STEM EXPO

RRCC Student Research Symposium

Poster session presentations:

Wednesday, Dec 4th

10am-12pm, 12pm—2pm

Thursday, Dec 5th

10am-12pm, 12pm—2pm

Posters and project demos will be on display on the Bridge at the Lakewood Campus

Student talks will be ongoing both days in Grays and Torreys Peak Rooms

Fall 2019 Program

RED ROCKS COMMUNITY COLLEGE

HONORS PROGRAM
Red Rocks Community College

Thanks to all the students and faculty that participated in the STEM Expo this year!

Faculty Advisors:

Tracy Gray, Biology

Steve Kaye, Biology

Emmanuel Santa-Martinez, Biology

Mursheda Ali, Biology

Stephen Fahey, Physics

Carlos Medina, Physics

Shane Spivey, Physics

Toni Nicholas, History

Barbra Sobhani, Honors and Space Grant

STEM EXPO Organizers: Barbra Sobhani, Shane Spivey and Tracy Gray

RRCC STEM EXPO

Fall 2019 Program

Talk Schedule

Student Research Presentations

Wednesday, Dec 4

Honors Speaker Series

3:00 Rhiannon Larsen

3:15 RockSat-X Team Presentation: Tiffany Lovett, Mac Grove, Cid Quesada, Nathan Clapp, Marieke Spiegelman, Santana Padilla, Shannon Walters

Thursday, Dec 5

2:00pm **Viability Testing for *Serratia Marcescens* in Space**, Tiffany Lovett and Grant Barbone

The bacteria *Serratia marcescens* is often studied in enclosed space environments on CubeSats and other orbital and sub-orbital experimental demonstrations. The RockSat-X 2020 Mission Team, including students from the Arapahoe and Red Rocks Community Colleges, is sponsored by the Colorado Space Grant Consortium, NASA Goddard Spaceflight Center, and NASA Wallops Flight Facility. The team is adding a secondary microbiological sample to their payload this summer. DemoSat experiments provide a platform for the team to gather experimental data and test samples in the upper atmosphere for survivability prior to rocket flight. *S. marcescens* is readily found environmentally, on people, and is safely utilized in a microbiology lab. Microbes exhibit characteristic changes in space such as increased metabolism, virulence, and colony production. *S. marcescens* produces colonies in white and red variations. The white variety has more defense against harmful UV radiation. This means that we expect to see the organism grow more white colonies when exposed to space conditions where there is less protection from UV radiation. Six samples were sent up on the DemoSat Fall 2019 High Altitude Balloon payload with a total flight time of 2 hours and 10 minutes on November 9. *S. marcescens* was incubated at 37°C then kept in pellets at 4°C until transport to the flight site in a cooling chest. Three samples each were kept on ground, insulated within the payload, and exposed on its exterior. The insulated organism was exposed to a low of -25°C and the external to -40°C. The samples were then grown on plates in the lab to detect cell survival and observe qualities of the growth. The organism was successfully grown in all three cases. After improvements to payload design and lab testing techniques for DemoSat Spring 2020 we expect to see interesting results for the RockSat-X 2020 mission.

STEM EXPO Poster Sessions

Wednesday, Dec 4, 10am – 12pm

1. **The Big Red Jeep Project**

Robert Schmidt, HNR 289 Advisor: Barbra Sobhani

Throughout this paper I will be visiting a few different topics; I start the paper off by talking about my experiences with developing a project plan, talking to many different companies and individuals of 4x4 community that are now supporting us. I will then cover how I was able to get sponsored, what being sponsored means and the hardships that came along the way with a project of this scope. From there, I will talk about how I was able to involve many of my fellow students in this project and make this project something that our school will be proud. Finally, I will be covering each company and the parts that they supplied to our build, I will talk about why we chose those companies, why those companies were important to the success of this project, and what we plan to do for them in the future of our build.

2. **Screens and Sleep**

Melody West, Montana Denton, Rachel Fink, BIO 11, Advisor: Tracy Gray

For this experiment, we measured the effect on sleep quality due to the use of electronic devices before bed. We used an app called “Sleep Cycle: smart alarm clock” to monitor our sleep. The app uses different methods to create a sleep quality measurement in a percentage. We conducted a procedure that records sleep quality with and without screen time usage before bed. We found that our participants’ sleep quality increased by an average of 12%. Results indicate that screens do in fact have a negative effect on sleep quality, although it should be further studied.

3. **Vitamin Effect on Plants**

Elizabeth Banuelos, Jack Horton, BIO 111 Advisor: Paul Le

When giving sunflowers three different types of vitamins that promote hair growth during its life cycle we will see how it is affected.

4. **The Effect of Time of Day Study on Information Retention**

Jessica Moore/ Shae Taylor/ Edina Kutor, BIO 111 Advisor: Paul Le

Knowledge retention is the key to success in many areas of life. College students, office workers, social event planners, and many more gauge their success on being able to remember and apply small details. Our study looks at the correlation between knowledge retention and the time of day that material is studied. Our experiment is focused on adult learners, whom were given 4 short informational articles. Two of these articles were read in the mornings shortly after waking and the other two were to be read at night before bed. A short test was then completed. Data is still being analyzed and the outcome of the study has not yet been found. This experiment was done on a small scale, with limited participants therefore the experiment should be run on a larger scale with further specified criteria to support any hypothesis for time of day study habits.

5. **Projectile Projection**

Wrigley Burris, PHY 211 Advisor: Shane Spivey

This experiment demonstrates the process to predicting where a projectile fired from a spring-loaded catapult will land. It will also outline the process of building the catapult and calibrating it. To test this, calculations were done to see how far the projectile would travel if the catapult were aimed at a 45° angle. This was then repeated for 35° and 25°. Then the catapult was aimed at those angles and launched. The

distance they traveled was compared to the calculated value to see how accurate the predictions were. The percent error was 13%, 17%, and 18% respectively for each angle. All of the distances were on average about 15% shorter than the hypothesized mark. This is most likely due to the assumption that there was no drag or air resistance as the projectile was traveling through the air and that the calculations only dealt in 2D while the test environment was in 3D. In the future if these assumptions were accounted for the hypothesized answer would be closer to the data.

6. Jacob's Ladder

Brock Williams, Vincent Castilow, PHY 212, Advisor: Carlos Medina

We constructed a Jacobs ladder to test the effects of temperature on the arc frequency. The Arc of a Jacobs ladder moves upward, expanding the gap in which current flows due to the hot gases generated rising. If amperage of the system is increased than the heat generated will also increase if the same potential drop exists across the gap. This will cause the frequency of the arc formation of the Jacob's ladder to rise. As hypothesized in the conclusion the Data does not disprove the idea that increased overall wattage causes the Arc to move up the Jacob's ladder faster. This result leans credibility to the idea that the Arc is driven upward by the heat of the plasmafied gasses as current passes through them. Next time this experiment could be altered to contain the Arc, and control / measure different environmental factors as well as the Amperage effect on the Ladder frequency.

7. Building an Electromagnetic Railgun

Forrest Getz, Andrew Lesuer, Nathaniel Yardeny PHY 212 Advisor: Carlos Medina

Our project goal was to build an electromagnetic railgun which would demonstrate some interesting relationships between electricity, magnetism, and conservation of energy - by transferring stored electrical energy into kinetic energy of a conductive projectile. The railgun is a proven design, but currently limited in practicality.

8. Cloud Chamber

Ian Boyd, Shay Rossignol, Dan DeBruyn PHY 212 Advisor: Carlos Medina

In 1910, a Scottish Physicist by the name of Charles Thomas Rees Wilson discovered, and designed, the first cloud chamber. The initial design was due to Wilson's interest in cloud formations and the condensation these clouds produced; Wilson was interested in reproducing clouds in a laboratory so he could study them more easily. During his studies, another Physicist, Victor Hess, was doing testing of ionization in the atmosphere. While doing a balloon experiment - where Hess sent an ion chamber, inside a balloon, into the atmosphere – Hess found that ionization in the atmosphere actually increased the further up the balloon went. The ionization in the atmosphere was later given the name "cosmic rays." Cosmic rays are believed to be highly charged protons and atomic nuclei, travelling through space, that can be seen when they collide with the earth's atmosphere. Charles Thomas Rees Wilson, used his cloud chamber design to study these cosmic rays. The "Wilson cloud chamber" became the main tool to study x-rays, radioactivity, and cosmic rays. The cloud chamber uses strong alcohol and extremely cold aluminum to create alcohol vapors inside of a chamber. When the vapor creates a cloud, you can see the trails left by ionizing radiation and charged particles as they travel through the cloud of vapor. "The Wilson cloud chamber led to the discovery of recoil electrons from x-ray and gamma ray collisions, the Compton-scattered electrons, and was used to discover the first intermediate mass particle, the muon. Wilson was awarded the Nobel Prize in physics in 1927 for the development of the cloud chamber." (hyperphysics cited in our Paper) Our Cloud Chamber is a replica that will display alpha and beta particles, along with ionizing radiation particles, in a fish tank filled with fine mist of isopropyl alcohol.

9. Radiation

Brandon Moore, Marc Moomaw, Anas Al Qaysi, PHY 212, Advisor: Carlos Medina

We tested the levels of radiation at Rocky Flats to determine if it was safe for the public and wildlife.

10. **Simple Seismometer**

Justin DeBerry, CJ Nearing, PHY 211 Advisor: Carlos Medina

We used the principals behind inertia, magnetic induction, Ohm's Law, and Faraday's law to design a seismometer that can produce voltage and current in response to seismic activity. Our design successfully demonstrated proof of concept and with certain modifications could be scaled up for use in the field.

11. **Ready, Aim, Fire**

Brady Eitel, Joanna Harden, Sima Marcus, PHY 211 Advisor: Shane Spivey

When launching objects, the force due to drag plays a critical role in determining the optimal angle of trajectory for the projectile. The goal of this project was to experimentally determine the angle that yielded the projectile's maximum range and then compare it to theoretical calculations with drag and without drag.

For our experiment, we built a projectile launcher that used elastic surgical tubing to fire projectiles from different angles. Our chosen projectiles were a tennis ball, golf ball, baseball, and racquetball, which we fired at several different angles — 38°, 43°, 44°, 45°, 48°, and 58°. We did three trials with the four projectiles at each angle and determined the maximum range for each and its corresponding angle.

For our theoretical calculations, we used an Excel spreadsheet created in class to model the motion of our four projectiles with drag. Then, we wrote a computer program using Visual Basic for Applications to find the optimal angle that yielded the maximum range for each projectile. We also used the range equation for our calculations without drag.

After comparing our experimental data to theoretical calculations both with and without drag, we concluded that the force due to drag affected the optimal launch angle in our experiment only slightly but changed the maximum range a projectile could reach more noticeably.

12. **The Effects of Bullet Mass and Velocity on Ballistics: Evaluating the Effectiveness of Basic Drag Models**

Kenneth Weiman, Jeffrey Pollock, Wyatt Soeffing, PHY 211 Advisor: Shane Spivey

The purpose of the experiments conducted was to determine the effect of different projectile weights and velocities on various physics concepts, to include dynamics, kinematics, and drag models. To collect data on this, three different types of ammunition were used in a series of tests to determine maximum projectile range, muzzle velocity, and adherence to drag models. Of the three ammunition types used (one supersonic, two subsonic), the supersonic ammunition was used as a control, and the subsonic variations were used to compare and collect data based off of deviation from the control. The same firearm was utilized across all experiments and mounted on a tripod that was erected at a fixed height. A barrel-mounted chronograph was used across all tests to provide accurate muzzle velocity data for all testing sessions.

Muzzle velocities of the projectiles tested were shown to be marginally slower than the manufacturers posted values out of the tested firearm, likely as a result of the test barrel being shorter in length than the one used by the ammunition manufacturer(s). Subsonic ammunition exhibited more bullet drop than the supersonic control on the test target as a result of the slower initial velocity and longer flight time. It also displaced the ballistic pendulum less than the supersonic control, indicating less retained energy. While the subsonic ammunition adhered to the compiled drag model, supersonic deviated a fairly large amount, mainly when trying to obtain muzzle velocity off of pendulum displacement..

13. **Determining an Unknown Spring Coefficient**

Jason Miller, William McCormick, Jake Morely, Jack Oreilly, PHY 211 Advisor: Shane Spivey

In this project we were analyzing Ampere's law. To analyse this physical law we are using an The objective of our project was to determine the spring constant (k) for a store-bought compression spring using a projectile launcher. Our design utilizes three-quarters inch PVC pipe as a barrel, a compression spring as a launching mechanism and an adjustable mount to select various launching angles. We tested the launcher using a marble with a known mass, firing it with at different compression distances and different angles then recording the distance in which the marble had traveled. Using the distance in which the marble traveled we were able to use kinematics to solve for the velocity at which the marble left the PVC pipe. From there we were able to solve for the spring constant utilizing potential and kinetic energy of our system through the law of conservation of energy. We then compared this data against compressing the spring with known masses and found that our system was very close to ideal and that our error came from a loss of energy through friction in the PVC pipe as well as drag while the marble was traveling through the air.

14. Ping Pong Ball Launcher

Anton Vandenberge, Santana Padilla, PHY 211 Advisor: Shane Spivey

Our objective with this project was to create a spring powered cannon that launches a ping-pong ball as a projectile at different angles in an effort to understand the relationship between the degree that the cannon is firing at and the distance the projectile will travel. We took our theoretical calculated results and compared that data to our experimental values to understand which angle the cannon would need to be positioned above horizontal to yield the farthest distance traveled when launched.

15. Center of Mass

Garrett Swindle, Carlos Gamboa, Jessica McConnell, Connor Solawetz, PHY 211 Advisor: Shane Spivey

Balancing and Center of mass are physical concepts humans use on a constant basis. Walking, riding a bike, and driving a car are all things that the center of mass becomes necessary to understand and control. By studying the change in the center of mass for different shapes and for different masses, we can form predictions as to where a new center of mass will be located.
We tested a changing mass on a circular disk and determined the equation to solve for the mass that will balance the disk when other masses are changed. This prediction was then tested using a small disk and a mass kit. We also calculated the center of mass for an object that is made of simple every-day shapes, to show that different shapes have different centers of mass. Our results were expected, as the calculated masses to balance the disk were accurate. Center of mass is a physical concept that is able to be calculated, and represents an important concept in human life.

16. Trajectory Models

Matt Scarborough / Grant Rold, PHY 211 Advisor: Shane Spivey

Many variables have effects on projectiles in motion however, air resistance(drag), cross sectional area, and mass have the largest impacts. There are two different ways to predict the trajectory of a projectile, that with air resistance considered, and that without. In our project we looked at the exact percent difference between these methods, and further compared to our measured findings to reveal the percent error between theoretical and measured data. Along with our theoretical and physical data, we investigated the significance that small variations in cross sectional area and mass play in the models of trajectory. To collect this data, we constructed a catapult variation where an electric motor spins a wheel such that a projectile can be launched at a desired angle and velocity. To calculate the trajectories, we used two separate Excel spreadsheets designed to follow kinematic equations and plot points on a graph. We observed in each trial the initial velocity of the projectiles to be consistently decreasing due to a failing motor, however this was reflected in the subsequent calculations and did not alter our results. As a result, our measured trajectory was less than the data calculated by the drag model, and in turn was less than the data considering no drag. The measured results were less than our model due to outside factors that

were unable to be accounted for, for example our drag model only can account for a constant head or tail wind, where the wind may not have been constant or perpendicular to our launches. Throughout the testing and analysis, we determined the cross-sectional area had a larger impact on the trajectory than the difference in mass on an object's drag. Overall, using our two models and physical data we consistently proved the significance of drag on a projectile's trajectory.

Wednesday, Dec 4, 12 – 2pm

17. Haiti's Hurricanes and Environmental Issues

Josephine Nash, HIS 247, Advisor: Toni Nicholas

I am doing my environmental crisis project on Haiti because I have personal experience witnessing the destruction and devastation that resulted from multiple hurricanes that took place during this century. My First Presbyterian Church went on a mission trip to Port-Au-Prince in Haiti during the summer of 2016. It was an extremely eye opening experience that was very shocking culturally and showed how due to the lack of media coverage regarding this natural disaster years later there was still immense damage and the citizens were struggling to work towards recovery. There was insufficient exposure to the severity of this situation. Hurricane Sandy occurred during 2012 and left this country in shambles.
My church did volunteer work there such as construction, clean up, community service, child care and spiritual worship. There was definitely an issue with pollution as well as littering and problems with sanitation. Additionally, the infrastructure was weak and lacked stability which is definitely concerning because of this areas vulnerability and history of frequent natural disasters such as hurricanes, earthquakes and flash floods.

18. World War Two Shipwrecks: An Environmental Time bomb

Alexander Dresser, HIS 247, Advisor: Toni Nicholas

During World War 2, thousands of ships were sunk during military operations. Now, 70 years later, some of those sunken ships pose a grave risk to the environment. Supply ships were a primary target for the enemy, especially tankers because they carried the desperately needed fuel. When tankers sank, most took their cargo with them to the bottom of the sea, with only a few able to release their cargo in time. After decades of saltwater immersion and rough seas, it is only a matter of time before the oil-rich wrecks begin leaking. Since each tanker could hold millions of gallons and many warships could hold hundreds of thousands of gallons that poses the risk of oil leaking into fragile ecosystems. Every sunken tanker has the potential to cause catastrophic damage the likes of Exxon Valdez or Deepwater Horizon disasters. Despite the potential consequences, any plan of action or prevention is buried in red tape because these shipwrecks are considered war graves, they are afforded special protection, and many are located within the waters of other nations. Raising awareness of these potential disasters and making resolving these issues a higher priority for the nations involved is the best way to prevent this disaster from happening.

19. Devastating Atomic Bombings on Hiroshima and Nagasaki

Jaren Craft, HIS 247, Advisor: Toni Nicholas

The atomic bombs dropped over the cities of Hiroshima and Nagasaki at the end of World War ll was a devastating blow to Japan which resulted in high casualties, large number of survivors exposed to radiation, and Japan's surrender. My project will cover questions, of why the atomic bombs were dropped, what the aftermath looked like, and the impact on the environment and people from exposure to radiation. The underlying theme acquired from my sources is that studies on Japanese survivors have provided substantial information that long-term effects of radiation exposure is believed to increase an extremely high cancer burden and a shortened life span on all survivors. Elevated mutation rates and other consequences from the effects of the atomic bombs dropped are still unknown which are interfering with the survivors at that time and today. Almost 75 years after the bombings, research is still being followed up on the survivors and it is important to learn more about the risks of radiation before ever thinking about dropping another atomic bomb again..

20. **Shadow of Chernobyl**

Austin Ricker, HIS 247, Advisor: Toni Nicholas

This project is an analysis of the 1986 Chernobyl Nuclear power plant disaster. The accident occurred in the northern Ukrainian city of Pripyat. The project looks at the medical and environmental aftermath caused by the nuclear accident. Additionally, the project looks at the political climate of the Ukrainian SSR as well as the political climate of the greater Soviet Union and how these political climates exacerbated the extent of the disaster. Finally, the abstract examines the political relationship between the United States and the USSR and how this relationship could have mitigated the environmental fallout.

21. **Fukushima Nuclear Meltdown and its Effects on the Environment**

Ryan Roderick, HIS 247, Advisor: Toni Nicholas

The Fukushima Nuclear Meltdown had many effects on the environment and people. There are many resources that I used for this project that were primary and secondary sources. I picked out information from each document and used what I thought was necessary. The main things that you will learn are the effects on the atmosphere due to this incident. Another is that we will be talking about the effects on the sea life in that area and the spread of radiation through water. We will also understand why the indecent even happened and why is was so detrimental. The Fukushima Nuclear Meltdown was very bad for the area around it and has started to spread to other areas in the world with a less intense outcome. This incident is a very recent event that should still be noticed, and people should understand what it has affected or not affected.

22. **The Great Pacific Garbage Patch exemplifies our plastic pollution crisis**.

Prasanna Thapa, HIS 247, Advisor: Toni Nicholas

The Great Pacific Garbage Patch is a collection of trash and debris in the North Pacific Ocean. It is one amongst several other such collections swirling in the oceans. These patches of refuse are bounded by ocean gyres. Debris in the patch is primarily plastic. Plastic is not biodegradable, it breaks down into finer and finer pieces, known as micro-plastics. This deterioration into micro-plastics is usually the result of exposure to UV rays, wave -action, marine life, and temperature. Micro-plastics have been discovered floating within the water surface layers, and also in the water column as far down as the ocean floor. This marine debris also prevents algae and plankton from photo-synthesizing, threatening the entire ecosystem. Large creatures like sea-birds, turtles, seals, and all kinds of fish and marine life are also affected either by directly ingesting this plastic or via indirect infiltration of their bodies, we then consume sea food that may have been exposed to the debris. Manmade litter and refuse do not belong in the oceans and it is negatively affecting nature, life, and equilibrium. It highlights our world's compounding pollution crisis.

23. **Space Pollution**

Ethan Xiong, HIS 247, Advisor: Toni Nicholas

In space, orbital debris, also known as space junk or space debris is a very dangerous upcoming issue. With the limited amount of space the earth can provide, many individuals will be looking up towards space to send all trash there. Once any manufactured object that no longer serves a useful purpose around the Earths' orbit is then classify as orbital debris. While in space, orbital debris, as tiny as apiece of chipped paint, can travel up to 30,000 Kilometers per hour or roughly about 18,642 Miles per hour. Extensive damage can occur to both maned and unmanned orbital spacecraft when traveling at these high speeds. When humans send trash into space, huge liability issue arises. Already, there is liability issue for when a different countries spacecraft collides with another. Assuming that each country will send their own trash into space, who will be liable for spacecraft collision. Action is currently being taken to help prevent a cluster of orbital debris, but the process is slow.

24. Fukushima Impact

Zachary Snyder, HIS 247, Advisor: Toni Nicholas

In 1971, the Fukushima power plant was constructed, located 155 miles north of Tokyo, Japan. While the plant was innovative and well engineered, the 9.0 earthquake and subsequent 50 foot tsunami in 2011 led to a 3 day meltdown that changed the Nuclear power industry forever. The impact of the meltdown and the measures to prevent further pollution are significant subjects that have to be handled carefully.

25. The Environmental Impact of Trench Warfare in World War I

Jacob Travers, HIS 247, Advisor: Toni Nicholas

Trench warfare is a military tactic largely employed in World War I where opposing armies fight from systems of trenches dug in the ground. In this study, I explored the environmental impact of trench warfare in the first World War. In my research, I found several first-hand accounts of the conditions in the trenches, and I found several scholarly articles exploring the environmental impacts of WWI trench warfare. Many of the memoirs written by WWI soldiers described the deplorable conditions of living and fighting in the trenches, describing how the landscape had been reduced to rubble. They also described the horrors of the war experienced in the trenches. Several scholarly articles also discussed the complete decimation of the lands and forests due to the trench warfare. These researchers also found that the massive number of bombings in the area actually cracked the bedrock, causing abnormal land and vegetation recovery. Although the earth does eventually recover from the effects of trench warfare, there are many far-reaching effects that will plague the earth for years to come.

26. Waste management and processing in Japan

Ethan Thomas, HIS 247, Advisor: Toni Nicholas

Japan by landmass is the 63rd smallest country in the world with only 145,914 square miles and is inhabited by 126 million people. Pair that with a GDP of over 4.8 trillion dollars that accounts for 6.02% of the world's GDP. This raises the question of how such a tiny country can handle all the waste that is produced with these astonishing numbers. I researched the tactics and solutions that Japan has used to manage and control this waste. Breaking it down into three guiding questions. What processes are used to process this waste? What role does recycling play? What roles do the citizens have? To analyze these questions I took a look at the history of Japan post-WWII as they rebuilt their economy and the infrastructure to support it. As well as new technologies that were developed and applied. This guided me to a broader and more complex understanding of Japanese solutions to their waste management.

27. Macondo

Brock Williams, HIS 247, Advisor: Toni Nicholas

The Macondo oil well spill is one of the largest recent environmental impacts and I will be assessing how to hopefully regulate future oilfield production in the ocean. This impact greatly affected the fishing production in the area. Also, the disaster was assessed initially and keeps affecting the environment today. In this research I hope to obtain a better outlook at what could be done to regulate the oilfield production..

28. The Aftershocks of Fukushima

Myles Tallmadge, HIS 247, Advisor: Toni Nicholas

The Fukushima Dai-ichi meltdown is one of the largest, most severe nuclear disasters in history, outdone only by the Chernobyl meltdown in April of 1986. What caused such a catastrophic nuclear disaster and what could have been done to prevent it? What effects has the disaster had on the surrounding area, and more interestingly, how has affected the world’s view of nuclear power as a whole, and what might the

future of nuclear look like? I aim to shed light on the cause and effect relationships that resulted from the disaster, and how nuclear energy has changed in response to the disaster.

29. The History of the Chernobyl Disaster

Paul Skiba, HIS 247, Advisor: Toni Nicholas

My purpose in writing about the Chernobyl disaster was to inform people on one of the worst man-made radioactive disasters that happened in the 20th Century. From life before and after the disaster, effects on the environment, and the solutions we have come up with to solve the problem. Some questions I had while researching this topic were pretty basic, “how, what, when, where, who”. My methods of obtaining this information from creditable sources were simple, I knew what I wanted to find out, so I searched the internet and the Red Rocks library for what I was looking for and if it was creditable and worth being included in my research then it was added. It was much harder than expected to find everything I wanted; it seems that the Soviet Union kept Chernobyl pretty hush-hush. My findings, as mentioned before were somewhat limited. In conclusion, Chernobyl was short-lived and a disaster that taught the world a lot about the effects and solutions to situations such as these..

30. The Love Canal Tragedy

Tyler Greenhalgh, HIS 247, Advisor: Toni Nicholas

For my topic I am choosing The Love Canal Tragedy. It is a cruel irony that Love Canal was originally meant to be a dream community. William T. Love. created the Love Canal it was a blue collar community that was about a three-block tract of land on the eastern edge of Niagara Falls, New York. After people lived there for a little, people started getting weird smells in their basements, unusual illnesses, and higher rates of cancer and birth mutations/miscarriages were occurring. After these residents have protested for an answer, finally in 1978 the media came out and said that Love Canal was built on top of 21,000 tons of toxic industrial waste that had been buried underground in the 1940's and '50's by a local company called Hooker Chemical Company. This lead to about 82 chemicals reported and about 11 of them turned out to be toxic and or cancer causing. Landfills can of course be an environmentally acceptable method of hazardous waste disposal, assuming they are properly cited, managed, and regulated, but a toxic waste landfill is a whole different ball game. The residents that were in love canal protested so that the federal government would buy their houses and re-located all of the people because it is an unsafe area to live. Since this accident occurred, the put a ceramic cap on top of the toxic waste so that it can not spread an contaminate anymore land. It is also monitored by a new company called Glen Springs, and they are in control of monitoring Love Canal.

31. The Amazon Rainforest's Downfall

Addison Peery, HIS 247, Advisor: Toni Nicholas

I am very interested in the Amazon Rainforest in the heart of South America. This large rainforest spans over Brazil, Bolivia, Peru, Ecuador, Colombia, and Venezuela, most of the northern countries, and is home to the most biodiverse ecosystem. In recent months the rainforest has taken a large hit to a “wildfire” that has rapidly spread, and it made me curious if this was the first time it has been devastated since human occupation. I can only imagine the amount of natural resources present in this vast ecosystem, and I’m sure humans aren’t just now getting to know this. During the 1900’s I want to find out if there were movements for deforestation, mining operations, or anything else that would have caused shrinking of the rainforest. I also want to look for preservation acts if there were any present. What we are facing today to the Amazon is quite terrifying, I want to know if there is a trend, we can find that could show a reversal if we preserve the rainforest. The impact around the world from the suffering of this one forest in South America, could be catastrophic. In my research I am hoping to find better news about the future of our most diverse ecosystem. I will begin with looking at what causes the most destruction to the forest, and follow with effects that can be seen directly from damage..

32. Bidirectional Telegraph

Nicholas Smith, Nichole Starr, Kayla Andis, PHY 212 Advisor: Carlos Medina

A telegraph is a device that utilizes the principles of electricity, electromagnetism and electromagnets to send signals rapidly across long distances. This project discuses the building and testing process of a bidirectional telegraph system, which allowed signals to be sent both directions between two separate modules connected by lengths of wire. The system was tested for current, experimental voltage and resistance at failure of the system under different conditions. These conditions included variations of initial voltage and length of wire between the modules. This data was then used to calculate the resistance of the system at different wire lengths and the minimum induced magnetic field needed for the bidirectional telegraph to function. Finally, the maximum possible length of wire between the modules was plotted vs the voltage put in the system. This showed the linear relationship between the voltage put into the system and the possible distance over which a signal could be transmitted.

33. Standing Waves

Mohammed Yaseen, Colton Gardner, Tristan Orr, PHY 212 Advisor: Carlos Medina

We will demonstrate standing waves using a drill and three different types of strings, and we will compare the frequency of the wave to the tension we will apply to the string.

34. Wave machine

Randi Faust, Jose Ramirez, PHY 212 Advisor: Carlos Medina

Demonstrate how transitional waves function.

35. Electromagnetic Eddy Current Braking

Skylar Johns, Andrew Pankey, Zane Prose, Josh Simpson, PHY 212 Advisor: Carlos Medina

To understand the occurrence of eddy currents, one must first be familiar with the concept of electromagnetic induction in accordance with Faraday's law. Faraday’s law details how electromotive force is induced around a closed loop when subject to a changing magnetic flux. This electromotive force provides the energy needed that results in an induced electric field, which in turn causes an induced current around a conducting loop. Electromagnetic induction comes into play as induced currents may occur through a loop only if the amount of magnetic field is changing. When an electrical conductor is subjected to a changing magnetic field, eddy currents are induced in said conductor. We will be focusing on the efficiency of eddy current brakes in our model. This build was designed with the intention to demonstrate the usefulness of induced eddy currents, particularly with a non-ferromagnetic metal. We will demonstrate how altering the magnetic field strength in our system slows down a moving object.

36. Determining Mass Without Gravity Using An Inertial Balance

Holly Hammons, Marlon Chance, Josh Velazquez, PHY 211 Advisor: Shane Spivey

The mass of an object can be easily measured on Earth by either weighing an object and dividing that weight by the acceleration due to gravity, or using a two pan balance. In a microgravity environment, such as the international space station, these methods of measuring mass cannot be used. Instead, astronauts must use an inertia balance. The inertial balance is a device that can determine mass by measuring inertia, using oscillating springs. If the spring constant is known, it can be used, along with the period of the oscillations, to calculate mass with simple harmonic motion calculations. Otherwise, the mass can still be determined by plotting it on a period versus time squared graph and relating it to the linear line created by known masses.While the inertia balance has been proven to accurately measure the mass of an object in space, the question arises, how accurate is an inertia balance under the influence of gravity on Earth? Our team has conducted a series of experiments that vary the type of metal of the spring, the thickness of the spring, and the angle of the mechanism. Our results showed that, while the inertia balance calculated different results as our variables changed, our results deviated too much from the actual masses that we couldn’t conclude our mechanism to be accurate. Our team can only conclude,

from our experimental observations, that gravity causes a noticeable effect on the inertia balance as the angle of the mechanism changes. In the future, we would like to rebuild the mechanism in an attempt to create more accurate results. We plan to make precision cuts into the metal, and ensure the system is completely stable. We also plan to develop a robotic arm that will pull the mechanism with the same force during each trial.

37. Demonstrating the Ideal Ratio of a Trebuchet

Anthony Boyd, Audrey Whitesell, Kadeja Salem, Ryan Jolly, PHY 211 Advisor: Shane Spivey

The purpose of this project is to find the ideal ratio of a trebuchet's arm length and launch angle to optimize the distance a projectile can be launched. Theoretical data will be compared to experimental data to verify that the predicted ratio is similar to actual ratio is found.

38. Spinning in Circles

Brendan Stewart, Dallas McKeough, Ibrahim Abdul-Nur, PHY 211 Advisor: Shane Spivey

Conservation of angular momentum is a topic of utmost importance in the study of Physics. It is critical on nearly every level of movement, from the celestial bodies down to the movement of atomic and subatomic particles. In our experiment, we analyze the transfer of angular momentum between objects in the same system, and how this conservation was affected by changes in moment of inertia. To analyze this, we constructed a system of interconnected rotating objects, and ran several experiments where velocity was added or suddenly removed from an object, and noting the effect on the rotation of the other object. Our experiments were marred by many failures, caused largely by the relatively small effect that changes in moment of inertia and initial velocity have on such a system relative to factors such as friction and oscillation. The utility of a well-constructed system of this nature would be that rotations could be achieved by fairly small forces. This would be applicable in, for example, orientation of satellites, or of gyroscopes; systems where minimizing power use, or maximizing precision, would be major concerns.

39. An Analysis of Acceleration in Pulley Systems

James Sorteberg, Andrew Linz, Ramon Chavez, PHY 211 Advisor: Shane Spivey

Pulleys have been a staple simple machine for most of recorded human history, and are used everyday in items such as cars, elevators, and flagpoles. The overall goal of these pulley systems is to transfer energy and reduce the force needed to lift an object by changing the direction at which force needs to be applied and distributing the load between multiple different ropes. Our group investigated a pulley's acceleration using a series of different weights and designs to determine the differences between reality and theory. The results of our experiment confirm that as you increase the weight in a pulley system the acceleration of that system will increase.

40. Torque Project

Michael Jennings, Christian Whitesides, PHY 211 Advisor: Shane Spivey

Our project is to test the effects of forces and torques applied to a beam that rotates about its center. To do this we tested various forces and various masses hung from or acting on the beam at different radii. We recorded the subsequent data and calculated the resulting torques and found relationships between the torque generated by a force, and the radius and mass of the object and or force.

41. Spring Projectile Canon

Matt Brown, Jake Hendrix, Luke Kimsey, PHY 211 Advisor: Shane Spivey

The purpose of the Spring Launch Projectiles project was to compare theoretical projectile motion to experimental projectile motion. We started the project with our design specifications and limitations. Once those were known we defined the variables that we wanted to test. We chose to test 3 launch angles, 30,

45, and 60 degrees, 2 different projectile masses, and 3 different springs. We calculated the theoretical projectile motion distances for each parameter using spring force, energy, drag, and kinematics. To test these calculations we designed an experiment using a small spring loaded cannon and collected the data. After analyzing the data our experimental error ranged from 1% to 75%. We encountered several difficulties in replicating our predictions from rapid spring deformation, inconsistent performance, and unpredictable environmental disturbances.

42. Free Hugs

Lexie Ogle, Olivia Veragen, BIO 111 Advisor: Paul Le

Olivia and I are presenting a psychology experiment we performed at school. We held up posters representing us and asked people to hug us based off our relationship status.

43. Companion Planting

Tracy Hamm, Macey Chappell, BIO 111 Advisor: Lacy Cleveland

The visual of a garden or farm a lot of us have engrained in our minds, is one of neatly planted rows of corn, sectioned-off/caged tomatoes and rows of symmetrically lined lettuce. While this idea of nutritional order is aesthetically appealing to many, is it really conducive to growth and production? What if there was a better way? A somewhat, coloring out of the lines, amalgamated, plants growing on top of other plants, rebellious sort of way? Rather than sectioning off and segregating our garden plants, research shows that companion planting can improve garden produce production, aid in soil regeneration, assist in regulating temperature and work more in congruence with mother nature overall. Out of all these possible benefits, we wanted to test idea of Campion Planting by measuring the size of a vegetable and flower, when grown together. Could one of our favorite flowers and yummiest of vegetables, benefit from being planted together? How could this be? Our Hypothesis: Companion Planting will enhance and increase the amount of flowers and vegetables produced, using radish (vegetable) and zinnia (flower) seeds.
For this experiment, our Independent variable included companion planting zinnia and radishes together in one pot (20 seeds, 10 of each), mixed and spread evenly. Our Dependent variables included measuring the size of foliage and flowers/radishes. Our controls included: planting 10 solo-zinnia seeds in one pot, 10 solo-radish seeds in another, 24 hour, indoor UV lighting, the same amount of water supplied to each pot, the same sized and color pots, equivalent soil mix and growing all at a temperature of 72 degrees, Fahrenheit. Over the course of three months, these seeds were attended to, photographed and measured, according to foliage height and flower/radish diameter. From our research, we have evidence to support the claim, that Companion Planting is beneficial.

44. Myofascial Release VS Electrical Muscle Stimulation

Lauryn Peters, BIO 111 Advisor: Tracy Gray

This study was conducted to determine which modality was more effective in reducing pain in the low back, (L1-L5), muscles. Both the EMS and Myofascial Release were accompanied with heat and treatments lasted 15 minutes. 3 total treatments were administered and final data collection confirmed that Myofascial release with heat was more effective in reducing pain.

Thursday, Dec 5, 10am – 12pm

45. A Utilitarian Survey of Climate Change

Maeve Wilder, PHI 218 Advisor: Jacqueline McGreevy

Our decisions in the next few years with regards to climate change will have massive repercussions for decades, and possibly even centuries, to come. This is why examining every aspect of the impacts of acting verses not acting against climate change is of utmost importance. Two different emissions models and their consequences will be compared to get a better idea of the decisions we as a planet face.

Possible futures for humans, animals, plants, oceans, weather, water supply, food supply, and the world economy will be looked at through the lenses of different emission models. This data will be compiled in a table to better enable viewers to utilize utilitarianism. The goal of utilitarianism is to achieve the greatest good for the greatest number. With the overview of climate change impacts that this research will provide, students can begin to weigh the options and come to an educated decision about what measures to take against the changes our planet it facing.

46. Social Conformity for Introverts vs. Extroverts

Tabitha Fritts, Carah Tichelbaut, BIO 111 Advisor: Paul Le

The objective was to see if there is a difference in how people conform to larger groups based on if they are more introverted or extroverted. For materials, we handed out instructions for the people in on the experiment to stand when they heard a certain word. Other than the printed instructions and people in a classroom, we had no other materials. We found that both parties, when surrounded by classmates they knew, questioned why people were standing. The extrovert questioned it, but stood anyways. In conclusion, our hypothesis that extroverts will stand and introverts won't was supported.

47. Individuals Who Sleep Longer Have Better Memory

Franzesca Aquino, Madeline Darr, Larry Villa, Franzesca Aquino, Madeline Darr, Larry Villa

Individuals who get more than six hours of sleep daily will perform significantly better than individuals who get less than six hours of sleep. To conduct our experiment we used an app called Memory Matches 2 and a total of six participants were used to collect data. Three of the individuals regularly get more than six hours of sleep and the other three individuals regularly get less than six hours of sleep. In the app it timed individuals by how long it took them to complete the matching game. In the app we had the individuals use the 6x6 structure, so a total of 36 cards were used. Our participants that slept more than six hours got significantly better results as expected. On average the individuals who slept more than six hours did better by about 54 seconds. In our experiment we concluded that our hypothesis was supported.

48. The Effects of Soil pH on Plant Growth

Emmaleigh Hawkins, BIO 111 Advisor: Paul Le

My experiment was created to test the effects of soil pH on plant growth and to see if a certain pH level was the most optimal for the plants used. Based on many experiments and research done in the past by other researchers and scientists, I hypothesized that soil pH would have a large affect on plant growth and for the plants I used, which were beans, the neutral pH soils would be the most optimal for growth. By using a variety of substances with different pH levels, such as lemon juice, coffee grounds, and ground limestone, I found that the beans reacted quite largely to differing pH levels and that the soil with the more neutral pH’s (levels seven and eight) had the most growth overall, as hypothesized.

49. Magnetic Levitation Train

Brigid Courtad, Hannah Garland, Perla Lyon, PHY 212 Advisor: Lynnette Hoerner

Through an understanding of magnetic fields and the calculation of velocity, this experiment is able to demonstrate how position and magnetic strength in a system affect the speed and distance a specified object is displaced. Through the use of a copper coiled track, magnets, and a double A battery we were able to simulate a simple magnetic levitation train. Within this experiment we posed the question of what magnetic strength and positioning of the track would result in the fastest and most predictable velocities. The variables included three distinctive copper-coiled tracks and two magnets of varying magnetic strengths. The two magnets will be attached to the battery in order to propel the battery through the coiled tracks. Each test has a recorded distance and time for each test as well as a recorded magnetic field that

will be measured using a magnetic field sensor. The results from these tests depict the most successful positioning of the tracks and magnetic strengths and their calculated average velocity given the magnetic field created. As an analysis, the experimental magnetic field values will be compared to the theoretical values that were predicted prior to the experiment itself.

50. Eddy Brakes

Nicholas Probst, John Devivo, PHY 212 Advisor: Lynnette Hoerner

In order to create an electromagnet brake that can slow a bike, smaller tests are going to be conducted to find what materials create the strongest electromagnet. Our group will be testing to see how current effects the efficacy of a magnetic break. In our case, we will be varying the metal that the insulated wire is wrapped around. The number of coils and the current output will remain the same for the duration of the small-scale experiment. In order to determine what electromagnet is the strongest, we will be seeing how fast it is able to stop a rotating disc. This disc will also have a constant starting speed, and each magnet will be activated at the same time during trials. Friction will be small in this case, because a skateboard bearing will be used to rotate the disc smoothly. A stopwatch will then be used to time how long it takes for each electromagnet to stop the rotating disk. The setup that stops the disc the fastest will then be mounted onto a bike to see if it can slow it down in a reasonable amount of time.nce the goal of the experiment is to create an electromagnetic brake that is capable of slowing down a bike, we will need to record the data of how strong each of the electromagnets we create is. To vary the different trials, we will be wring multiple batteries in parallel to change the current of the electromagnet. We will also be measuring the amount of copper wire that we wrap around the core and how much current we are using and at what voltage. Then we will need to spin the sheet metal disk at a set initial velocity and record the amount of time it takes the brake to stop the disk and how fast the velocity and acceleration of the disk are changing. This will be accomplished using angular velocity and acceleration equations. We will then need to calculate the electric field of that the copper wire creates and the resulting magnetic field of the electromagnet so that we can determine how the brake should have worked. Once all of the calculations are done we can determine which brake core is the most effective and compare that to what our experimental results actually were.

51. Magnetically Induced Current Generator

Trenton Spitler, Jesse Ward, Jason Miller, Michael Crespin , PHY 212 Advisor: Lynnette Hoerner

The project we decided upon uses the concept of induction with magnets to induce a current through makeshift solenoids. By rotating these solenoids around a central point between two powerful magnets we are attempting to induce a current through the copper wire. In order to test the concept we will be varying the number of arms/solenoids around the central post and we will also attempt to examine the effect the rotation speed has on the results but without a way to rotate at a constant measured speed this will be mostly conceptual. The rotation of the generator will be done through hand rotation. This will be the overall purpose and concept of our project. An induced current is caused when a changing magnetic field goes through a loop. This will be achieved in our hand motor by the spinning motion of the solenoid arms as they pass the magnets. Magnetic flux is the amount of magnetic field that's passing through the loop and depends on the strength of the magnetic field that’s creating it. Lenz’s law will be used in this project because we will be creating a closed loop through all of the arm solenoids. Lenz’s law states that in order for a current to travel through these loops the magnetic field must be changing and simply having flux is not enough. The idea for this project mostly comes from a video on how to build a dc motor. We will be basing our design for our project off of this video, but the variables we will be testing are ones we concluded on as a group. In addition, we will be modifying the design to create an AC output instead of a DC output. We will be using some of the tools provided in the school’s labs to measure the variables we require such as magnetic field and voltage.

52. The Physics of the Trebuchet

Chloe L Montgomery, PHY 211 Advisor: Paul Wright

We intend to build a functioning trebuchet and use it to fire a small projectile at a targeted area with an assortment of varied counterweights. Using the weights of the counterweight and the projectile along with the distance traveled by the projectile we will calculate the initial velocity experimentally. Once we have this value we will be able to compare it to the theoretical velocity calculated through Newton's third law and one dimensional kinematics. We will do this over several trials and using different amounts of weight for the counterweight, but this weight will always be proportional in some way to the weight of the projectile.

Thursday, Dec 5, 12 – 2pm

53. Amazonia

Noemi Mota, HIS 247 Advisor: Toni Nicholas

Recently, the Amazon has captured attention worldwide. The Amazon rainforest is 2.6 million square miles about forty-percent of South American territory. It is known as the largest tropical rainforest on earth and it expands into Brazil, Bolivia Peru, Ecuador, Colombia, Venezuela, Guyana, Suriname, and the French overseas territory of Guiana. The Amazon is home to endangered species dependent on its tropics and forty-thousands plant types exclusive to this region. Unfortunately today, the Amazon is experiencing deforestation which risks life on earth. This region is crucial to the earths ecosystem. Its trees absorb five percent of the carbon dioxide released into the atmosphere emitted by humans. Unfortunately, deforestation in the Amazon releases carbon into the atmosphere and increases the rate of climate change on earth.

54. Trebuchet versus Catapult: A Demonstration of Projectile Motion

Chris Wilhoite, Jon Dimercurio, Thomas Clements, Cid Quezada, PHY 211 Advisor: Paul Wright

Throughout the semester in PHY 211, we have learned a great deal about using kinematics to determine a projectile's motion. We wanted to create a project that would encompass what we have learned throughout the semester and its applications in the "real world". Our project consists of two launching devices: a trebuchet and a catapult. The trebuchet functions by using counterweights and the catapult operates using a torsion system. The two siege engines will each launch objects of equal mass 30 meters. The first step in conducting our experiment involves creating an ideal environment to obtain theoretical data in which we can compare our experimental data with. Using our ideal system and theoretical data, we set-up an experiment that would put our theoretical results to the test. Our experiment was conducted in the gym to eliminate as many outside forces as possible. We positioned our siege engines to be perfectly parallel to one another at the same launching point so we could compare the distances accordingly. Once the experimental data was collected, we compared it with our theoretical data to see how our results lined up. Then finally, after comparing the experimental data with the theoretical data and assessing the possible causes of error, we optimized our systems to come as close as possible to obtaining our theoretical results. Using kinematic applications, we were able to better understand and interpret projectile motion; strengthening our understanding of physics and its applications in the "real world".

55. An Analysis of coefficients of static friction

Kumar Chhabra, Casey Chambers, Dave Bonner PHY 211 Advisor: Paul Wright

The purpose of this project is to test the relationships between static friction and mass, and between static friction and surface area. The experiment will be conducted using an articulating ramp setup. The

materials used for the surfaces will be pine or fir lumber. The ramp will be constructed of a two meter section of a 2” x 8”. The ramp will have a pivot point at the bottom consisting of a piece of pipe strapped to the bottom of the ramp, with a base allowing the pipe to rotate and the ramp to incline. The base will need to be leveled the entire length of the ramp. Wooden blocks with different masses and surface areas will be placed at the top of the ramp and the angle between the ramp and the ground will be increased steadily until the blocks begin to slide. The experimental coefficients found will be compared to the established coefficients found in engineering tables. The data will also be compared as a ratio of static friction coefficients to surface area and mass respectively. This comparison will be done both through a table and a scatter point graph with the “best line” feature. This line will be used as a function to predict variation in the static friction coefficient based on surface area and/or mass of the unknown wooden object.

56. There and Back Again

Micah Wiederwohl, Collin Chader, Sam Shive, PHY 211 Advisor: Paul Wright

For our project, we will be demonstrating our understanding of kinematics. Making use of our kinematics equations we will launch a projectile at an angle from atop a hill and catch it at the bottom. The launching mechanism will be attached to a cart that will meet the projectile at the bottom of the hill and catch it.

57. Bridge Analysis

Soltan Aljohani/ David/ Lupita, PHY 211 Advisor: Paul Wright

58. Shuffle Board Machine

Brendan Navarro, Grace Waters, Jacob Travers, Zak Scott, and Quinn Maillot, PHY 211 Advisor: Paul Wright

In this project, we designed a form of an automated shuffleboard. A motorized accelerator assembly is employed to find the coefficient of kinetic friction of wood on wood. This coefficient enables us to isolate the exact distance an object will travel. The data gathered will be used to code a program to determine how fast the accelerator vehicle needs to go in order to launch the block to the desired distance.
By feeding a position into the program, the code will then compute the release speed of the block in order to make the block stop at the specified location. The controller will then ramp the motor up to the desired speed and release the block which will then slide to the desired location. Upon testing, we observed that our shuffleboard machine can consistently reach specified locations. We rewrote the program to accept a given distance to have the shuffleboard machine output the velocity needed for the block to reach that point.

59. The Effect of Drag on Projectiles

Samantha Weese/Charley Bartley, PHY 211 Advisor: Paul Wright

The purpose of our experiment is to measure the effects of drag on projectiles, and to calculate the coefficient of drag for carrying fluids. We intend to investigate the relative effects of the area of the cross section of our projectile as well as the density of the fluid that our projectile moves through. We are trying to determine the drag coefficient of objects through certain fluids, which would then determine how much energy needs to be transferred in order to push that object through that certain fluid. Our hypothesis is that object of different surface areas will experience more drag than those with a smaller surface area. We will be testing our hypothesis by dropping three different sized balls in different fluids. We will be

using a tennis ball, baseball, and a pool ball. We will fill three different clear tubes with different fluids, and will drop each ball in the same tube and measure the amount of time it takes each ball to sink to the bottom. Tube A will be empty to measure to coefficient of drag of air, Tube B will be filled with water, and Tube C will be filled with oil. To account for the buoyancy of the tennis ball, we will be filling it with and to ensure that the air inside of the tennis ball will not effect our results. Measuring the rate of change in centimeters, we will determine the time it takes each ball to sink into the respective solutions by one meter. We will then use our data to solve for the drag coefficient as laid out in the equation D=1/2ζρAv^2, C being the drag coefficient that we will be solving for, ρ being the density of the fluid, A being the cross section of the projectile perpendicular to the direction of travel, and v being the speed of the projectile. We expect the pool ball to displace each fluid the fastest due to its value of mass compared to the other, which means that the drag coefficient on the pool ball will be less than those on both the baseball and the tennis ball. In conclusion, knowing the drag coefficients of projectiles with different masses and surface areas will help in furthering physics education in terms of how fast objects sink and whether or not their surface areas help to keep objects suspending in fluid for longer periods of time.

60. How do worms affect plant growth?

Mariah Webb, Jennifer Arendall, Samantha Blagg, BIO 111 Advisor: Paul Le

For our experiment, we asked the question, "How would different amounts of worms in soil affect plant growth?" We hypothesized that if there are more earthworms in the soil, then there will be more growth in the plant. To test this idea we bought three small pots; all the same type and size. Then we poured the same amount and type of soil into the pots where we grew one sunflower seed per pot. The first pot was our control and contains no worms. The second pot contains 4 worms and the third pot contains 8. The pots were placed in the same spot next to a sliding glass door and received the same amount of sunlight a day and were watered the same amount. Each day the sprouts of the sunflower seeds were measured in length. During the entirety of the experiment, the the pot with no worms had the tallest plant. This evidence falsifies our hypothesis because we believed the more worms in a soil mix can help improve a plant's growth by providing nutrients and mixing up the soil. Originally, the plant with 4 worms was taller than the one with 8 worms but then the pot with 8 became taller than it. Recently near the end of the experiment, the pot with 8 worms became smaller than the pot with 4 again because it was unhealthy and the top of it withered off and fell. Currently the pot with no worms is tallest, the pot with 4 worms is second tallest, and the pot with 8 worms is the shortest. These results could tell that worms slow the process of plant growth or at least having no worms in soil helps plants grow faster and healthier than if they had them. Although our hypothesis appears to be falsified, we have found interesting information that can help us form a conclusion that we can share with others..

61. The Nature of Eye Contact

Maryssa, Grant, Arya, Wes, BIO 111 Advisor: Paul Le

Previous research regarding the study of eye contact has shown physiological arousal as much as attention responses in each other’s responses to another’s gaze upon them. It can even have this effect without seeing another’s gaze at all, according to Aki Myllyneva and Jari K. Hietanen, the founders of this original experiment that was apart of the inspiration for our group project. The goal of my group’s experiment is to investigate and measure if it is just merely the knowledge of knowing you are being seen that triggers this physiological arousal and/or attention responses and what they are. By narrowing it down to specific age groups, a specific public setting and by choosing a physiological response that we notice over and over again in the study: Do they look out into distance, straight at the person and/or does their gaze face the ground and when responding was the visibility of the model and other participants clear to see and to be seen. By using different scenarios of eye contact like across the way from one another, around a corner, or a quick rush-by we were able to notice different responses in participants in each setting mostly through what we predicted to be which was physiological arousal..

62. How much will a plant with worms grow?

Jenny, Mariah, and Sam, BIO 111 Advisor: Paul Le

For our science project we are seeing how the amount of worms effect the way a plant grows. So we have three different plants, one plant has no worms, the second plant has a small amount of worms and then the third plant has a large amount of worms. Our productions are that the plant with no worms will grow the most and the one with the most amount of worms will grow the lest. So far in our experiment our predictions are being proved true. The one with no worms is grown the most and the one with the most worms is growing but not as much as the one with no worms.we have been going all of the plants the same amount of water and sunlight.

63. Oily Skin vs. Cosmetics

Selena Fishel, Mandy Farmer, Shyanne Deherrera, BIO 111 Advisor: Paul Le

The purpose of our experiment was to show the effect of different types of foundation on oily skin. We used some foundations that were formulated for oily skin and some that weren't. In order to record the effects, each of us wore the foundations for a day each and wrote down the effects it had on our skin. In addition, we used oranges as a visual aid to simulate the pores of skin.