 16.9 fluid ounces of Propel, 14 fluid ounces of Nesquik chocolate milk, 11.5 fluid ounces of Simply Orange orange juice or 14 fluid ounces of Dasani water. I tested 13 students running suicides after drinking various liquids. On each day of testing, I gave my subjects (i) 12 ounces of water, (ii) a bottle of Propel which contains 230 mg of sodium, (iii) a bottle of Simply Orange orange juice which contains 640 mg of potassium or (iv) a bottle of Nesquik chocolate milk which contains 400 mg of calcium. Instead of giving each participant the same amount of each electrolyte being tested, each participant consumed a single bottle of each liquid as an athlete would purchase at a store or at a gym. One hour after drinking the liquids, each student ran one suicide drill. I used a stopwatch to time each drill and recorded each time on a chart.</p> <p><b>Results</b> After testing all of the various sports drinks, the data supports my hypothesis that Propel best enhances one's athletic performance. Next time you wonder which sports drink to reach for during a workout, I strongly advise Propel! However, Propel is not the only drink out there and so if I could further my study, I would test more drinks such as Powerade and monster.</p> <p><b>Conclusions</b> After collecting and analyzing my data, it appears that Propel produces the best athletic performance. 46.2% of the students ran their fastest suicide drills after drinking Propel, 41.7% ran their fastest drill after drinking chocolate milk, 7.7% ran their fastest drill after drinking orange juice and only one student ran his fastest suicide drill after drinking plain water. Also, 38.5% of the students ran their slowest suicide time after drinking water, 30.8% of ran their worst time after drinking orange juice, 25% ran their slowest time after drinking chocolate milk and only one student ran his slowest suicide drill after drinking Propel. After drinking Propel, the average suicide time was the lowest at 31.72 seconds. The average suicide time after drinking orange juice and chocolate milk tied with an average time of 31.91 seconds. Though very close, water had the worst average suicide time with an average of 31.92 seconds. Not only did Propel have the fastest average suicide time, but drinking Propel also improved participants running performance by an average of 84.6% as compared to water, while chocolate milk and orange juice</p>	
<b>Summary Statement</b> As an athlete who is always looking for ways to improve my athletic performance, I tested the liquids orange juice, Propel and chocolate milk, to determine if any of these liquids enhanced physical performance as compared to water.	
<b>Help Received</b> For my project, I received help from my P.E teacher to find times for my subjects to run drills in our schools gymnasium and my mother to help me purchase the drinks I tested.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR  
2019 PROJECT SUMMARY**

<b>Name(s)</b>  <b>Varun Salwan</b>	<b>Project Number</b>  <b>J1222</b>
<b>Project Title</b>  <b>How Does Mindful Meditation Affect the Blood Pressure and Heart Rate?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> How Does Weight Affect Blood Pressure?</p> <p>Abstract</p> <p>Objectives/ Goals: My project was to determine how weight affects blood pressure in adults. I believe that as our weight or BMI (body mass index) increases, our blood pressure will go up as well.</p> <p><b>Methods</b> Methods and Materials: I measured the BMI (derived from the weight and height of the individual) and checked the average blood pressures of 30 people (15 men, 15 women) with a blood pressure cuff. I checked the blood pressure on 3 separate occasions over 3 weeks. I excluded people who had a preexisting condition of high blood pressure or on any medications that would lower blood pressure.</p> <p><b>Results</b> Results: The experimental results supported my hypothesis by showing that as the BMI increased, so did both systolic and diastolic pressures. In people who are underweight (BMI &lt;18.5) the average blood pressure was 110/68, 118/74 in people with a normal BMI (18.5-24.9), 132/82 in overweight individuals (BMI 25-29.9) and 138/88 in the obese (BMI&gt;30).</p> <p><b>Conclusions</b> Conclusions: My conclusion is that as our weight (BMI) increases, so does our blood pressure.</p>	
<b>Summary Statement</b>  My project is about how mindful meditation can effect your blood pressure and heart rate in a positive way.	
<b>Help Received</b>  My dad who is a doctor, Arvind Salwan, M.D.	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Arav Shah</b>	<b>Project Number</b> <b>J1223</b>
<b>Project Title</b> <b>Face Time: Do Facial Parameters Change over Time?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective of this project is to determine if a person's facial parameters change over time. With increasing use of facial recognition as a method of identification, it is relevant to determine how its effectiveness might change over time as a person's face ages. This project tests the hypothesis that some key ratios of facial geometry do not change over time.</p> <p><b>Methods</b> To test this hypothesis, before and after facial portraits from 16 subjects taken at least 5 years apart were analyzed. For each portrait, 6 unique facial feature distances - for example, eye-to-eye distance - were measured using Microsoft PowerPoint, and using these measurements, 15 unique key facial geometric ratios (FGRs) - for example, eye-to-eye distance to ear-to-ear distance - were calculated using Microsoft Excel. Next, for each of the 15 FGRs, ratio-of-ratios (RORs) were computed from the before and after portraits to quantify the relative change in the FGRs for that person. Finally, tolerance acceptance criteria were applied to determine which, if any, of the FGRs had changed over time.</p> <p><b>Results</b> Based on the measurements and analysis, 4 of the 15 FGRs studied changed less over time compared to the other FGRs, as follows: 1. Eye/Eye-Eye 2. Eye-Eye/Ear-Ear 3. Eye-Eye/Nose-Mouth 4. Ear-Ear/Nose-Mouth</p> <p><b>Conclusions</b> The results directionally indicate that certain FGRs change less over time compared to other FGRs, and may be useful in facial recognition techniques. However, a substantially larger number of samples, more accurate and/or automated measurement techniques, and tighter tolerances for acceptance criteria would be required to prove the hypothesis conclusively.</p>	
<b>Summary Statement</b> Based on measurements of pictures of subjects taken years apart, it was found that some facial geometric ratios change less over time.	
<b>Help Received</b> My dad helped me with using Powerpoint and Excel, and Mr. N Dalal, an expert data scientist, gave me guidance in establishing acceptance criteria.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR  
2019 PROJECT SUMMARY**

<b>Name(s)</b> <b>Reeya Singh</b>	<b>Project Number</b> <b>J1224</b>
<b>Project Title</b> <b>The Effect of Temporary Blindness on Hearing</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective of this study was to test if blinding people temporarily would cause a measurable improvement in hearing.</p> <p><b>Methods</b> I used The Mimi Hearing app to test participants hearing, an iPad was used to facilitate the test, a blindfold to temporarily blind the participants and an over-ear headphone to hear the test.</p> <p><b>Results</b> My data shows an overall improvement in hearing for both left and right ears and both age groups (over 40 and under 40). I tested 17 people in each age group. Finally, in order to ensure the applicability of my results I ran a p-test over the data and found that all p-values were less than .05, showing statistical significance. Thus, we can stipulate that even in a larger population temporary blindness should result in an increase in both left and right ear hearing level at all ages.</p> <p><b>Conclusions</b> My study confirms the hypothesis that when subjects are temporarily blinded, their ability to hear will improve. The study demonstrated a significant improvement in hearing after subjects were temporarily blinded, compared to their hearing at baseline.</p>	
<b>Summary Statement</b> I was able to show an increase in hearing level when one was temporarily blinded vs. normal sight.	
<b>Help Received</b> I designed, built and performed the experiment myself. I asked an E.N.T how to measure hearing. After calculating my p-values, my cousin taught me more in depth about statistical significance.	