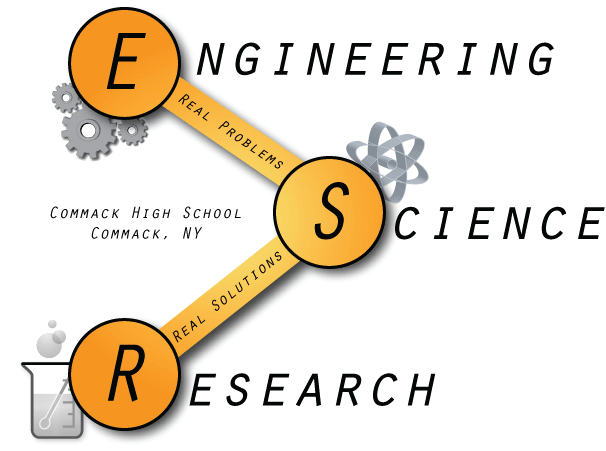
*The Research Dragon*





**Commack High School’s**

**Research Yearbook**

**2011 - 2012**

**A Celebration of Research at Commack High School**

**Thursday May 24th, 2012**

**7:00 pm**

**Evening Events**

Poster Presentation of student projects

Slide Show Presentation… Dan Kowalsky and Patryk Piascik

Introduction…………..….Michael Iadevaia

Opening Remarks….….…Mr. James Engeldrum, Director of Science, K-12

Student Reflections…..….Thomas Vetere, Chantel Yang

Alumni Comments……….Erica Portnoy

Guest Speaker………….. Andrea Dickstein

Director, eBusiness and Marketing Communications

Eppendorf North America

Honoring Our Mentors…..Meghan Kennedy, Jessica Schwartz, Jared Wilson

Anthony Bisulco, Justin Cheung

Rajkumar Pammal

Special Recognition …….Rebecca Alford, Savina Kim

Honoring Our Seniors…...Harrison Ferlauto, Kayla Neville

Closing Remarks…..…….Michael Iadevaia

Welcome to our Celebration of Science Research. This evening, we pay tribute to the creativity, hard work, and success of our students over the past school year. Participating in the science research program requires a personal commitment, dedication to the completion of a project from start to finish, and the enthusiasm to overcome the obstacles and enjoy the success along the way.

At each science fair that we have participated in, our students represented the Commack community in a respectful and professional manner. They were all well prepared and eager to share their efforts and results with science fair judges.

This evening, we honor each one of our science research students for their involvement and participation in the Commack High School science research program.

Ms. Jeanette Collette……………Science Teacher

Mr. Richard Kurtz………………Science Teacher

Dr. Lorraine Solomon…………..Science Teacher

Ms. Andrea Beatty……………...Lab Assistant

Mr. James Engeldrum………….. Director of Science, K-12

*With gratitude we would like to thank the following who have helped our staff and students in so many ways all year to make our research program work so well.*

Carolyn Campbell, Mindi Goonan, Elizabeth Koelzer, Elaine McCauley, Camille Horak, Laura Newman, Nancy Nunziata, Eileen Rogers, Genny Sebesta, Susan Shapiro, Elizabeth Smith, Victoria Stack, Judy Titolo, and Ed Storck and our fabulous custodians.

**Science Fair Participation**

**Intel International Science and Engineering Fair**

Pittsburgh, PA May 14-18, 2012

Rebecca Alford

Steve Jang

Rajkumar Pammal

Trinity Russell

*Awards to Be Announced*

**INTEL STS**

**Savina Kim, Finalist**

**Rebecca Alford, Semifinalist**

**Austin Lee, Semifinalist**

**National Cancer Institute and National Institute of Environmental Sciences Convention**

Kayla Neville, Best Basic Research Poster

*This is the first time the award has gone to anyone other than a professional researcher*.

**Toshiba/NSTA ExploraVision Program**

Christina Cabana and Justin Cheung - Honorable Mention, top 10% of students nationwide

- Invited to present at a special Earth Day NY celebration

**National Engineering and Design Challenge**

Hugh Han and Tommy Kowalski - National Honorable Mention for the “Clip-N-Slip”

**Junior Science and Humanities Symposium**

*Students must apply to the symposium and be selected to present their projects*.

Brian Hastings

Steve Jang

Savina Kim

Rajkumar Pammal

1st place, advancing to National Competition - Rajkumar Pammal

**Junior Science and Humanities Symposium – National Level**

Rajkumar Pammal - 2nd Place, Environmental Sciences

- $8000 Scholarship

-Invited to London International Youth Science Forum, August 16-30, 2012

**Long Island Science and Engineering Fair, Round 1**

*(Round 1 finalists advance to LISEF 2 for awards)*

Rebecca Alford

Brian Hastings

Michael Iadevaia

Steve Jang

Savina Kim

Alexander Mermelstein

Rajkumar Pammal

Trinity Russell

**Long Island Science and Engineering Fair, Round 2**

Rebecca Alford - 1st Place, Cellular Biology

Brian Hastings - Honorable Mention, Environmental Science

Steve Jang - 1st Place, Chemistry

Savina Kim - 3rd Place, Cellular Biology

Rajkumar Pammal - 1st Place, Environmental Management

Trinity Russell - 1st Place, Animal Sciences

The Wisner-Gross Award in Environmental Science - Brian Hastings

The ASM Material Science Education Award - Rajkumar Pammal

InVitro Biology Certificate - Rebecca Alford

InVitro Biology Certificate - Savina Kim

Stockholm Junior Water Prize - Brian Hastings

Stockholm Junior Water Prize - Rajkumar Pammal

*All First Place winners advance to International Competition in Pittsburgh, PA in May*

**Long Island Science and Engineering Fair, JV Division**

Daniella Azoulay - 1st Place, Biology

Anthony Bisulco - 1st Place, Physics

Christina Cabana - Honorable Mention, Biology

Justin Cheung - 1st Place, Behavioral Science

Greta Huang - Honorable Mention, Biology

TJ Passaro - Honorable Mention, Biology

**New York State Science and Engineering Fair, INTEL Division**

Brian Hastings - 3rd Place, Animal Science

- Stockholm Water Prize

Savina Kim - 3rd Place, Cell and Molecular Biology

Alex Mermelstein - 2nd Place, Physics

**WAC Lighting Foundation Invitational Science Fair**

Rachel Aitchison - Merit Award, General Biology

Daniella Azoulay - 3rd Place, General Biology

Stephanie Badir

Jae Yoon Bae

Anthony Bisulco - 2nd Place, Physics and Astronomy

Christina Cabana - Honorable Mention, General Biology

Ryan Chan

Justin Cheung - 1st place, Social Science

Charles Eder

Harrison Ferlauto - Honorable Mention, Earth and Environmental Science

Alexander Ferreira - Merit Award, Earth and Environmental Science

Colleen Flynn - 3rd Place, Physics and Astronomy

Gabriel Green

Jonah Haber

Hugh Han - 2nd Place, Prototype Engineering

Greta Huang - Honorable Mention, Molecular Biology

Anthony Jao

Andrew Kim

Tommy Kowalski - 2nd Place, Prototype Engineering

Angela Kubik - Merit Award, General Biology

Briana Kubik - Merit Award, General Biology

Sarah Lamorte - 3rd Place, Chemistry

Austin Lee - Honorable Mention, Earth and Environmental Science, Senior Division

Grace Lee

Sam Luber - Merit Award, Social Science

Lindsay Marano

Scott Massa - Merit Award, General Biology

**WAC Lighting Foundation Invitational Science Fair (Cont.)**

Marissa Mathew

Philip Mauser

Kayla Neville - Honorable Mention, Molecular Biology

Andrea O’Brisky - 3rd Place, Physics and Astronomy

TJ Passaro - Honorable Mention, Molecular Biology

Neela Qadir

Tracey Rosenlicht

Zachary Silber

Rakia Syed

Nakul Thampy

Rubin Thomas

Cortney Tiberia

Thomas Vetere

Chantal Yang - Merit Award, General Biology

Rachel Yang - 1st Place, General Biology

**Noyce Symposium**

*Students must apply to the symposium and be selected to present their projects.*

Rachel Aitchison

Zan Asif

Peter Brennan

Robert Delgado

Charles Eder

William Furst

Samantha Galina

Lisa Kim

Daniel Kowalsky

Lindsay Marano

Scott Massa

Patryk Piascik

Melanie Shayowitz

Jacqueline Tuminello

Chantel Yang

Young Seok Yoon

**Long Island Science Congress**

*Awards announced on May 22, 2012*

Hong Joo Ahn - Honorable Mention

Christopher Arens - Honorable Mention

Eric Bass - Achievement

Jianna Cressy - Achievement

Scott Gold - To Be Announced

Maurice Green - Honorable Mention

Brian Huang - Achievement

John Ioannou - To Be Announced

Hamid Jalili - Achievement

Laura James - Meritorious

Gabrielle Khalife - Meritorious

Gloria Kim - Meritorious

Julie McDonald - To Be Announced

Scott Mulligan - Achievement

Erin Neville - Meritorious

Claire Regan - To Be Announced

Eric Rizzo - Achievement

Laxshika Raveendran - Meritorious

Michelle Zhou - Meritorious

**New York State Science & Engineering Fair, Andromeda Division**

*Awards announced on May 23, 2012*

George Burke

Sarah Choi

Arya Doshi

Jacqueline Gallo

Rachel Gross

Diana Hagedorn

Meghan Kennedy

Megan Kurten

Ryan McCaffrey

Maeve McLoughlin

Alinur Rahim

Daniella Rana

Jessica Schwartz

Zachary Shushan

Daniel Tamer

Noah Tollin

John Voiklis

Jared Wilson

**ABSTRACTS**

**Seniors**

***Rebecca Alford***

**The Membrane Mutational Effect Classifier (MMEC): A Novel Structure-Based Approach to**

**Predicting the Functional Effects of Mutations in Membrane Proteins**

Deciphering the molecular basis of traits (phenotypes) is key in understanding various rare genetic disorders. However, determining the effects of genetic variation on protein function is computationally challenging due a large possible conformational search space that proteins explore when they fold and function. Proteins that are bound to the cell membrane are especially difficult to understand as the computational modeling and experimental determination of structure and function is complicated by the membrane environment. Nonetheless, membrane proteins are critical to various cellular processes as well as to understanding the connection between protein structure and the resulting phenotype. This work describes the Membrane Mutational Effects Classifier (MMEC): a new computational method that predicts loss-of-function and silent phenotypes due to mutations in membrane proteins. To make predictions, the user provides a membrane protein structure model and optional list of mutations to classify. Using sequence- and protein structure-based features from the Rosetta Molecular Modeling Software, MMEC uses statistical inference methods to predict the resulting phenotype of a given mutation. Testing against a leave-out set demonstrated that MMEC consistently generates predictions with 93% accuracy at best. Therefore, by providing access to novel and previously difficult-to-obtain predictions, MMEC can further current research by improving understanding of the connection between protein structure, function and disease.

***Jason Bass***

**How do Migration Patterns (Geographic location, Distance travelled) Compare among**

**Green (*Chelonia mydas*), Hawksbill (*Eretmochelys imbricate*), and**

**Loggerhead (*Caretta* caretta) Sea Turtles?**

Green (*Chelonia mydas*), Hawksbill (*Eretmochelys imbricate*), and Loggerhead (*Caretta* caretta) Sea Turtles can be found in various locations around the world, they have different diets and are known to have specific migration patterns (Rice, 2008). Loggerheads have been known to make extensive journeys following their prey (Lusci, 2003), and Green Sea Turtles return to the same beaches that they were born in order to lay eggs (Lohmann, 2008). This study consisted of obtaining data from various studies for three species of sea turtles. These turtles were tracked so that their total distances and straight-line distances were compiled. The data used in this research project was obtained from the website, Seaturtle.org. Calculations were done to compare the average total distance per day and average straight-line distance per day for these species. T- tests were also used, to check for differences in the averages. Although the Loggerhead turtle was expected to have the greatest average straight-line distance per day out of all the species, it was second to the Green Sea Turtle. This data shows that the standard deviation for each category is usually higher than the average distances calculated. This means that the there is great variation in the journey distances among individual turtles. The data obtained for this study was obtained from studies based all around the world. In order to get more accurate results, this project could be narrowed down to a single region where the different species may migrate more or less due to the habitat.

***Michael Iadevaia***

**A Statistical Analysis of the Correlation Between Kidney Cancer and Chloroform**

**In Drinking Water in Suffolk County, NY**

The purpose of this study was to use existing data sets to investigate the potential correlation between chloroform in drinking water and kidney cancer in Suffolk County, New York. The data was obtained from the Suffolk County Environmental Health Lab (which stringently monitors the substances found in the aquifer water supplies). Using statistical analysis, a correlation was developed to show that there could be causation between chloroform levels and kidney cancer in Suffolk County. The correlation coefficients were determined by graphing the percent of chloroform found in water each year with the number if samples found with chloroform. Using Least-Squares regression analysis, the coefficients were calculated. The resulting correlation coefficient (r) was approximately 0.82, whereas the r2 was 0.67. As such, there was a moderate relationship between the two variables. Additionally, no patterns were found in the residual model, indicating that the model was fairly reliable for this data set. Utilizing the county data to develop a correlation between substances would be crucial to help determine possible causes of cancer.

***Alex Izen***

**To What Extent is the Pythagorean Expectation Formula Applicable to American Football?**

Pythagorean expectation is a formula invented by Bill James to estimate how many games a baseball team “should” have won based on the number of runs they scored and allowed (James, 1986). Comparing a team’s actual and Pythagorean winning percentage can be used to evaluate how “lucky” that team was and home good fortune played in their favor. The term is derived from the formula’s resemblance to the Pythagorean Theorem. The basic formula is: WPct represents the estimated winning percentage, RS stands for the total runs scored and RA stands for the total runs allowed. Furthermore, the formula regresses towards the mean.

With professional sports being such a major staple in American society, it is very important that the people in charge of these organizations make educated decisions. Fielding a competitive team drives profit and revenue for a team, and this is very important not just to the team, but also to the entire community in which the team is located, as there is a direct correlation to the team’s performance to the economy in the city (Keri, 2007). Currently, baseball executive utilize this formula when making personnel decision and evaluating their teams. If this formula could be applied with similar implications in American football, it could significantly alter the way executives manage a football team and therefor improve the record of the team. (Schatz, 2011). However, I hypothesize that the formula will not work as well with football. I believe that the football season is too short to provide a large enough sample size to be effectively applied, in addition to the large variability in scoring intervals.

***Steve Jang***

**Systems and Analysis of Novel Phototriggers for Drug Delivery Systems**

Despite two decades of research of photolabile linkers, the field could not come up with a strong candidate for drug delivery. The project’s objective was to improve the photo-releasing efficiency of phototriggers by studying the mechanisms of the photoreaction and the factors that contribute to increase in photo-releasing efficiency. The paper focuses on one of the phototriggers called triphenylethanonyl. The phototrigger is a modified form of benzoin designed based on the concept of improving the resonance present on the carbocation. In result, the resonance will stabilize the product after photoreaction, and therefore, increase the photo-releasing efficiency. The photo-releasing efficiency of the compound, 1,2,2-triphenylethanonyl N-t-boc gamma amino butanoic acid the efficiency was far greater than the previous phototriggers. The study of 1,2,2-triphenylethanonyl N-t-boc gamma amino butanoic acid reaction mechanism confirmed the effectiveness of stabilizing the carbocation and also gave rise to the importance of the spin state in determining the photo-releasing efficiency.

***Abdullah Khan***

**The Dispersion of *Frangula alnus* Across the United States**

Glossy Buckthorn is an invasive plant that disperses over novel ranges and takes over the ecosystem of that region. In North America specifically, it has taken over much of the central and eastern region, and has eliminated the native species of that ecosystem. To investigate the rate at which Glossy Buckthorn dispersed through North America, herbarium records were collected and organized according to the year that the collection was made. Using commands in R-project and the latitude/longitude location of the specific collections, the distances that Buckthorn dispersed were calculated relative to the first collection. Then, DIVA-GIS was used to create a graphical representation of the collection points. These maps were created in 20-year time intervals so the dispersal of Buckthorn could be tracked through time. It was discovered that around 1950s, Glossy Buckthorn had spread over a wide range of land in North America. Starting around the southern New England region in the 1890s, Buckthorn spread to central United States and Canada by 2010. It was noted that Buckthorn, like many invasive plants, had a cyclic cycle in which it: 1) dispersed to a new region 2) suspended its dispersal 3) in filled the new region 4) resume its dispersal. Approaching the actual prompt, Buckthorn dispersed at the rate of about 63 km per year. Even for an invasive plant, that is a very high dispersal rate. Also, this data discloses that Glossy Buckthorn in general is a very vigorous invasive plant because it has the ability to disperse and concentrate into novel ranges. The importance of this investigation lies in the fact that this plant has no economic benefit but instead destroys species of plants that do have benefits in fields such as medicine and lumber. By studying the strength of Glossy Buckthorn, environmental policies can be made to eliminate Buckthorn from ecosystems to reduce economic loss.

***Lisa Kim***

**Historical Snowfall and Temperature Records at Erasmus Hall, NY in the**

**Early 19th Century as Compared to Modern Climatic Normals**

Today climate change is a major global concern. Increasing global temperatures and erratic weather patterns are causing environment al and economic problems. To improve our understanding of climate change it is imperative that more information related to changing weather patterns be collected and analyzed. The purpose of this investigation was to study the historical weather data recorded at Erasmus Hall, Brooklyn, New York, and compare it to the temperature and snowfall of modern data from the same area. Comparing historical weather data to modern data can be used to increase our understanding of climate change and trends that can be used to predict future climate conditions. Historical weather data was obtained from meteorological records taken at Erasmus Hall High School (1826-1857) and compared to modern weather data (1976-2007). These data were digitalized and studied to determine if there were differences in the mean annual temperature and the total annual snowfall. The months between November and March were analyzed. Results showed that there were statistical differences between the historical and modern temperatures of November, December, February, and March, but not January. On average the modern time period was warmer by 3.4°F. There were also significant statistical differences in the amount of snowfall between both sets of data for the months of December, January, February, and March, but not November. The total average snowfall was 120.8 inches more in the modern data. This project illustrates the potential use of historical data to get a clearer view of climate trends.

***Savina Kim***

**Cognitive Deficits in Neuropsychiatric Disorders: A Schizophrenia Model**

**Associated with Neuronal 007Nicotinic Acetlycholine Receptor Localization**

Cognitive deficits are prevalent symptoms in central nervous system disorders such as Alzheimer’s disease, Parkinson’s disease, and schizophrenia. In schizophrenia, where cigarette smoking occurs at a particularly high rate (~90%), it is thought that nicotine "self administration" may ameliorate symptoms of attention deficits and thought disorder. Despite the well known links between α7 nicotinic acetylcholine receptor (α7 nAChR) activation and cognitive improvements, the mechanism(s) underlying this association are not known. This study aimed to link the molecular level of α7 nAChR localization to its higher cognitive network level.

The alteration of α7nAChR localization by a valine to leucine polymorphism (V321L) of Neuregulin-1 (Nrg1), a schizophrenia susceptibility gene, was observed. Using a Neuroblastoma-2a cell line and immunofluorescence labeling, I found that V321L-Nrg1 decreases α7 nAChR surface expression by ~50% but not its internal α7 pool, suggesting that Nrg1 affects receptor insertion but not assembly. Next, signaling pathways that direct receptor trafficking were investigated. V321L-Nrg1 triggers a ~30% decrease in PI3K signaling, suggesting the decrease in surface α7nAChRs results from attenuated PI3K-Akt signaling.

Understanding how α7 nAChRs traffic to the axonal surface to modulate neurotransmitters and maintain synaptic transmission is essential. It is a prerequisite for synthesizing new treatments targeting cognition. This proposed model of α7 nAChR localization raises the possibility of developing novel pharmacotherapeutic strategies aimed at modifying α7 nAChR expression in different brain regions. It will be of considerable interest to manipulate its localization pathways to alter receptor properties and normalize cognitive deficiencies caused by neuropsychiatric and neurodegenerative diseases.

***Daniel Kowalsky***

**Is There Genetic Variation Present in**

**Cellar Spiders (*Pholcus phalangiodes*) From Geographical Regions?**

The purpose of this study was to explore the genetic variation among cellar spiders (*Pholcus phalangiodies*). Organisms that have similar genomes or are considered the same species may evolve gene differences over time if they are isolated. Natural selection, a process where favorable adaptations are passed down to their offspring, is the driving force for the accumulation of genetic difference among once related organisms. It is thought that allopatric speciation plays a crucial role in evolutionary change at the genetic, physical, and behavioral levels. Allopatric speciation is when a population of the same species becomes isolated due to geographic isolation caused by physical barriers. Cellar spiders offer a unique opportunity to investigate speciation and its relationship to genetic variation, another component to understanding evolution. These spiders are often found in isolated places within a building. The spiders’ widespread distribution allows for the comparison of their DNA from a variety of areas. Cellar spiders are sedentary organisms in that they are not known for great dispersal. There may not be a lot of gene flow for example between a population of cellar spiders in a house and another nearby home. Essentially, they may represent small genetically isolated populations. This increases genetic drift within their population. Using a Qiagen DNA extraction kit, DNA was lysed and specific genes were amplified using PCR and compared using Clustal W. Results thus far show that there is little variation between spiders in the COI gene; however, there is variation present in the 28sr ribosomal gene.

***Zachary Kramer***

**A Study of the Factors Affecting Antibiotic Resistance in *Escherchia coli***

The bacterium strain *Escherichia coli* K12 is commonly encountered daily by humans. While the harmless strains are part of the normal flora of the gut, and benefit their hosts by producing vitamin K2 and preventing the formation of pathogenic bacteria within the intestine, some serotypes can cause the host to be violently ill and require the help of an antibiotic, such as penicillin, to eradicate the bacterial infection. In recent years, *Escherichia coli* have been able to withstand antibiotics such as penicillin at a much higher rate than in past generations. This new found resistance to mass produced antibiotics presents a severe problem for afflicted individuals and scientists alike since no one will purchase an obsolete antibiotic, forcing researchers to develop new antibiotics. Some antibiotics that have been recently examined as possible candidates to substitute penicillin include the newer Beta- Lactam inhibitors Amoxicillin and Ampicillin, the Amino Glycoside Kanamycin, and the Fluoroquinolones Streptomycin and Ciprofloxin. Each antibiotic is grown in a bacterial broth and spread onto an ager plate each seeded with two different antibiotics. It was hypothesized that the Beta- Lactam antibiotics would be the least effective at destroying the colonies of bacteria. The hypothesis was justifiable since Amoxicillin and Ampicillin are both partially synthesized from the original Penicillin antibiotic. Therefore, the bacteria would be able to resist the Amoxicillin and Ampicillin due to it already producing Beta- Lactamase to counteract Penicillin. This hypothesis is supported by the data gathered from allowing the antibiotics to interact with the bacteria. The penicillin based antibiotics were the least effective at eliminating the bacteria because it already produces a countermeasure against Beta- Lactam inhibitors like Penicillin.

***Austin Lee***

**Carbonation in Pervious Concrete: A Novel Study**

**Exploring the Sustainability Benefits of Pervious Concrete**

The increasing concentration of atmospheric CO2 is a current and prominent environmental problem that has been linked to global climate change. Methods that can reduce CO2 levels in the atmosphere would be beneficial to the environment because they can potentially reduce the rate of global temperature increase. One method of atmospheric CO2 reduction is the process of carbonation that is associated with concrete. Carbonation in concrete occurs when atmospheric CO2 permeates into concrete and becomes incorporated into the chemical compound Ca(OH) 2 to form CaCO3  and H2O. The purpose of this project was to investigate the absorption of CO2 by pervious concrete.  Although previous studies have determined ways to prevent carbonation because of its detrimental effect on concrete strength, ways to optimize carbonation as a method of sequestering atmospheric CO2 within concrete have not been investigated. The purpose of this study was to determine the increase in carbonation rates in concrete with greater porosities. The amount of carbonation was quantified by dropping phenolphthalein onto the surface of the concrete and observing areas of color change due to carbonation’s chemical effect on the concrete. Different amounts of fine aggregate were used to create concrete mixes with varying porosities and compression strengths.  Results indicate that using 10% or more of the original fine aggregate produces concrete with no additional porosity. Results also demonstrate that porosity greatly increases the amount of carbonation in concrete. The study provided evidence for additional sustainability benefits of pervious concrete and provides more incentive for its use.

***Philip Mauser***

**The Design and Construction of a Solar Tracking System**

Energy is an important part of our everyday lives. One way that energy can be obtained is through solar energy; a growing industry that will likely be important to our future. The purpose of the investigation was to discover a more cost effective way to increase the output of simple photovoltaic cells. Using materials from local hardware stores as well as a simple microcontroller and servo, a device was built that would track the sun and would not be affected by false tracking, where a device cannot determine where the sun is because of limitations of sensors, to increase output. This device is a small simple single axis tracker that would track the sun by pre-programmed coordinates rather than by using photo sensors. In test situations the device performed, as expected, much better than a cell that would be unable to move. The average voltages of a movable cell were significantly higher than the average voltages of non-movable ones and there was a 35% increase in voltage (and thus power) for a movable cell when compared to a stationary cell. This work indicates that a simple tracker can be built which may reduce the price and efficiency because current systems are expensive. This will hopefully introduce a more inexpensive way to increase solar energy output.

***Alexander Mermelstein***

**Applying Statistical Pattern Recognition to X-ray Beams and Particle Showers**

The goal of this project was to apply statistical pattern recognition to aligning x-ray beams and identifying particles in high energy physics particle showers. Applying pattern recognition to these situations will result in optimization of the beam focus, and identifying particles as protons or electrons. Convex or concave synchrotron radiation images were analyzed using the Kolmogorov-Smirnov (K-S) statistical goodness-of-fit test. A simulation involving the curvature of mouths helped develop this program in R. The program successfully classified 96% of simulations. This program will help researchers more accurately focus synchrotron radiation beams at a sample, saving time and resulting in improved experimental data. Elementary particles observed in a calorimeter can also be categorized as either protons or electrons utilizing the K-S test. The particle identification program compared a defined parameter from an unknown particle to known sample data, in simulations. The program correctly identified 80% of simulated particles. This project showed that pattern recognition is a viable strategy to both align x-ray beams in a synchrotron, and to identify particle showers.

***Anthony Musto***

**Parent Child Perceived Motivation for Participation in Karate**

Previous research taken last year indicates that parents are motivated to involve their children in sports for many reasons such as, to have fun, to feel good when they have played well, to have a good time and to get exercise. Some motivational factors that both parents and children tend to agree on are enjoying quality time spent with friends, feeling important and staying in shape. In the research done last year by Musto (2011) some of the motivational factors match those of their children while other factors do not match, most children are not cognizant of the reasons their parents want them to participate in sports. Karate is a unique sport as it combines many characteristics of team and individual sports. Karate involves group activities like team games and challenges while also testing and strengthening the individual discipline. This combination of both team and individual activities cannot be found in many other sports which is one factor that makes Karate so unique. The purpose of this study was to compare the parent-child perceived motivation for participation in Karate between the boys and girls and their respected parents. In this study children and parents at a suburban karate school will complete the same two surveys related to motivation for Karate participation. One survey consisted of 25 items where participants used a Likerd scale to express their opinions. In the other survey, participants were asked to rank the importance of seven items in terms of motivation. The results indicated that Parents and children do tend to agree with a strong .7 correlation based on their results. The children and parents both find having fun and learning to be the most important the same as in other sports like soccer. The girls’ parents agree with their daughter’s results while it was the same for the boys and their parent’s, yet the boys and girls have a very low correlation.

***Neela Qadir***

**The Antibacterial Effect of International Disinfectants on *Escherichia coli K-12***

The purpose of this experiment was to determine if “green” disinfectants and disinfectant recipes from different countries have the same effect on killing *Escherichia coli* K-12 as conventional disinfectants. The hypothesis was that “green” disinfectants and disinfectant recipes from different countries would not kill *Escherichia coli* K-12 as effectively as conventional cleaners. The effects of “green” disinfectants, disinfectant recipes and conventional disinfectants were tested by using two “green” disinfecting sprays, Clorox Green Works and Scrubbing Bubbles, eight disinfectant recipes from different countries, vinegar, baking soda, grapefruit skin, grapefruit seed extract, pineapple yeast, bleach alternative, Dettol and a Clorox mixture and two conventional disinfectants, Clorox and Lysol. *Escherichia coli* K-12 was grown before experimentation and the concentration levels were checked before each trial for consistency. *Escherichia coli* K-12 was spread onto broth plates. Twenty micro liters of the disinfecting sprays were put onto paper disks and the disks were placed on the plates. The negative control was 20 uL of distilled water and the positive control was 20 uL of 20% bleach. Each control was also dispensed onto a paper disk. The plates were left in the incubator for 48-72 h and their inhibition zones showed how effectively each product killed *Escherichia coli* K-12. The results indicated that some disinfectant recipes from different countries work as effectively as conventional disinfectants. The “green” products were less effective compared to conventional cleaners and some disinfectant recipes from different countries. The order of effectiveness starting from the most effective disinfectant to least effective disinfectant was Lysol and Dettol (Same mean zone of inhibition), grapefruit seed extract, Clorox, Clorox mixture, vinegar, baking soda and Clorox Green Works (Same mean zone of inhibition), Nature’s Source, grapefruit skin, bleach alternative and pineapple yeast.

***Patryk Piascik***

**Prevalence of Type-2 Diabetes Mellitus Between Africa and Europe**

Type 1 Diabetes Mellitus (T1D) is an inflammatory autoimmune disease of the pancreas which prevents the production of the hormone Insulin. Insulin is required to for cells to take up glucose to form ATP required for cellular metabolism. To increase our understanding of this disease, it is important to analyze data of T1D because it currently affects about 346 million people around the world which in turn affects our world socially and economically. A comparison of data related to the prevalence of T1D and the link to demographic, health and economic data was made between 5 regions in both Africa and Europe. Categories of comparison were: Prevalence of T1D, Child Mortality Rate of Children less than 5 years of age, Gross National Income Per Capita in ID (International Dollars), Healthcare Expenditure Per Capita, and Percent of GDP Spent on Healthcare. The study concluded that there is no clear relationship between Healthcare, Income of Nations, and Mortality Rates and the prevalence of T1D statistically. The data indicates that TID is statistically more prevalent in Europe than in Africa. There are also regional differences especially in Europe. Although Africa has a lower rate of T1D than Europe this difference may be due to economic factors more than epidemiological factors. For example, the data shows that health care systems are very poor; expenditure on Healthcare in Africa is substantially less than in Europe. There is a high infant mortality rate in Africa. This fact combined with economic issues may cause an under reporting of actual TID cases in poor African countries. The genetic, environmental and social/economic aspects of T1D need to be further studied especially in poorer nations.

***Cortney Tiberia***

**The Effect of Different Types of Lighting on Emulsion and Inkjet Prints; A Pixel Analysis**

There are two main types of photographs. These are traditionally printed photographs and digital or inkjet/laser photographs. The traditional photos are developed using certain chemicals in a dark room. While developing, Silver halide crystals are exposed and reduced to metallic silver. Exposed crystals are developed faster than unexposed crystals and this allows for a differentiation between the two which forms the picture. Digital photographs are typically printed from an inkjet or laser printer. Inside the printer there are several small chambers which contain a heater. A pulse of current is passed through the heating element which causes rapid vaporization and this causes the ink inside the chamber to form a bubble. This increases the pressure and the bubble falls to the paper. They also require different types of paper. Today, traditional photography is not used as often compared to digital photography. People, however, are worried that digital photographs will not last as long as the traditional. The purpose of this experiment was to compare the effects of different light conditions on traditionally made photographs and laser printers produced photographs. One traditional and one digital photograph were cut into even pieces and these samples were put under different light sources. These included fluorescent, incandescent, sunlight, CFL light bulbs (environmentally friendly), showcase light and darkness as the control. The samples were observed for changes every week, then put back in their respective lighting conditions for 10 weeks. Using Adobe Photoshop the percentages on the CMYK color scale were recorded and compared week to week to test for changes. The results show that the traditional photos under fluorescent light faded the most; this suggests that people should print photos with an inkjet printer and keep all types of photos out of fluorescent light.

**Underclassmen**

***Hong Joo Ahn, Maurice Green***

**Effect of *Aloe vera* on the Healing Process of *Phaseolus vulgaris***

Process of healing is an intricate process where an organism repairs the cells where it is damaged physically. Even though the effect of *Aloe vera* on animals is well known, there is a limited amount of information on the effect of *Aloe vera* on plant healing, let alone plant healing itself. Through this research, the effect of *Aloe vera* on plants is cleared out. This experiment might give the field of agriculture a better way to take care of the damaged crops, and make more profit out of the crops they are growing. There were three parts to the experiment; measuring the cut with the ruler, staining with Methylene Blue, and Sudan IV. The purpose of the variety of experiments was to accurately measure the effect of *Aloe vera* in variety of approaches. Through these experiments, we are able to find the correlation between *Aloe Vera* and the effect of healing on plants. We hypothesized that *Aloe vera* will expedite the healing process of *Phaseolus vulgaris*, and not change the outward appearance of the bean plant. At the end of the experiment, the data gives little to no evidence that there is an effect on the healing process.

***Rachel Aitchison, Scott Massa, Chantel Yang***

**A Study of the Heat Tolerance Gene *Hsr-omega* of *Drosophila melanogaster* from**

**Different Geographic Regions**

The purpose of this investigation was to study the expression of heat tolerance genes of fruit flies, *Drosophila melanogaster*, originating from different regions in the United States to gain further insight on the effect of temperature as a selective pressure and to determine if the same species has different evolutionary adaptations based on geographical climate. Fruit flies contain heat tolerance genes such as *Hsr-omega*. RNA was extracted from fruit flies obtained from Maine, North Carolina, and Florida. The fruit flies in this study were obtained from Maine, North Carolina, and Florida, and the RNA of the flies was extracted to compare their genes. RT-PCR and reverse transcriptase enzymes were used to convert the RNA into cDNA. Additionally, PCR was used to determine at what quantity each of the genes is expressed by flies of the regional groups. It was hypothesized that the heat tolerance gene, Hsr-omega, would be expressed at a larger quantity in groups native to Miami, Florida which has a high average temperature and would be expressed at a smaller quantity in groups native to Bowdoinham, Maine which has a low average temperature. Results thus far suggest that our hypothesis was correct, although the data remains inconclusive. Future studies could examine cold tolerance genes such as Frost, other effects of thermal tolerance genes, or linked genes.

***Christopher Arens***

**The Preference and Selection of Different Shells by the**

**Marine Hermit Crab *Pagurus* *longicarpus***

*Pagurus Longicarpus,* is a soft bodied Marine Hermit Crab that ranges from 2.5 centimeters to 3.5 centimeters, and depend on the empty shell of gastropods for protection. Hermit Crabs are found along the Western Atlantic ranging from south Florida to the coast of Maine, and throughout their life, switch shells as they grow in order to accommodate with their growth. The purpose of this study was to determine what shell characteristic the *Pagurus* *longicarpus* prefers. For this study, 12 crabs approximately the same size were used, and each one was removed from its shell and placed inside a container filled with saltwater. For each trial, 2 shells were presented to each crab. Possible choice shells were its original shell, an old/dried saltwater shell, an old shell found in fresh water, and an artificial shell. Two empty shells and one crab were placed inside the container and video-recorded for a 10-minute interval in each trial. It was hypothesized that the original shell will be chosen over all the possible shell combinations, and choices. Based on the results recorded so far, it was found that the Hermit Crabs prefer their original shell. In each experiment, both shell choices were inspected, this shows that the crabs where more interested in their own shell rather than another one.

***Zan Asif***

**Regional Effects on Recovery Duration of Cold-Induced Hibernation in**

***Drosophila Melanogaster***

The purpose of this experiment was to determine the ability of fruit flies (*Drosophila melanogaster*) from different geographic locations to recover after encountering freezing temperatures*.*  Fruit flies are widely dispersed insects that cannot control their internal temperature (ectoderms), therefore, temperature has a major effect on their activity and geographic distribution. Fruit flies are ideal organisms to use for scientific studies because they are easy to rear in a lab and they share homologous genes with humans. Fruit flies from different geographic locations are known to have different tolerance to cold temperatures. Cold tolerance is the level of resistance that an animal has to cold weather. For example, it has been shown that temperate flies recover faster from cold shock than flies from tropical regions. In this study individual flies reared from stocks from Maine, New York, North Carolina and Florida were put into tubes and put into the freezer (-5° C). After a set time they were removed from the cold and their recovery time was recorded. It was hypothesized that, flies from colder regions would have a higher level of cold tolerance and a quicker recovery from cold shock compared to flies from warmer regions. Based on results, the flies from Maine have the quickest recovery time compared to flies from New York or Florida. The flies from Maine had an average recovery time of 36.0 seconds, New York had 41.3 seconds and Florida had an average recovery time of 45.8 seconds. The flies from Maine live in the north and are adapted to colder weather so they recovered quicker. New York is between Maine and Florida so its recovery time was less than Maine but higher than Florida. Florida was the most south so it had the lowest recovery time.

***Daniella Azoulay***

**A Computational Approach to Identifying Evolutionary Relationships of the**

**Salamander Axolotl (*Ambystoma mexicanum*)**

By deciphering the functions of homogeneous proteins, we can gain insight into the process of evolution. The purpose of this study was to investigate the evolution of the Mexican Salamander Axolotl (*Ambystoma mexicanum*) using the protein Chemokine Receptor 4. The investigation of the evolution of Axolotl has yielded inter- species evolutionary patterns. Such evolutionary patterns are highly valuable to our understanding of molecular genetics. In order to investigate the evolution of Axolotl, a genetic network was created. A genetic network is a collection of organisms whose evolution, in relation to each other, can be traced according to an individual protein or gene. Genetic networks allow one to learn more about the evolution of a focus species or related species. Information about the protein Chemokine Receptor 4 in *Ambystoma mexicanum* was utilized to support the evidence of evolutionary relationships between *Ambystoma mexicanum* and 101 other sequentially related species. Tools which included Pymol were used to create an image of the protein and combine the collected data to predict a genetic network for the protein Chemokine Receptor 4 in *Ambystoma mexicanum*. Additional database tools included the National Center for Biotechnology Information (NCBI), Basic Local Alignment Search Tool (BLAST), and ProtParam, which were used to calculate protein features. These properties were applied to the 101 species whose Chemokine Receptor 4 variants were related closest sequentially to Axolotl’s Chemokine Receptor 4. Conclusions show that salamanders such as *Salamandra salamandra* were closest to Axolotl in the line of evolution because they had the most in common with Axolotl in all aspects of data collection.

***Stephanie Badir, Tracey Rosenlicht***

**A Computational Approach to Predicting Critical Sites in the ABCR Protein**

**Toward Understanding Stargardt’s Disease**

Stargardt’s macular degeneration is one of many retinal disorders whose symptoms are correlated with the ATP-binding cassette, sub-family A (ABCA4) protein. If the protein becomes mutated it can lead to vision loss, where most commonly in individuals over 60 years of age. The purpose of this project was to determine the importance of specific mutated residues in the ATP-binding cassette protein. Human and animal ABCA4 sequences were utilized to compile data. Computational biology techniques were used to assess the different chemical and physical of the properties of the 30 variants of the protein. The properties that were investigated included hydropathicity, amino acid composition, isoelectric point, the number of charged residues, instability indices, and cleavage sites. The different properties of the 30 variants were analyzed using several databases, including ExpasyTools and CBS Prediction Server. Thus far results show that when looking at the instability index of a protein if the value was smaller than 40, it is predicted as stable, and values above 40 predicted that the protein was unstable. Based on the analysis we can conclude that the instability indexes of the variants analyzed were unstable, making the protein more susceptible to mutate. Additionally, it was found that all the ABCR variants were hydrophilic. It was concluded that if a mutation in a protein is more likely to mutate toward the middle of the sequence. Furthermore, the amino acid mutation that leads to a change in the function of the protein is one that mutates to a different classification group (e.g. hydrophobic to hydrophilic). Understanding the properties of the ABCA4 protein can potentially explain the relevance of the mutated residues in concurrence with the disease itself.

***Jae Yoon Bae, Ryan Chan, Gabriel Green***

**A Study of the Social Memory of the Male Marine Hermit Crab *Pagurus longicarpus***

Many studies have been conducted on the social behavior of *Pagurus longicarpus*. However, the study of their social memory has rarely been done. This project was designed to test the social memory of male *Pagurus longicarpus* by observing their behaviors during initial and secondary interactions with each other. *Pagurus longicarpus* shows territorial behavior and acts in an agonistic way towards intruders in a defined area. In addition, itinteracts less aggressively after a first encounter, due to the establishment of a social hierarchy system of dominance.A total of 4 trials were conducted, each consisting of a different pair of crabs and 2 separate interactions. For the First Interaction,two hermit crabs that had been previously isolated were placed together into a salt-water enclosure. The crabs were recorded with a video camera for ten minutes, and then removed. The second interaction consisted of the same two crabs placed into the same tank after 48 hours. At 30 second intervals, the distance between the two hermit crabs were measured, and the behaviors exhibited by them were recorded. The results were that there was an average of 19% less fighting and 20% more moving away from First to Second Interaction. Also, distances between the crabs increased by 59% in the Second Interaction. Based on the trials, *Pagurus longicarpus* showed significantly less aggressive behaviors and kept a further distance from First to Second Interactions. Therefore, a conclusion can be drawn that the crabs established a “social hierarchy” system of dominance, thus exhibiting social memory.

***Eric Bass, Scott Mulligan, Eric Rizzo***

**A Study of Territorial Behaviors Among *Crayfish (Procambarus Fallax)***

Crayfish are aquatic crustaceans that live in freshwater and resemble a small lobster. Crayfish are vital to the ecosystems of many regions because they provide a food source for many larger animals and are bottom feeders. Most crayfish live under rocks and debris in shallow water in lakes, ponds, streams, rivers, and swamps The crayfish’s habitat is in danger of destruction due to dams, water pollution and erosion, thus making it critical to analyze their behavior as it may spark up major information to boost their survival in nature. The purpose of the investigation was to study the complexities among the territorial behaviors of crayfish. We will utilize data recorded when the crayfish are placed in a close proximity. We hypothesized that if you were to increase the number of crayfish in the same environment with the same factors, the distance between the crayfish would correspond with territorial behaviors exhibited by the crayfish. For example, if one of a larger crayfish were to attack a smaller crayfish, the smaller crayfish may retreat, thus increasing the distance between them. Based on the distance observed, the smaller crayfish will engage the larger crayfish and take advantage of them when they are doing a distracting behavior such as eating. These conclusions may lead to revelations in the conservation of crayfish and improving the existent structures that house them.

***Anthony Bisulco***

**Developing a Computer Program to Detect Super SID Solar Flare Data Autonomously**

The approaching peak of the present solar activity cycle poses potential risk to the world's electrical and electronic systems.  Solar flares result from sudden energy bursts released into space from the sun. These energy bursts can be strong enough to interfere with, or damage, critical computer, power, and communications systems.

The purpose of this investigation is to develop a computer program, which detects solar flares autonomously. The Stanford Solar Center distributes the Super SID device to facilitate the monitoring of solar flares by measuring very low frequency waves (VLF) radio signal propagation.   VLF waves are the lowest wavelength on the radio spectrum, which are transmitted by different VLF stations.  The Super SID interface-preamplifier continuously extracts and records the amplitude of selected frequency signals (from transmitters of various locations).  The device interfaces the antenna, which receives the VLF waves, and a computer, which records the signals.

The goal of this investigation is to develop a means to identify solar flares in Super Sid data so solar flare trends can be more easily predicted. It is proposed that this goal can be achieved by using a custom designed MATLAB program to analyze the recorded VLF signal data. Solar flares aren't the only source of spikes in VLF wave data.  Sunrise and sunset causes a consistent pattern of spikes in VLF data, while solar flares cause distinct amplitude spikes in VLF radio signals.  One way to find the spikes is to take the derivative of a function and find the local maximums and global maximums. In this study, derivatives of running average data points from daytime data are checked for range and significance of amplitude changes and serve to identify solar flares autonomously.

***Peter Brennan, William Furst***

**Determining the Rate of Occurrence of Novae in the Andromeda Galaxy**

Novae occur when there are two binary stars (companion stars) whose gravitational pulls have a significant effect on one another. One of these stars is a very hot white dwarf star and the other is a red giant. The white dwarf star pulls material off of the red giant and onto its surface where it reacts explosively due to the temperatures of the white dwarf star. This explosion leads to an increase in luminosity. By using images taken from the WIYN 0.9 meter telescope on Kitt Peak, we were able to determine the rate of occurrence of novae over a 10 year span. This rate could be affected by a many number of things such as the number of binaries, the mass of the pre-nova stars, and the population’s formation history. We observed these images in different areas, or fields in the Andromeda Galaxy, one at a time to find any changes in the images. Once a Nova candidate was found, we observed it closely to determine if it was truly a Nova, or just an imposter. During the research we also recorded the different traits that each nova has. There have been a total of 105 novae from 1995 to 2005. This comes out to a rate of 10.5 novae per year. This data could help us to determine where another nova might occur, before it actually does because if we study the elements that are required for a Nova to occur, we can figure out where one might happen.

***George Burke***

**The Design and Construction of a Novel Rotating Rain Gutter System**

The purpose of this project was to design and construct a universally designed manual rotating gutter system to allow a physically challenged individual or any person the opportunity to complete a household chore more easily without assistance. The main purposes of rain gutters are to allow rainwater and debris hitting a rooftop a path to the ground to avoid or minimize erosion to the foundation of a building and to minimize the inconvenience of getting drenched with water while passing under an overhang. In a standard gutter system debris is collected at the base of the gutter over time and needs to be removed. The current way of cleaning rain gutters is for a person to get onto the roof and manually scrape out the debris from the gutter. A physically challenged individual would need to acquire assistance for this task when using standard rain gutters. I propose a rotating gutter that can be attached to a roof and can be rotated outward will make it accessible to clean from the ground. The way that this design functions is by having a person use a long rod which will be able to rotate a half round gutter between two nearly full circular ends in which the gutter can rotate freely and be tilted for cleaning from the ground. The prototype was constructed of PVC piping connected to a simulated roof to test the prototype for flaws. The results show that it is possible to create a rotating rain gutter system. Improvements that were made thus far include creating stopping points for both where the gutter should be when cleaning and also when in use. Future improvements will include better attachment of the ends of the gutter to the house and possibly a motorized turning mechanism.

***Christina Cabana***

**The Effects of *Wolbachia* Gut Bacteria on the Learning Capabilities of**

**Fruit Flies (*Drosophila melanogaster*)**

The visceral organs, particularly those of the excretion/digestive systems, are home to a variety of bacteria. *Wolbachia* are a type of probiotic bacteria found in the visceral organs of many arthropods. An organism’s visceral and somatic structures send information to their stress networks. The brain then interprets these signals and formulates an appropriate response. Gut bacteria have been linked to stress response and regulation of CRF (Corticotophin-releasing factor). CRF mRNA has been detected in various regions of the brain, including the hippocampus. Among other things, the hippocampus regulates learning and memory. In insects, *Wolbachia* manifest themselves directly into the brain tissue. The purpose of this investigation was to determine the effects of *Wolbachia* on the learning capabilities of fruit flies (*Drosophila melanogaster*). It was hypothesized that *Wolbachia* would have a positive effect on such capabilities. To test this hypothesis, flies of the same lineage were put through an appetitive learning assessment. Half of the flies were infested with *Wolbachia* and the other half had been treated with antibiotics to kill any gut flora. The flies were conditioned to move toward darkness in order to receive banana. Flies that continued to move toward darkness after the banana was removed were recorded and discarded. The number of flies that learned the behaivior after each cycle was recorded and analyzed. The assay has become progressively more effective. Results suggest that *Wolbachia* invested flies are more likely to learn the behavior after one cycle, and have been proven statistically significant. However, for conclusive results the sample size must be expanded. This experiment has provided valuable insight into the connection of gut flora and learning abilities and further similar experimentation would benefit the scientific community.

***Ryan Chan – See Jae Yoon Bae***

***Eddie Choi – See James Whittaker***

***Sarah Choi, Jacqueline Gallo, Daniella Rana***

**The Social Interaction of the Marine Hermit Crab *Pagurus longicarpus***

*Pagurus longicarpus* are hermit crabs that inhabit both rocky and sandy areas from the shore up to a depth of 45 meters They have two pincers on the first pair of walking legs. They are one of the most common shallow-water hermit crabs along the east coast and Gulf of Mexico. Their most unique characteristic is that they crawl into and stay in empty shells of other organisms such as snails. The purpose of this experiment was to determine the social interaction of *Pagurus longicarpus*. Hermit crabs were videotaped in different groups to observe their interaction with each other. The distances between crabs were measured at thirty second intervals and the behaviors of individual crabs were observed and recorded. As stated in the literature it can be inferred that the larger crabs will have more dominance, and the smallest crabs will have the least dominance. Thus far it has been found that large crabs and medium crabs will fight as perhaps they are either vying for dominance or need a desirable shell from another individual. Large and medium crabs tended to not interact with small crabs because their shells cannot be used by larger crabs. The distance between all combinations of crabs is relatively the same; this suggests that there is a set distance between the crabs. There is little average difference between any of the combinations tested. The large and medium crabs moved around the tank the most perhaps because they do not have to worry about conflict with other crabs because they can get away unscathed. Results indicate that *Pagurus longicarpus* is mostly inactive and avoid interaction as much possible.

***Justin Cheung***

**The Effects of Perfect and Relative Pitch on Mandarin Pitch Pronunciation and Differentiation**

The purpose of this study was to determine if there is a correlation between perfect pitch and accuracy of Mandarin pitch identification and pronunciation. Individuals with perfect pitch can precisely identify changes in pitch. Mandarin is a tonal language where pitch changes are used to convey meaning. Individuals with perfect pitch were expected to be able to differentiate and pronounce syllables of Mandarin with greater accuracy than those with relative pitch or neither relative nor perfect pitch. This hypothesis was tested with three groups of subjects: perfect pitch, relative pitch, and neither perfect nor relative pitch. New York Philharmonic members were used as subjects in the perfect and relative pitch groups. A native speaker was recorded speaking Mandarin sentences that included “confusion terms,” Mandarin words that are the same phonetic syllables but have different pitch change patterns. The tests that were performed evaluate a variety of skills including differentiating between confusion terms, judging the type of pitch change, and repeating Mandarin sentences. The accuracy of each subject was judged by comparison to the native speaker. Using a two sample T-Test to determine statistical difference between mean scores and a Chi-squared test to test for independence between group categorization and the accuracy of responses, data has shown that the perfect pitch group is significantly more proficient at differentiating and pronouncing Mandarin phrases. This study highlights the close relationship between pitch and linguistics. Therefore, the results of this study could be applied towards treatment of linguistic disorders in stroke victims or autistic children.

***Jianna Cressy, Brian Huang, Hamid Jalili***

**The Effects of Regalia on Fungal Pathogens**

The purpose of this study was to test the effectiveness of Regalia in protecting plants from powdery mildew. Regalia is an extract from the plant Reynoutria spp which contains active compounds such as specialized proteins and other compounds known to inhibit fungal diseases. Regalia induces a plant to produce cell strengtheners, antioxidants, phenolics, and PR proteins, which are all known inhibitors of plant pathogens. Powdery Mildew is a host specific fungal pathogen which gets on a plant and steals it nutrients. We grew twenty pumpkin grew and waited until the plants were ready to apply Regalia. We applied the Regalia at different concentrations (1%, 3%, 5%) with different concentrations, and waited three days before infecting the plant with the fungus. There was one control group that was infected with powdery mildew, but not treated with Regalia. The plants were infected with powdery mildew on the first true leaf. We hypothesize that the greatest concentration of Regalia will perform best in preventing an infection of powdery mildew. Thus far we have found that the control group has no visible powdery mildew, and group C (which has the greatest concentration) has the most which would go against our hypothesis that group C should have the least. We have observed that the 3% solution did the best against in preventing an infection of powdery mildew. This experiment is important because it provides a treatment against powdery mildew can cause crop failure which results in the loss of millions of dollars for farmers around the world.

***Binoy Daniel, David Hans***

**The Prediction of Coronal Mass Ejection through Solar Flare Data**

The purpose of this investigation was to determine if there is a predictable relationship between coronal mass ejections and M-class and X-class solar flares. With the potential of power grid disruption and radio blackouts caused by a coronal mass ejection, identifying a correlation with solar flares can assist in preparing for this potential destruction. A coronal mass ejection (CME) occurs when the structured strong magnetic fields of the sun releases fierce bursts of magnetic fields and coronal material while a solar flare is a large energy release from the magnetic energy of the sun. To compare these events, the total emitted energy per area of the solar flare is converted from its integrated flux (j/m 2) to the total energy of the 1-8 A Band (ergs). This value was then compared to the kinetic energy (ergs), mass (gm) and linear speed (k/m2) of the CME. The sunspot area of the eruptive flare’s active region was also recorded to determine a connection with the coronal eruption. Additionally all flares must be restricted to M class flares and higher and no backside flares should be included within the data. Results have so far indicated that there is a predictable correlation with the flare’s energy and the linear speed of the CME. Also, the kinetic energy of the CMEs was found correlated with its mass and linear speed.

***Robert Delgado***

**The Effect of Various Liquids and Additives on the Prominence of the Marangoni Effect**

With an increase in the areas of microphysics and astrophysics, it is becoming, more and more imperative to understand what roles that particles take on when placed in several, situated environments. One of these ways is to use the Marangoni Effect deﬁned as:As the viscosity increases in a liquid, various properties such as speciﬁc heat, resistivity, change drastically. This drastic change makes the Marangoni Effect on that speciﬁc liquid much more chaotic and unpredictable. The purpose of this experiment was to simply the stochastic part of the Marangoni Effect. The signiﬁcance of the data is determined by comparing the amount and rate of change (Data Table A) of the altered liquid with respect to the original liquid. This is quantiﬁed by comparing how fast the rings were made and the distance between them. The rings are made when the liquid is heated up, and an inward dehydration occurs. Inward dehydration is not constant, and when it slows down a ring forms, this is due in part to the Marangoni Effect. Generally, only two distinct rings were made per experiment. The physics of this included the work done by the force of gravity, the heat and the convection inside the liquid. As time progressed, the downward force becomes greater thus allowing for the Marangoni Effect to appear.

***Arya Doshi***

**How do Wild-type Normal Fruit Flies (*Drosophila Melanogaster*) Condition in a Single Y-maze**

**Compared to Alzheimer’s Model Flies?**

The purpose of this study was to determine how a normal fruit fly reacts in a Y-maze compared to an Alzheimer’s model fly (Amyloid Protein Precursor, Appl.). Evidence indicates that the β-amyloid (Aβ) component of senile plaques may be the key molecule in the pathology of Alzheimer's disease (AD). The source and place of the neurotoxic action of Aβ, however, is still a matter of controversy. The precursor of the β-amyloid peptide is the predominantly neuronal β-amyloid precursor protein. To conduct this study a small Y-maze made of plastic tubing and electric tape was used. A fly was placed at the end of the bottom of the Y. The fly moved through the tube and at the intersection of the 3 arms of the Y it was presented with a choice of moving to the light arm or the dark arm. To successfully perform this experiment, it required training fruit flies in memorizing scents of different fruits it might be attracted to, and also to see if it prefers light over complete darkness. The first priority of this experiment was to determine whether the fly is attracted to dark or light by doing 4 trials each involving 40 tests per fly and also how long it takes get to either side. I then moved on to adding a banana to test the dark arm and test these flies again. Reaction time, whether it goes to light or dark and each specific fly was recorded and taken into consideration while drawing a conclusion to this experiment. It was hypothesized that both the flies would be attracted to the light with faster time. Based on the results I have concluded that my hypothesis was successful because regular wild type fly did have a tendency to remember which side to go to. It also had a better sense of smell when it came to placing the banana on the dark side of the maze. The model fly had varying data to successfully prove that this design had no effect on its actions.

***Charles Eder***

**Determining the Effects of Magnetic Activity on Meteors Using FM Radio Waves**

The purpose of this investigation was to determine if magnetic activity in the magnetosphere affects the characteristics of meteors in the earth’s atmosphere. This was accomplished by recording the characteristics of FM radio waves reflected off of meteors, a method known as radio echo observation. The duration of the radio signals and their amplitudes were observed which reveal the length and density of a meteor. The term meteor describes specifically the streak of light created as meteoroids burn up in the atmosphere and their gases become ionized. Meteoroids are metallic objects, normally composed of iron or nickel, which can range from 100 micrometers to 10 meters in diameter. It has been speculated that a meteoroid’s size or speed influences the duration of the meteor which it creates, but the density of the ionized gas is influenced by electromagnetic activity, leading to differences in the amplitudes of radio signals reflected from the meteors. Denser ionized meteor trails reflect radio waves more effectively and the radio waves therefore have greater amplitudes. A radio receiver was connected to a radio antenna and tuned to a frequency of 76.31 MHz. A program called Spectrum Labs was used to analyze the radio reflections which were received. This study integrates and compares data of magnetic activity taken from the United States Geological Survey and the analyzed radio waves. The data were poorly correlated which suggests there is no relation between magnetic activity and meteor characteristics.

***Harrison Ferlauto***

**The Effect of Bisphenol A (BPA) on the Fecundity of Fruit Flies (Drosophila melanogaster)**

Bisphenol A (BPA) is used in the manufacture of polycarbonate plastics and epoxy resins that are found in a wide variety of common products such as reusable food and drink containers, baby bottles, protective liners in metal canned foods and beverages, dental composites and sealants, and many other products. Studies have shown that low doses of Bisphenol A, even doses below the US-EPA’s current reference dose of 50 µg/kg per day, can have negative effects on organisms of all sorts. The purpose of this investigation was to determine if Bisphenol A has a gender- dependent effect on the fecundity of fruit flies. Two stock tubes were made: one with BPA and one without. Five virgin BPA males were removed and mated with five virgin, untreated, females. The same experiment was performed except with females exposed to BPA, not males. There was also a group where both males and females were exposed, and a control group with no flies exposed. Additionally, these mating combinations were also performed in BPA tubes as well. Five trials were performed for each group. Results show that BPA’s effect on fecundity is not dependent on which gender was exposed. Also, flies that lived in regular food tubes with no BPA had normal fecundity, regardless of whether they originated from the BPA stock tube. This suggests that BPA’s effect on fecundity is dependent on exposure time; living in a BPA environment for one’s whole life is worse than being exposed to BPA for a short period.

***Alexander Ferreira***

**An Exploration of the Validity and Use of Historical**

**Temperature Data from the H.M.S. *Plover* (1851-1854)**

The Arctic climate is changing rapidly. To understand why, scientists rely on historical weather data from many sources. To study these past weather conditions, it is imperative that past weather data be utilized to develop models for the investigation of climate-related trends. The quality of past data, however, needs to be evaluated as thoroughly as possible before it can be compared to modern data. During the stay of the H.M.S. *Plover*, a British survey ship stationed at Point Barrow, Alaska from 1851 until 1854, a thermometer was kept within a thermometer shelter to provide protection from environmental conditions whilst permit the surrounding air to enter. Did this thermometer shelter skew the actual temperature readings from Point Barrow, Alaska (screen-bias)? To determine the screen-bias of the shelter, a replica was constructed. This shelter, equipped with a modern platinum resistance thermometer, was installed at the National Oceanic and Atmospheric Administration (N.O.A.A.) Barrow Observatory at Point Barrow, Alaska alongside the facility’s standard instrument. The data collected from the two thermometers were compared to each other to determine the screen-bias of the thermometer shelter used on the H.M.S. *Plover*. Finally, temperature data were digitized from the records of the H.M.S. *Plover* and were then compared to the modern data from the N.O.A.A. Barrow Observatory to assess the extent of climate change in the Arctic. Thus far, the results of this study have shown that has been a significant change in the climate of the Arctic since the mid-nineteenth century until the present-day. This conclusion, however, can only be confirmed by further data collection during the next few years.

***Colleen Flynn, Andrea O’Brisky***

**The Coffee Ring Effect**

The purpose of this study was to investigate the formation of coffee stains under different conditions. When one spills coffee on a surface, the coffee stain evaporates, a ring like shape forms on the edge, leaving the center more translucent. The liquid on the edge evaporates and then the coffee in the center of the droplet flows to fill in the empty space, bringing the suspended coffee particles along with it. This is caused by the spherical particles found in coffee compared to other liquids which contain oblong particles. Changing factors such as adding materials, changing the temperature, coffee particle percentage and surface used can possibly alter the coffee ring effect. The study of coffee stains can be applied to several other fields such as the art industry which uses added materials to create products that are evenly dried throughout. It has also been suggested that the medical and biological fields would benefit. A device was built to keep the angle of the dropper and distance from the dropper to the slides constant. Different percentages of coffee particles were tested in order to find what percent (out of .5%, 1%, 1.5%, 5%) had the greatest and smallest coffee rings. Temperatures at room (20°C), above room (50°C), and below room temperature were tested (7°C). Surfaces such as tile were used to test friction. In addition, added substances, honey (increased viscosity), soap (increased surface tension), and salt (which dissolves in water will be used). It was hypothesized that adding or changing the surroundings of the coffee will either increase or decrease the coffee ring effect. Results indicate that the added particles created the smallest coffee rings, or completely prevented the coffee ring effect. The largest coffee rings were created when the temperature was 55°C at 5% coffee concentration.

***William Furst – See Peter Brennan***

***Samantha Galina***

**Transformation of *Arabidopsis thaliana* by the Over Exposure of**

**Specific Transfer Proteins of *Agrobacterium***

The purpose of this study was to observe the possible changes in transgenic plants induced by the over-expression of a single protein, known to be involved in DNA transport from *Agrobacterium* to the plant cells of *Arabidopsis thaliana*. *Arabidopsis thaliana* is a small flowering plant belonging to the Brassicaceae family. It is commonly used in biology because of its small size, rapid life cycle, simple genetic sequence, prolific seed production, and many types of possible mutations. *Agrobacterium*, was used as a medium to transfer the DNA and it is the only bacteria able to transfer DNA trans-kingdom. This bacterium causes the plant disease crown-gall, that result in the formation of “tumors” (uncontrolled cell division) or galls on the plant. The transfer protein variables included VirE3, VirE3M, and Atu6002. *A. thaliana* plants were grown for approximately 6 weeks. The plants were then dipped into the specific protein *Agrobacterium* solutions (VirE3M, Atu6002, and VirE3). The fruits were cut from the plants, and the seeds extracted and placed on Petri dishes to grow for approximately a week with a B5 and kanamycin agar solution. The B5 contained nutrients necessary for plant growth and the kanamycin was used to determine which plants were transgenic. The plants with mutation continued to grow and were transferred into soil until fully developed. The DNA of the leaves of the plants were extracted and analyzed using PCR and Gel Electrophoresis, to determine which seeds were transgenic-either heterozygous or homozygous. Each sample in the first transformation generation of the protein Atu6002, exhibited the presence of the DNA. Further tests are needed to determine whether the samples are homozygous or heterozygous.

***Jacqueline Gallo – See Sarah Choi***

***Scott Gold, John Ioannou***

**The Application and Use of Biofilms as Biobarriers**

The purpose of this investigation was to test the effectiveness of Biofilm-barriers in various substrates to block or reduce the flow of water through the substrate. Biofilms are the result of the generation of slime-like material call EPS (extracellular polymeric substances). Communities of microorganisms aggregate, excreting this EPS. These communities can be made up of hundreds of species of bacteria, however for this research one bacterium was used; *Pseudomonas florescens*. These selected bacteria were cultured and inoculated in a molasses medium. Acrylic tubes were set up with different substrates in them, including sand, small pebbles, large pebbled and glass beads. Tests were conducted to observe the change in flow rates and the volume of the pores of the substrate in each tube. In these tests, molasses medium was poured through the top of the tube, and time to see the rate at which it flowed. As the biofilms grew the flow rate became sequentially slower. It was hypothesized that substrates with larger pores would have faster flow rates, and biofilms would be less effective. Results suggest that although the large pebbles have larger pores, they have a slower flow rate, contrary to the hypothesis. Tests concerning the biofilms have begun to produce results on a small scale, this far indicating that biofilms have more success in substrate with smaller pores. Though these results are relatively minor they may lead to future conclusions.

***Gabriel Green – See Jae Yoon Bae***

***Maurice Green – See Hong Joo Ahn***

***Rachel Gross, Megan Kurten***

**The Effect of Competitiveness on an Individuals Reaction Time**

The purpose of this study was to determine to what extent a person’s reaction time is affected by their competitive nature. Response time is the rate at which an individual’s stimuli are affected, leading to a change in behavior, and caused by any change in the environment. Reaction time is elapsed between the time the information is presented and the time it takes for the sub sequential behavior or response, and it indicates how fast the individual can see, process the information, react, and respond. This study can be applied to safety workers in dangerous environments, as well as awareness of people while playing sports or learning in school. One individual may have an exceptional reaction rate while focused, but does being distracted by competition affect the rate of reaction? We hypothesized that the reaction time of an individual will be faster in a group situation if they say to have a competitive nature, but if a person does not have a competitive nature, there will be little effect on their reaction time. To investigate this hypothesis, a group of people were given a brief survey about their competitiveness and asked to take a reaction test, without the pressure or presence of another participant. Then, they were asked to take the test again, but in a competitive group environment. Each participant took the test 5 times and in both the individual and group trial. We compared each individuals times when in the individual and group environment. Thus for results indicate that there is a positive correlation between the competitive nature of a person. When they have a more competitive nature, their reaction time in the competitive situation, tends to be faster than their individual time. With people who tend not to be competitive, there is not a significant difference in the reaction time of their individual situation and the competitive situation.

***Ashna Gupta***

**The Effect of Alternative Anxiety Medication on the Memory of Stressed *Drosophila melanogaster***

The recent trend for people to have a more holistic approach to life has led to the use of alternative, herbal medication as a form of treatment for stress. Fruit flies have been used in behavioral studies because they possess a gene structure similar to that of humans and are easy to maintain in the laboratory. The goal of this investigation was to study the effects of an herbal anxiety medication known as valerian root on the memory of stressed flies. A simple Y-maze was constructed using plastic tubes, in which single adult flies were injected into the base of the “Y”. The fly could either travel towards a light or dark area, but generally prefer light. To counteract this preference flies were conditioned to go towards dark by rewarding them with food if they chose the dark. After multiple trials with the same fly, the food was removed and the fly learned to travel towards the dark. Two groups were tested; one group was exposed to valerian root, the other was not. Each group was stressed by vibration. After being stressed individual flies were placed in the maze. It was hypothesized that stressed flies given the valerian would be conditioned faster than those stressed flies not given the medication. Results indicate that stressed flies administered with the valerian root solution were capable of retaining information better than stressed flies alone. After trials in which food was placed in the dark tunnel, the medicated stressed flies were able to travel to the dark once the food was removed at the same rate as the control group. Stressed flies alone took generally took longer to complete the maze and did not perform consistently. This suggests that the valerian root solution was effective in improving the memory and concentration of stressed flies.

***Jonah Haber, Anthony Jao, Andrew Kim***

**The Effect of Acidity on the Behavior of Grass Shrimp (*Palaemonetes pugio)***

As society has become more industrialized over the past 200 years, the concentration of CO2 in the atmosphere increased. This increase is due to the burning of fossil fuels that drive the modern world. Less commonly known is that high levels of CO2 dissolved in seawater can create carbonic acid, which increases the acidity of the ocean’s water. The altering of the pH is known to damage the aquatic ecosystem. The purpose of this study was to examine the effect of changing pH on the behavior of Grass shrimp (*Palaemonetes pugio*). This species of shrimp is used extensively in experiments pertaining to toxicology and pollution because they are sensitive to even the slightest changes in their environment. Grass shrimp are used extensively in toxicology assays by the US Environmental Protection Agency. A simple assay was used where starved shrimp that were kept in water of two different pH’s (~7.8-8.5, and ~6.8-7.5) were placed at one end of a narrow tank and timed to see how long it took them to get to a piece of food on the other side. Our results have shown that the shrimp that were exposed to the lower pH were slightly affected by the decrease in pH, but not significantly. For example, we found that some shrimp were faster, relative to the control group shrimp that were exposed to normal salt water. Some shrimp, on the other hand, that were exposed to the low pH took over 2 min. to get to the food. According to our statistical analysis, the Grass Shrimp were not affected significantly by the decrease in pH in their environment. In the future, some adjustments that can be made are the increase in sample size, the use of carbonic acid, or exploration other behaviors.

***Diana Hagedorn***

**Genetic Variation Among Bdelloid Rotifers Found in Different Geographic Locations**

Rotifers, commonly called “wheel animals”, are from a phylum of aquatic invertebrates, sometimes found in mosses and lichens. The word “rotifer” is derived from Latin, meaning “Wheel bearer”, as the corona around its mouth resembles a wheel. These organisms were first studied by Rev. John Harris in 1696, and other forms were described by Anton van Leeuwenhoek in 1702. Bdelloid rotifers are assumed to have reproduced without sex for millions of years. Their genomes contain divergent copies of each gene, suggesting an asexual evolutionary history. These rotifers are able to live in unstable habitats, as they can adapt through anhydrobiosis. They first contract into the compact shape known as a tun. During this contraction, the cephalic and caudal extremities are withdrawn into the trunk. This fractures their DNA, and ruptures their cellular membranes. When this occurs, the rotifers incorporate foreign DNA in the process of rebuilding shattered genetic material. It is possible that they will ultimately absorb other genetic material from other bdelloids, or even any other unrelated species. If Bdelloid Rotifers absorb new, foreign DNA, when rebuilding genetic information, genetic information will vary among rotifers found in differing areas. Although most other multicellular organisms have safeguards against this foreign DNA, bdelloids embrace the information. Upon embracing this new information, DNA will ultimately vary. Thus far, my results indicate that I am indeed able to attain the DNA from the rotifer. My next step will be to amplify the DNA to compare the genetic information within different individuals.

***Hugh Han, Thomas Kowalski***

**The Clip-N-Slip: A Device to Improve the Bagging of Paper Materials on an Assembly Line**

**For People with Disabilities**

The unemployment rate in the United States for the adult population is currently very high, and the unemployment rate for those with disabilities is even higher. Organizations such as AHRC Nassau employ people with disabilities and allow them to work for pay. After observing the AHRC Nassau work facility, we noticed that many workers were having trouble with a specific job—the collating and bagging of advertisement brochures and other papers. The problem encountered with this task is that organizing a large number of paper advertisements and then inserting them into a tight plastic bag is quite difficult, especially for workers who have disabilities regarding dexterity. We designed and constructed a device called the Clip-N-Slip to help workers more easily organize and then insert paper materials into a tight plastic bag. The Clip-N-Slip, which required some learning and practice to use effectively, was appreciated by many of the workers at AHRC because of its ability to help the organizing and bagging of paper materials.

***David Hans – See Binoy Daniel***

***Brian Hastings***

**The Effects of Water Quality on Growth and   
Mortality of Juvenile Hard Clam (*Mercenaria mercenaria*)**

Water quality and the timing of seeding clams from hatcheries are important to the shellfish industry. Variation in water quality is a stressor to marine life that can cause inhibition of growth and disruption of the natural environment. In this study, relationships were evaluated between biotic performance based upon growth of juvenile hard clam and water quality over a fall-winter period (2011). Three size classes of clams were set in predator exclusion boxes. Growth of clams, temperature, salinity, pH, dissolved oxygen, and chlorophyll a were measured weekly. Results indicated that clams of initial sizes 9 to 10 mm showed higher growth rates and more cumulative growth than clams less than 8.5 mm and greater than 12 mm. A comparative analysis between predicted effective water quality and growth showed that when water parameters were close to the predicted optimal range, more growth took place. These clams filter water, creating cleaner water columns, decreasing turbidity and controlling algal populations in bays, which could be toxic to humans and aquatic life. Results suggest that shellfish industry workers should release clams when they are about 9 to 10 mm, and when the environment's water quality measurements are within the optimal range.

***Marissa Heuser***

**Classical Conditioning of Grass Shrimp (*Palaemonetes pugio*)**

The purpose of this study was to determine if grass shrimp (*Palaemonetes pugio*) can be classically conditioned to associate the tapping of glass to feeding.  Classical conditioning involves the pairing of a neutral stimulus to an unconditional stimulus of some significance leading to a conditioned response. The neutral stimulus could be any event that does not result in an obvious behavioral response from the organism (tapping on glass of the tank). The experiment began by randomly selecting grass shrimp from communal tanks. The shrimp were then placed in a smaller tank and starved for three days. Each shrimp was then placed in a beaker and food was presented immediately after rapping three times on the glass. As the shrimp began to move toward the food, the food was taken away. The process was repeated for ten trials to see if the shrimp associated the tapping sound with the appearance of food.  It was hypothesized that the shrimp’s ability to become conditioned verifies that invertebrates can learn.  Thus far results indicated that after ten trials all shrimp had associated the tapping with the food.

***Brian Huang – See Jianna Cressy***

***Greta Huang, TJ Passaro***

**A Study of Novel Inhibitors PF-573, 228 and PF-576, 271 and their**

**Effects on Platelet Physiology**

Focal Adhesion Kinase (FAK) is a non-receptor tyrosine kinase involved in cell signaling, which aids in thrombosis (platelet clotting). Previous studies have suggested that inhibitors PF-576, 271 (PF- 271) and PF-573, 228 (PF- 228) inhibit FAK, presenting a possible tool for analysis of FAK function in cells. However, preliminary studies conducted at the Hitchcock lab have indicated differently, suggesting that PF-271 and PF-228 do not inhibit FAK, instead they inhibit a different kinase. This study aims to reaffirm the results of these preliminary studies and to properly define the effects of PF-271 and PF-228 on platelet activation. FAK-null platelets were aggregated in conjunction with the inhibitors in order to compare their response to that of PF4-Cre ( wild type) control platelets. FAK-null platelets, in theory, should not have a response to the FAK inhibitors because they do not have FAK. The controls should respond to the presence of the FAK inhibitor because FAK is present in PF4-Cre platelets, and behave like FAK-null platelets. Once FAK was inhibited in wild-type controls, platelet function and signaling pathways should have been the same in both wild-type and FAK-null mice. However, FAK-null platelets with inhibitor aggregated differently from FAK-null platelets without inhibitors. The disparity in clotting of these platelets seemed to support the preliminary studies conducted by the Hitchcock Lab. By correcting inaccuracies concerning the inhibitors PF-271 and PF-228, we will be able to characterize the function of certain kinases. Through various tests, we have found PF- 271 and PF- 228 to have a negative effect on platelet aggregation and to be ineffective in inhibiting FAK. Further understanding of kinase function in platelets will increase the scope of medical knowledge, allowing for the treatment of diseases, including myocardial infarction.

***John Ioannou – See Scott Gold***

***Hamid Jalili – See Jianna Cressy***

***Laura James, Gloria Kim, Laxshika Raveendran***

**Why do California Blackworms (*Lumbriculus variegatus*) Clump?**

The aggregation of animals is a common feature in the behaviors of animals that occur for protection, or as a natural instinct. It may be caused by the intimidation of larger predators, or it may occur just because the animals enjoy the presence of other animals. By multiple trials, and different methods of experiment we are able to narrow down the reasons for the aggregation of California Blackworms (*Lumbriculus variegatus*). Currently results show the blackworms have the tendency to clump and unclump at a faster rate when they are isolated from other worms. Also from prior trials of observations, the worms were more sensitive, and their movements were more reactant under the intensity of the light. So far the data shows the reason for the clumping of these worms are due to the environment, and their surroundings. By concluding this research project, we are able to increase our understanding of the behaviors of animals, and the results can be used when recreating an environment for certain species.

***Anthony Jao – See Jonah Haber***

***Laura Jao***

**Virulence Factor Expression in *Yersinia pestis*:**

**Using GFP to Monitor Expression of Pilus Genes**

The purpose of this study was to modify a GFP reporter system in order to determine the conditions under which gene clusters (y433 and y561) that encode for pilus biogenesis in *Yersinia pestis* are expressed. *Yersinia pestis* is a bacteria known as the causative agent of the bubonic plague. During the disease’s culmination, fleas acted as carriers of the bacteria. Fleas then transmitted the bacteria to rats that then transmitted it to humans via bites. Thus, the bacteria were therefore exposed to a range of different temperatures among other conditions during pathogenesis. One important virulence factor of *Y.* pestis is the secretion of pili during pathogenesis. Pili are short filamentous projections that are necessary in order for bacteria to adhere to host cells. In addition, pili also aid in protection against phagocytosis. They are assembled using chaperone/usher pathways, a collection of genes that encode for either chaperone proteins, usher proteins, or subunit proteins; two of the gene clusters include y433 and y561. In this study, genes of interest were first transformed into *E. coli* competent cells, then digested using two restriction enzymes, and lastly cloned back into *Y. pestsis* in such a way that they were put in the control of GFP expression. The GFP reporter system was utilized to measure changes in gene expression during exposure to different external stimuli *in vivo*.

***Meghan Kennedy, Jessica Schwartz***

**The Design and Construction of a Wheelchair Mirror for those with Multiple Sclerosis**

It is estimated that between 350,000 and 400,000 individuals in the United States have multiple sclerosis (MS). Additionally, estimates range from one to two-and-a-half million for people living with MS throughout the world. Many people are affected by this widely dispersed disease and because of this people need the help of assistive technology. Many devices, such as canes and wheelchairs are used to help with the mobility of people who are struggling with the limitations of MS. One device that would be beneficial to a patient in a wheelchair is a device that will help the patient get a better view of what is behind them. For this project, four patients that we met at a Rehabilitation Center who used motorized wheelchairs were consulted for the development of our concept. Our idea was to create a mirror connected to a long gooseneck material, which can be easily removed and is moveable from the wheelchair. One end of the gooseneck would be clamped on to the back of the wheelchair with multiple clamps for support and sturdiness. The gooseneck then comes up, above, and over the patient’s head with a long rectangular mirror connected to the other end. The mirror is positioned so the patient can just glance up, without really having the need to move their head. In addition, the mirror would have to be positioned so that the patient’s view was not obstructed, which can pose a safety concern. We customized each device specific to the wheelchair of the user, by using different sized clamps and different lengths of gooseneck material.

***Gabrielle Khalife***

**The Effect of Acetylsalicylic Acid, Antioxidant Compounds, and Stressful Conditions on Telomere Aging in *Tetrahymena thermophilia***

New blood tests currently seek to tell people their biological age by measuring the length of the individual’s telomeres. Telomeres are structures on the tip of chromosomes that have been found to shorten as people age. The purpose of this experiment was to test the effect of various substances and conditions including Aspirin, antioxidants and stressful conditions on telomere aging in *Tetrahymena thermophila*. The ciliated protazoan, *T. thermophila* is advantageous as a model eukaryotic organism because it grows rapidly in a wide temperature range of 18°C to 41°C, its rapid life cycle allows for genetic analysis and it possesses many processes related to a wide diversity of eukaryotes, including humans, which are not found in other single-celled model systems. In this study, the *T. thermophila* were exposed to the various conditions for a set time of 30 minutes. It was made sure to constantly reculture the T. *thermpohila* to be aware of their age. By doing so, their age is referred to as day 1, day 2, etc. DNA extraction of the *T.thermophila* was done by adding 700umL of Urea Lysis Buffer. To phenol-extract the lysate, 600uL of phenol: chloroform was added. After centrifuging for 10 seconds, the aqueous layer was extracted. 150uL of 5M NaCl was added to help reduce the carbohydrate level in the final product. The DNA was precipitated by adding 700uL of isopropyl alcohol and the mixture sat at room temperature for 10 minutes before draining the supernatant in a collection beaker. 500uL of 70% ethanol was then added to solubilize the salts and remove them from the DNA pellet. The sample was centrifuged for 3 minutes before removing the supernatant and the pellet was allowed to air dry before adding 50 uL of Tris-EDTA (TE) buffer. Finally, the DNA was re-suspended in the TE buffer and 1 uL of Rnase A added, then incubated for 10 minutes at 37°C. The DNA was amplified with COI-1 primer. When viewing the gels, it was inferred that the bands that were the brightest had the longer telomere lengths. Results conclude that we were able to properly extract DNA from the *T.thermophila*. Further research will be conducted.

***Andrew Kim – See Jonah Haber***

***Gloria Kim – See Laura James***

***Thomas Kowalski – See Hugh Han***

***Angela Kubik, Briana Kubik***

**A Study of the Breakdown of Insects in the Pitcher Plant (*Sarracenia purpurea*)**

Enzymes in the Pitcher plantplay a significant role in the digestive process and adaption of the plant. The Pitcher plant is a carnivorous plant categorized as an insectivorous plant that gains most of its nutrients and nitrogen from the insects in the surrounding environment. Many Pitcher plants live in acidic bogs which do not have, due to a low pH, the nitrifying bacteria that are needed to convert into usable nitrogen in the soil. This lack of soil nitrogen is the reason why pitcher plants require the ability to take nitrogen from insects. In order for a Pitcher plant to digest it’s nutrients from an insect it must release enzymes into the pitcher and, depending on the structure and size of the insect, the enzyme rate can vary. To estimate the rate of enzyme activity we used a method involving ASA400 coarse grained photographic film. The gelatin on the film is partially made of protein and when digested the film becomes transparent. The data supports our hypothesis that crickets and meal worms, crickets produced a greater enzyme activity. We are also taking into account the effects of pH and temperature on the amount of enzyme activity. Results indicate that the pitchers containing the crickets need more enzyme activity than the pitchers containing the *Tenebrio*. Data also indicates that the crickets displayed the most obvious decomposition changes.

***Briana Kubik – See Angela Kubik***

***Megan Kurten – See Rachel Gross***

***Sarah LaMorte***

**The Effects of Sweat on the Metal of Musical Instruments**

Musical instruments are lacquered to prevent the metal from coming in contact with a human hand. When the lacquer is worn away, the sweat from the musician’s hands reacts with the exposed metal, causing a chemical reaction. These reactions can manifest themselves as discoloration to as major a problem such as red rot or the deterioration of the metal. The purpose of this project was to (1) identify the harm of sweat on the alloys of musical instruments and (2) find a way to protect the instruments from the chemical reactions that take place. By measuring the contact angles of a drop of water on the metals, change in texture, color and change in mass, and observing the wear of lacquer, it will be determined how sweat has a direct affect the metals of musical instruments. It was hypothesized that over time, when sweat comes in contact with the metal, reactions will occur causing the metal to deteriorate. The metals that were covered in the cellulose lacquer and treated with both EU and ISO sweat showed fewer signs of deterioration, than the metals that were left unlacquered. Both EU and ISO treated lacquered copper had discoloration under the lacquer on the actual surface of the copper. The unlacquered coppers both had a texture and color change. By the fifth week of sweat application both had a contact angle of 0˚ and a percent change of 100%. Overall, zinc was most affected by the application of sweat. Lacquered zinc treated with both sweats had the lacquer stripped, leaving the bare zinc exposed and open to discoloration. Both unlacquered zincs had a change in texture and in color. The lactic acid and the acetic acid in the sweats reacted with the zinc to form a salt and release Hydrogen gas. This is known as a redox reaction.

***Grace Lee***

**Investigating Climate Change: A Comparative Analysis of Temperature in**

**Setauket, NY from 1885-2011.**

Climate change, currently a major issue in today’s world, has been gradually happening over the past centuries, accelerating during the industrial age. To observe climate change more thoroughly, a comprehensive understanding of weather patterns and climate changes over time is pivotal. This understanding is essential for the development of models necessary to predict climate trends in the future; however, to forecast the future conditions of the earth’s dynamic atmosphere, we must base our analysis on concrete, tangible data, such as historical documents, weather data, and old ship records. These data can be used to reconstruct historical weather patterns. Historical climate reconstruction is used to reproduce the climate of a specific time and place. In this study, a set of data (1885-2010) from Setauket, Long Island, NY- recorded and kept by the Strong family and the national weather service since 1885, was analyzed to reconstruct temperature patterns. Average temperatures over a year period for the hottest and coldest months, July, August, January and February, were plotted onto graphs; the results showed a similar pattern in all the months analyzed. High and low peaks occurred in a cyclic manner; however, the general trend was an increase in temperature towards modern times. Results showed an average of 2.03°F in temperature and a higher percentage of warmer days in the later decades. These changes are significant to Long Island because Long Island is more vulnerable to the detrimental effects of increased sea level. Some direct impacts include beach erosion, complete loss of beaches, increased flooding, loss of ecologically important wetlands sand saltwater contamination of drinking water.

***Sam Luber***

**Hand Gestures and Their Involvement In Verbal Communication**

Hand gestures are nonverbal forms of communication in which the hands are in motion as a form of expression. The information expressed can affect the vocabulary used, amplitude of hands (the distance between the thumbs in a hand gesture), and speed of communication. The purpose of this investigation was to compare communication with and without hand gestures. In this study, participants sat in front of a camera and were asked to express stories pertaining to specific themes (past vacation, past birthday, hobby, and auto-biography) for one minute each. For the first thirty seconds, his hands were free to move; however for the last thirty seconds the participant held a ruler behind his back, restraining his hands. The videos were analyzed to determine the number of words per five-second interval, the number of fillers (a saying used to connect a thought such as like, uhm, etc.) used, and the amplitude of each hand gesture. Data suggests that hand gestures do increase communication speed; in other words, the mean number of words of communication was proven significantly different when using hands compared to the restriction of hands. In general, the number of fillers used by each participant was not significantly impacted when using hands compared to without using hands. Data obtained suggests that hand gestures do help in communication, and are an important component in human communication.

***Lindsay Marano***

**The Effect of the Absence of Gluten on the Taste and**

**Physical Characteristics of Pie Crust**

Gluten is a type of protein found mostly in grains such as wheat, rye and barley. Gluten plays a critical role in the unique baking quality of wheat by conferring water absorption capacity, cohesivity, viscosity, and elasticity on dough. It may be described as the rubbery mass that remains after wheat dough is washed to remove starch granules and water-soluble constituents. The proteins in gluten can be divided into two major components based on their solubility in aqueous alcohols: the soluble gliadins and the insoluble glutenins, which work together to form a “two-component glue,” in which gliadins are the solvent for glutenins, and combine to give dough its properties. My investigation explores the properties of dough when gluten is omitted, since gluten is not always a desirable ingredient for health reasons. A gluten-free diet is necessary for the well-being of people with celiac disease, an auto-immune disease caused by intolerance to gluten that affects more than two million people in the United States. The ingestion of gluten triggers the damaging of the villi that line the small intestine, which results in the mal-absorption of nutrients. Using both gluten-free flour and regular all-purpose flour both gluten-free and regular pie crusts were baked. Taste and characteristics of the pie crusts were compared before and after baking. Thus far, it has been found that there are consistent differences between the regular and gluten-free pie crusts in mass, thickness, length, strength, or width after they have been baked. In general, the gluten-free pie crusts demonstrate a greater percent change in width, length, and mass, and a smaller percent change in thickness, and the regular pie crust displays a higher breaking strength.

***Scott Massa – See Rachel Aitchison***

***Marissa Mathew, Rakia Syed***

**The Effect of Abiotic Stress Factors on the Radish Plant (*Raphanus sativus*)**

Plants can flourish in the constantly fluctuating environment because they have the ability to adapt to various stress factors. Abiotic stress factors are non-living forces that impact the plant’s growth and development negatively. Salt stress is an abiotic stress factor that changes the salinity of the growth environment and disrupts the equilibrium between salt and free water in the cells. Another factor is mechanical stress, which changes the plant’s pathway of growing, forcing it to adapt physically to its environment. Mechanical stress can be caused by outside physical forces such as wind, submergence, and soil particles. The purpose of this investigation was to monitor Radish seed responses to higher salinity levels and higher agar concentrations. In this experiment, plants were exposed to mechanical stress by creating growth media of higher agar concentrations. Higher agar concentrations place more pressure on the roots, making the growth media a physical obstacle that the plants must adapt to. The plants experiencing salt stress had their media changed by adding higher concentrations of sodium chloride solutions to the growth media. The high salinity condition in the 15mM NaCl caused the roots to shrink and develop pale leaves. The high agar concentration in the 5% agar made it difficult for the roots to penetrate the agar. The roots are not predestined to grow in any certain pathway, so because of the plasticity of the roots, the roots are able to adapt and conform to the growth environment around them, showing the environment has a great effect on the root appearance. This investigation is beneficial because it allows people to understand the complexity of plant roots and their ability to adapt to various conditions.

***Ryan McCaffrey, Alinur Rahim, John Voiklis***

**The Design, Construction, and Testing of an Economical Water Filtration System**

This project was designed in order to find the varying qualities of water filtered by different water filtration systems. Water (H2O) is constantly being polluted each day by substances in the air and on the ground, which makes water unsafe for consumption. The results of this experiment displayed which filter (carbon or sand) was the most effective at purifying water and which filter was the most efficient. Efficiency was defined by the amount of money spent on the filter and the amount of time consumed to produce these results.

This experiment was conducted by collecting polluted water from a constant source. The water was purified through both a sand filter and a carbon BRITA filter. The sand filter was created during the experiment by the organizing and layering particle mesh with a rock and sand placed above in a five-gallon water jug. The turbidity of both the original water and purified water were measured by a spectrophotometer. The spectrophotometer reads the turbidity of the water by passing light waves through the test samples, finding how much light is absorbed by particles in the water. The experimental results show that the pollutants in the water were dramatically abated after being filtered.

After testing, it was concluded that both filters significantly removed particles from the polluted water samples. The novel sand filter removed 67% of visible pollutants from the water, while the carbon BRITA filter only removed 28%. The hypothesis of the experiment, which claimed the sand and carbon filters have the same ability at abating particles from polluted water, was supported by the results, which proved the sand filter produced a matching water quality with the carbon filter, if not better. Although the sand filter consumed more time during the filtering process, it was constructed at a price of eleven dollars while the carbon filter priced eighteen dollars. Developing nations can therefore use their environmental resources to produce water of a less polluted quality.

***Julie McDonald, Claire Regan***

**Identifying HII Regions**

The purpose of this investigation was to discover and correctly classify misclassified HII regions. HII regions are the location of new star formation. It was hypothesized that if items classified as separate galaxies by SDSS Photo program were observed, some of them would be found to be HII regions. They are composed of ionized hydrogen, which is very chemically reactive. Research was conducted using the outline written by Sloan Digital Sky Survey, SDSS. Their original program, Photo, misclassified HII regions as galaxies. To find these regions, a search query had to be written to find objects within the SDSS database. The query was designed to return objects with magnitudes that were common to the magnitudes of previously observed HII regions. These potential regions were examined with SDSS’ navigation tool and explore tool. These tools provided information such as spectral graphs, color, location, cross-identifications, and possible warnings. The regions that were deduced to be HII regions were recorded in a catalog and sent to SDSS for further evaluation. The catalog sent to SDSS will help the designers of Photo fix the flaws in their original program. The hypothesis was correct. So far, our catalog contains about 143 misclassified regions. This research is important to astronomers because it enables them to further enhance their understanding of the areas and conditions in which stars form. Also, by studying the size of the regions, it is possible to determine the distance of the galaxy in which it is found.

***Maeve McLoughlin***

**A Comparison of the Movement of Three Different Horse Breeds**

The purpose of this study was to compare the movements (walk, trot, and canter) of 3 different pure bred horses. These 3 horse breeds are found throughout the United States and are used for different functions. Throughout history horses have played an important role in human societies they have been used to pull loads, to transport people and for riding pleasure. Each type of horse has different physical characteristics that effect their movement the way that horse moves if affected by their biomechanics. Biomechanics is the study of the mechanical laws relating to the movement or structure of living organisms. In this study the Irish Sport, Belgian Warmblood and the Thoroughbred were compared in terms of their movements. The methods that were used in this study were taking videos of each horse doing their movements and using a video analysis to pinpoint every movement/second of the video to see a pattern throughout each of the horse’s movements. By using the video analysis tool, this enabled me to also measure the distance between each leg every single stride. It was hypothesized that, the movements between different horse breeds would vary by the distance between each of their legs and the patterns that each of the horse makes with each gait. Results so far show that, the horse’s patterns and leg movement patterns vary.

***Scott Mulligan – See Eric Bass***

***Erin Neville***

**Is There a Correlation Between Left/Right Brain Dominance and Exercise?**

The purpose of this study was to determine the relationship between the frequency of exercise and brain dominance. Vigorous exercise can trigger the release of chemicals within our nervous system that calm us down, make us think more clearly, perform better. The left side of the brain excels at verbal, analytical, rational and logical tasks. It takes over most of the time, using words to describe, figuring things out, along with drawing conclusions based on facts and logic. The right side is good at tasks requiring the ability to see similarities, to understand how parts fit together as a whole, for example figuring out a puzzle. It is hypothesized that the more exercise a person participates in, there will be less brain dominance shown in that individual. In this study participants eighteen years or older took part in a survey consisting of forty-one questions; twenty questions determining brain dominance and twenty-one determining the level of daily exercise. The data reveals that people who showed moderate left brain dominance had 46.3 % of daily exercise. Right dominance was revealed in people who had a daily exercise 56.3%. However people who displayed no brain dominance had 60 % of daily exercise level. As data supports, the earlier stated hypothesis that the more exercise one participated in, the person will show no brain dominance is valid. On average people who displayed no brain dominance had a higher daily exercise level then people who showed brain dominance. Knowing if there is a correlation between brain dominance and exercise can become another motive for adults to be active. Remembering that the mental benefits of exercising are immediate can be a big help in improving your overall knowledge and decision making.

***Kayla Neville***

**Cytotoxicity of Graphene Oxide Nanoribbons, a Possible Drug Delivery and Imaging Agent,**

**In Human Breast Cancer Cell Line MCF-7**

Graphene oxide nanoribbons are a type of carbon based nanoparticle that has much potential to revolutionize the field of nanomedicine. They are currently being explored for their potential medical applications, such as multi-functional tumor detection and drug delivery agents to quickly diagnose and improve the accuracy and efficiency of drug treatment. Before these nanoribbons can be used and studied further, the cytotoxicity status must be known. This study was conducted to determine the LD50 value, or the concentration of graphene oxide nanoribbons at which half of the initial cells remain viable, of the GONR on human breast cancer cell line MCF-7. The cytotoxicity was determined through the use of four Colorimetric assays: Neutral red, Alamar Blue, Lactic dehydrogenase (LDH), and Water Soluble Tetrazolium-1 (WST-1) assay. There were 6 trials conducted for each concentration of 0, 1, 10, 50, 100, 250, 400, and 500 μg GONR /mL DSPE-PEG. After the dye was introduced to the cells, the dye’s fluorescence was and absorbance was measured. In addition, one non-colorimetric Trypan blue assay was used which relied on proliferation rates alone. This study uses this data to determine the LD50 value for GONR in MCF-7 cancer cell lines.

***Andrea O’Brisky – See Colleen Flynn***

***Rajkumar Pammal***

**Improving Reverse Osmosis Membranes for Desalination: The Modification of Cellulose Nanofibers**

Widespread water scarcity is a significant issue for society today, as 1.1 billion people, approximately 15% of the world population, lack access to clean water. To provide freshwater in areas lacking it, pressure-driven filtration methods such as reverse osmosis (RO) membranes have been utilized. The purpose of this investigation was to improve RO membranes for desalination, the removal of salt ions from water, by adding cellulose nanofibers to the barrier layers of such membranes. It was hypothesized that the nanofibers could be incorporated into the membrane if their surface properties were modified from hydrophilic to hydrophobic. Using a TEMPO-catalyzed oxidation reaction followed by an acylation modification reaction, the cellulose nanofibers were successfully modified. This crucial success was confirmed by an FT-IR spectrum analysis showing an altered chemical composition, and by water contact angle measurements. Due to the increase in hydrophobicity caused by this chemical modification, the cellulose nanofibers were uniformly dispersed in an organic solvent to be used in the synthesis of the barrier layer. Following this success, a novel substrate for the barrier layer was synthesized, and its surface properties were fully characterized for applications in RO membranes. Therefore, the modified hydrophobic cellulose nanofibers developed through this investigation can be incorporated into a unique reverse osmosis membrane, with the promise of higher flux while maintaining rejection ratios. These novel membranes may also prove to be more economical than commercially available membranes, due to decreased pressure requirements.

***TJ Passaro – See Greta Huang***

***Alinur Rahim – See Ryan McCaffrey***

***Daniella Rana – See Sarah Choi***

***Laxshika Raveendran – See Laura James***

***Claire Regan – See Julie McDonald***

***Eric Rizzo – See Eric Bass***

***Tracey Rosenlicht – See Stephanie Badir***

***Trinity Russell***

**A Behavioral Comparison of Laboratory Reared Stock and Recently Captured Fruit Flies (*Drosophila melanogaster*) using Upward Movement, Phototaxic, and Starvation Assays**

Fruit flies (*Drosophila melanogaster*) are model research organisms and are frequently reared in research institutions. Research specimens domesticated in a laboratory reared setting may have different behavioral phenotypes as compared to their wild counterpart. Additionally, it has been determined that the absence of “key” stimuli in the physical environment of captive animals can result in altered behavioral patterns (Price, 1999). The purpose of this investigation was to test for differences in the behavioral phenotype of outdoor captured fruit flies as compared to laboratory reared fruit flies using three tests: an upward movement assay, a starvation assay, and a phototaxic assay. Results from the upward movement assay demonstrated a statistical difference in the vertical moving speed of laboratory reared flies and outdoor-caught flies. Results from the phototaxic assay revealed outdoor captured fruit flies exhibited a natural phototaxic behavior while laboratory reared flies exhibited an inverse phototaxic behavior. The starvation assay proved that flies recently descended from outdoor caught fruit flies were able to withstand starvation twice as long as laboratory reared flies. These results indicate a strong behavioral difference between flies that are descended from laboratory stock and recently outdoor-caught flies. Research regarding the differences in domesticated organisms is an imperative topic for study because changes in behavioral phenotype may alter the results of research experiments. Thus it is crucial to have a thorough comprehension of the behavior of outdoor caught flies as compared to the behavior of their wild counterpart.

***Jessica Schwartz – See Meghan Kennedy***

***Melanie Shayowitz***

**Phototropism vs. Gravitropism in the Growth and Orientation of Radish Seeds**

The purpose of this study was to determine the relative effect gravity and light has on the growth orientation of germinating radish seeds.  The effect of light on plant growth is called phototropism. Phototropism is a plant’s orientation response to light and Gravitropism is a plant’s growth in response to gravity.  Charles Darwin studied both of these tropisms that ultimately led to the discovery of the plant hormone auxin.  It was hypothesized that gravitropism will have a more powerful influence than phototropism on plant growth orientation.   Roots under natural conditions grow downward and shoots grow upwards.  In this study germinating radish seeds were presented with light from either just below or above, as well as from above and below at the same time and with no light exposure.  The growth and the orientation of roots and shoots were observed.  Thus far, the orientation of all shoots is straight up towards light, so the stems are displaying negative gravitropism and positive phototropism.  Even when there is light coming from below the shoots are not influenced to grow towards gravity.  This suggests that for germinating radish seeds gravitropism has a greater effect than phototropism in growth orientation.

***Zachary Shushan. Daniel Tamer, Noah Tollin***

**Investigation of Voltage Production in a Sediment Battery**

The purpose of this investigation was to generate the most voltage possible using a sediment battery. A sediment battery is an example of an alternative energy source, because the energy comes from a renewable source which is energy which theoretically can continually be replenished. Within each sediment prokaryotes, which are unicellular anaerobic bacteria containing some organelles but no cellular nucleus, are present. The bacteria are essential in the battery because they use processes such as Glycolysis, Fermentation and the Electron transport chain. Through these processes, which are part of anaerobic respiration, electron acceptors (not oxygen) such as sulfate and nitrate are used which allow electrons to pass through to the electrode thus powering the battery. It was hypothesized that the sand from a Long Island North Shore beach would generate the greatest voltage. The first task of this experiment was to construct a sediment battery. This was done by acquiring a 5 Liter bucket filled approximately 1/3 with a specific sediment and then pouring water in to fill the rest of the bucket. One graphite electrode (anode) was dug in to the sediment while the other graphite electrode (cathode) was hung above the sediment in the water. Finally these 5/16” diameter, 15 cm long electrodes, which were epoxied to wire, were attached to a 310 ohm resistor, thus voltage could then be tested for. Within the battery different sediments such as soil from a nearby garden, soil from a salt marsh and sand from a Long Island North Shore beach, were utilized to generate the most voltage possible. The soil generated an average of 250 mV, and the marine beach sand generated an average of 860 mV. Finding the sediment type which generates the most voltage will be the goal for the future of this investigation.

***Zachary Silber, Rubin Thomas***

**The Use of Additives to Improve the Physical Properties of Epoxies**

The purpose of this investigation was to determine the effect of certain additives on the properties of a standard epoxy, specifically tensile strength. If anything could be found that improves important characteristics of the epoxy the resulting research could be used to develop a product superior to epoxies currently on the market. Epoxies are thermosetting polymers, they irreversibly cure, or harden. Composed of two parts, the resin and the hardener, epoxies can be utilized as an adhesive because they cure with certain properties. These properties include a high modulus to resist physical strain and a high solvent resistance to better resist weathering over time. These characteristics can be modified by introducing additional components into the recipe for standard epoxy. Prior success has be found when a material actually bonds into the structure rather then being a completely separate component. Most additives will actually weaken the epoxy, and cause the desired traits to decrease. In this study epoxidized soybean oil (ESO) was incorporated into a standard epoxy in varying amounts. As more ESO was added to the sample, the tensile strength decreased. Once the amount of ESO went above 20%, the epoxy was too brittle to work with.

***Rakia Syed – See Marissa Mathew***

***Daniel Tamer – See Zachary Shushan***

***Nakul Thampy, Thomas Vetere***

**Steptricity: Design Concepts for Optimal Piezoelectric Generators in**

**Energy Harvesting Environments**

The purpose of this experiment was to generate eco-friendly electricity in a simple and innovative way. Energy harvesting is when energy is taken from the environment and turned into a usable form. Piezoelectricity is the generation of electricity through pressure and vibrations. Our project is designed to incorporate piezoelectric plates in energy harvesting environments, such as stairs, and converting the surrounding pressures and vibrations into usable a usable form. For example, our quartz plates, when applied to stairs, will produce electric current when people step on them. The piezoelectric element we are using is quartz and we incorporated the quartz into multiple circuit designs, for example, a series circuit, parallel circuit, and singular circuit. The electricity was captured using copper tape electrodes. Our series circuit design was the most successful. We also found that our design was being affected by 60 cycle interference. In our new designs, we inhibited 60-cycle electricity in the air and surrounding appliances by grounding the extra charge into aluminum foil. We accomplished this by covering the electrodes with aluminum foil. In the future, we will test each circuit with a diode and capacitor. The diode will direct the positive voltage into the capacitor. The capacitor will serve to easily read the voltage increase produced by **each step on the plates. Our singular plate circuit has an average of 14.5 mV, our series circuit has an average of 36.6 mV, and our parallel circuit has an average of 15.0 mV.**

***Rubin Thomas – See Zachary Silber***

***Noah Tollin – See Zachary Shushan***

***Jacqueline Tuminello***

**A Study of a Honey Bee Pest: The Lesser Wax Worm (*Achroia grisella*) and its Food Preference**

The lesser wax worm is the caterpillar larvae of a wax moth belonging to the Lepidopteran order. A characteristic of these moths is that they tend to feed on the honeycomb of honey bees. The adult wax moth is known to invade and infest hives and stored wax of the honeybee.  The adults lay their eggs on beeswax and the emerging larvae consume and destroy honeycomb that is either in the hive, or more importantly, stored comb.  The purpose of this study was to determine the relative importance of food quality, and the presence of wax worm larvae on attracting other wax worm larvae. Wax worms consumed two different diets containing bran, glycerin, honeycomb, distilled water, and honey.  The wax worms were presented with a choice of two different diets to observe if they can sense different food quality. After this experiment was performed, the lesser preferred diet was used; the worms were presented with a choice of going to the diet containing live wax worm larvae, or the diet not containing live wax worm larvae. For the first part of the experiment, it was hypothesized that worms would be attracted to a diet with a greater percentage of honey. For the second part of the experiment, it was hypothesized that the worms would be attracted to the food not containing live wax worm larvae. After the first experiment, the non-preferred diet of the two was selected to be used for the second experiment. The first experiment showed that the wax worms preferred the diet containing a higher percentage of honey and honeycomb. The second experiment suggests that the worms were able to sense the competition for food, and they consumed more of the food not containing live wax worm larvae even though they were found to prefer the food with the other worms. This shows that the data supported the experimental hypotheses

***Jake Vallen, Kelly Weiner***

**The Effect of Heartburn Medications: Tums (CaCo3), Zantac OTC (Ranitidine),**

**and Prilosec OTC (Omeprazole) on the Hydrolysis of Protein Molecules.**

Many people are threatened with a condition, acid reflux or more commonly known as heartburn. Heartburn is a disorder where the esophageal sphincter does not function properly letting harmful acidic gastric juice into the esophagus. This burns the tissue causing a painful sensation in the upper chest. Millions of people take medications for conditions related to heartburn such as Tums (CaCO3), Zantac OTC (Ranitidine), and Prilosec OTC (Omeprazole). Each medication acts in a different way to increase the pH of gastric juice that seeps into the esophagus from the stomach which makes it imperative to study the effects of these medications. The purpose of this investigation was to determine the effects of various heartburn medications on protein digestion. To carry out this study, gelatin was used as the protein being digested by pepsin, which works best at a pH of 2. As the gelatin was digested by pepsin in the HCl solution, the raspberry red color was released. As the color was released absorbance was measured in a spectrophotometer. The greater amount of absorbance indicated a greater amount of protein digestion. It was hypothesized that the homogenous mixture of pepsin and Tums would be most effective in raising the pH of the HCl solution buffered at a pH of 2 and digesting the red gelatin. Results have not supported our hypothesis because even though the Tums mixture was most effective in raising the pH, the Prilosec mixture was most effective in digesting the red gelatin.

***James Whittaker, Joshua Zweig, Eddie Choi***

**Optimization of Energy Output in a Microbial Fuel Cell**

Microbial Fuel Cells produce electricity through the anaerobic respiration of microbial organisms such as those of the family *Geobacter. Geobacter* is often found in freshwater, fish bearing bodies of water, such as inland lakes and streams.  In their natural environments, the bacteria respirate anaerobically. They gain energy for this respiration from the surrounding sediments in their environment. In the anode of this experiments fuel cell, the bacteria respirate as they would in their natural environments but the electrons emitted through the bacteria's pilus during this process are harnessed by the anode's carbon electrodes.  The cell’s construction, allowed for a circuit to be formed, which allowed for a flow of electrons to occur. The sediments within the anode had various variables placed into them in order to discover what helps the fuel cell produce the largest output of electricity in millivolts. Of the three variables, magnesium, carbon and iron, iron led to the generation of the most energy due to the fact that of the variables, its density was greatest. The fuel cell worked successfully and produced the most energy during an Iron trial with a voltage of 445 mV. This experiment’s fuel cell has created a viable source of energy. Research in the area of energy production is very important to all people, as a source of fuel is necessary in the modern world and conventional energy is increasingly expense to acquire.

***Jared Wilson***

**The Design and Construction of a Clothing Assistance Device**

Despite being a significant health and social problem, disabilities only gained attention in epidemiology around the 1970s. According to a census performed by the United States government in 2009, approximately 19.2 million people are physically disabled. As time goes on more and more individuals will need devices to help them live as independently as possible. The engineering goal of this research project was to design and construct a device that will aid a person with a disability to put on socks. By making putting on a sock, a seemingly easy every day activity, more accessible for people with physical disabilities, opportunities for independence will open up. Some of the physical disabilities of people that will be focused on are cerebral palsy, multiple sclerosis, and arthritis. The device will have the sock move in a trapezoid formation, going passed the heal and up the leg. More than one model was developed as limitations were discovered. The device is universally designed so that people of all conditions, or foot sizes, will be able to use the device in the same way. Without universal design, each person would need their own specific type of the model, restricting its use.

***Chantel Yang – See Rachel Aitchison***

***Rachel Yang***

**Computational Modeling of the Large Loop Region of the**

**Protein Alpha-synuclein in Parkinson’s Disease (PD)**

The purpose of this investigation was to remodel and redesign the large loop region of the protein α-synuclein using Rosetta, which use homology modeling to predict sites in the protein based on similarities in sequence with known proteins. The relatives of α-synuclein, including β-synuclein and γ-synuclein, were analyzed and used as a basis of comparison for structural/sequential similarities. In addition to Rosetta, various servers were used to provide protein structure, topology, and function data. A preliminary run of the α-synuclein FASTA sequence through the ModWeb server revealed that the RMSD (Root Mean Squared Deviation), a measure of distance between two structural variants of the protein, was higher in the large loop region than in the alpha helices. This suggests that the loop region has a larger degree of variability in folding, which makes it a notable area for remodeling. The sequences also were entered into the online NetSurfP server, an artificial neural network trained to determine the probability of each amino acid’s formation into an alpha-helix, beta-sheet, or coil. Analysis of amino acid propensities revealed that amino acids in the loop region had a higher probability of forming coils. Other servers, such as Wloop and ArchPred, produced a redesigned α-synuclein loop region with many gaps, showing the areas of conformational instability in the loop. Finally, the Rosetta Relax application was used to reduce the overall folding energy, increase protein stability, and provide an optimized redesigned model for each of the synucleins. Analyzing the sequence and refining the structure of the loop region of α-synuclein may elucidate the mechanisms of α-synuclein misfolding and aggregation into Lewy Bodies, which is significant since α-synuclein represents a possible drug target for PD treatment.

***Young Seok Yoon***

**The Effect of an Electrostatic Field on the Emergence and Survival of Brine Shrimp (*Artemia salina*)**

Over the last years there has been an intense debate concerning the possibility of non-thermal effects produced by electro-magnetic fields (EMF) on biological systems (Costanzo, 2008). However the underlying mechanism is unclear because of lack of research on exposure of static or ELF field an organism at early stage of development especially in animals. Brine Shrimp was used because they have a short hatching time of 15 to 20 hours, their cysts are only 200 to 300 micrometer in a diameter (Treece, 2000), and the cysts may be stored for long periods and hatched on demand because of its dormant state. The purpose of this experiment was to investigate the effects of electric field exposure on the developmental stage of brine shrimp. It was hypothesized that if brine shrimps are exposed to an electrostatic field, it would have a better chance of survival and emergence compared to control group exposed that is not exposed to an electric field. There was a significant difference between the means of the experimental groups (electrostatic exposure) and the control groups (no exposure). This implies that electroculture increases the resiliency of brine shrimps by increasing their emergence and survival rate. The increase in vigor of plants in electroculture may be extended to animals as well.

***Michelle Zhou***

**The Effect of Various Bicarbonate Solutions on Powdery Mildew Infected Pumpkin Plants**

The purpose of this investigation was to determine the effects of Potassium and Sodium Bicarbonate on Powdery Mildew, a fungal disease known for attacking a wide range of plants including *Solanum lycopersicum.* The fungal disease Powdery Mildew is one of the most widespread and easily recognized plant diseases, and is becoming an increasing threat. Powdery mildew causes economic loss by weakening plants, promoting poor growth, and decreasing yields. In ornamental plants, powdery mildew detracts from the value of plants through the malformation and discoloration of leaves, destruction of fruit and flowers and overall decreased plant growth. A 3 bicarbonate solution was made which included a homemade Sodium Bicarbonate, and 2 manufactured solutions; Greencure (Potassium and Sodium). 2 groups were labeled “Greencure Sodium”, 2 groups “Greencure Potassium”, 2 groups “Sodium Bicarbonate”, 1 group “control”,and one group ‘infected”. In the Groups labeled Greencure Sodium, Greencure Potassium, and Sodium Bicarbonate, label one “before sprayed” and the other “after spayed”. The bicarbonate spray were then applied accordingly plants with the “spray before” label, after which the fungus Powdery Mildew was then inoculated upon. For the group labeled “spray after”, Powdery Mildew was first inoculated, and then the bicarbonate sprays were applied accordingly. Each week, measurements for the plant’s height, and leaf length and width were taken for each group. Using statistical evidence, the data indicates that the timing between the sprays is not statistically different with one another. The measurements obtained from the Plant Height, Leaf width, and length proved to be mostly statistically different with Greencure Sodium proving the most effective.

***Joshua Zweig – See James Whittaker***

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