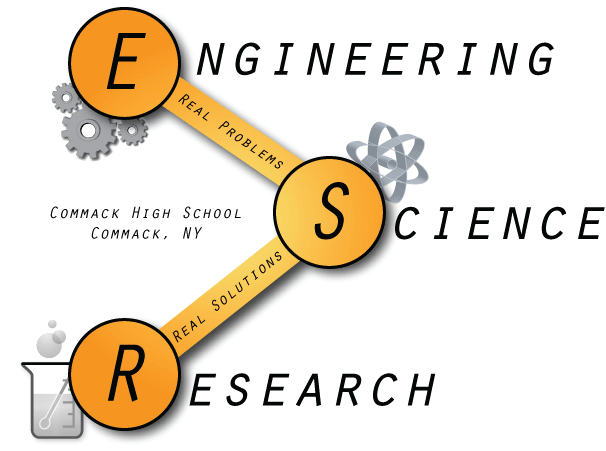
*The Research Dragon*





**Commack High School’s**

**Research Yearbook**

**2014 - 2015**

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

**Thursday May 21st, 2015**

**7:00 pm**

**Evening Events**

Poster Presentation of student projects

Slide Show Presentation… Thomas Vetere

Introduction…………..….Monica Cramer

Opening Remarks….….…Ms. Alison Offerman-Celentano

Director of Science, K-12

Student Reflections…..….Alexis Davitashvili, Benjamin Wolgang

Alumni Comments……….Justin Cheung

Guest Speaker………….. Dr. Paul Lawrence

Director of DNA Production

Applied DNA Sciences, Inc.

Special Recognition……..Rachel Aitchison, Ryan McCaffrey

Honoring Our Seniors…...Brianna Delgado, Jake Finnell

Senior Picture Compilation….Gabriel Green

Closing Remarks…..…….Monica Cramer

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

Ms. Alison Offerman-Celentano………….. 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.*

Susan Abbott, Toni Boble, Joe Costa, Lisa DiCicco, Chris DiGangi, Susan Fanwick, Carolyn Gallogly, Paul Giordano, Dolores Godzieba, Steven Hartman,

Camille Horak,Dr. John Kelly, Elizabeth Koelzer, Dr. Barbara Kruger, Dr. Fred Kruger, Dr. Susan Lee, Brenda Lentsch, Lee Orth, Eileen Rogers, Genny Sebesta, Gary Shaw, Elizabeth Smith, Victoria Stack, Dr. Grace Tan, Estela Velez, Lois Webster, Frann Weinstein.

Ed Storck and our fabulous custodial staff.

Ms. Nolan, Ms. Shapiro, Ms. Boritz, Mr. Keltos, and the administrative staff for their continued support.

Dr. James, Dr. Pecora, Ms. Newman and Ms. Ryan, and the members of our Board of Education for their support and recognition of our program.

**Science Fair Participation**

**Intel Science Talent Search**

Scott Massa - National Finalist

Matthew O’Connell – National Semifinalist

**Intel International Science and Engineering Fair**

**David Li**

**Scott Massa**

***Awards to be Announced***

**Long Island High School Psychology Fair**

Thomas Vetere

*Students were selected after a competitive process to present their research at the conference.*

**Toshiba/NSTA ExploraVision Program**

Matthew Damiata – Honorable Mention

Alexis Davitashivili – Honorable Mention

Raphael Iskra – Honorable Mention

Joshua Mann

Paul Mokotoff

Nicholas Nasis – Honorable Mention

Eric Nigro – Honorable Mention

Trevor Rosenlicht – Honorable Mention

Ryan von Hof

*Honorable Mention represents the top 10% of nationwide student participation*

**ASE AstroSat Challenge**

Daniel Lee

William Liu

**MIT Prime Mathematics Program**

Mehtaab Sawhney

**European Society for translational Medicine Conference**

Matthew O’Connell – Student Presenter

**ASSET Technology Conference**

Matthew O’Connell – Keynote Speaker

**Long Island Systems Application and Technology Conference**

David Li – Student Presenter

**Institute for Economic Empowerment Design Challenge**

Melike Akoglu – National Honorable Mention

Abinya Anand – National Honorable Mention

Daniel Cho – National Honorable Mention

Brianna Delgado – National Honorable Mention

Anoop Singh – National Honorable Mention

**Ability One Design Challenge**

Melike Akoglu – National Semifinalist

Abinya Anand – National Semifinalist

Daniel Cho – National Semifinalist

Brianna Delgado – National Semifinalist

Anoop Singh – National Semifinalist

**TechnoVation Challenge**

Olivia Dubi

Tara McCaffrey

Amy Uthup

**Junior Science and Humanities Symposium**

*Students must apply to the symposium and be selected to present their projects*. *First Place finishers return for Round 2.*

Jason Bak – 1st Place, Earth and Environmental Science

Emily Chen

Daniel Hosseinian – 1st Place, Earth and Environmental Science

David Li – 3rd Place, Engineering

Scott Massa – 1st Place, Biology

Ryan McCaffrey

**Junior Science and Humanities Symposium, Round 2**

*First and Second Place finishers advance to the National levels of competition.*

Jason Bak – 2nd Place, Earth and Environmental Science

Daniel Hosseinian – 2nd Place, Earth and Environmental Science

*(Scott Massa was unable to compete due to INTEL Finals in Washington, D.C.)*

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

*92 students nationwide are invited to present their research at individual lectures at the symposium.*

Jason Bak

Daniel Hosseinian, Presenter

**NYIT Connect-to-Tech Engineering & Technology Competition**

Melike Akoglu – 2nd Place

Abinya Anand - 2nd Place

Daniel Cho - 2nd Place

Brianna Delgado - 2nd Place

Claire Drotman – 3rd Place

William Furst – 3rd Place

David Li -1st Place

Anoop Singh - 2nd Place

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

Zack Abrams

Gianna Anderson

Brandon Axelrod – 3rd Place, Environmental Science

Isabella Daquita – Honorable Mention, Biology

Samantha Gray – Honorable Mention, Biology

Joshua Hardoon – 3rd Place, Environmental Science

Raymond Janis -3rd Place, Environmental Science

Mikayla Kelly

Helen Koukoulas – Honorable Mention, Biology

Nicole LaRedolla

Jake Nieto – Honorable Mention, Environmental Science

Megan Padgett

Kelly Page

Samuel Petruzzi – Honorable Mention, Environmental Science

Muzaffer Tasoglu – Honorable Mention, Environmental Science

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

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

Jason Bak

Ryan Chan

Emily Chen

Brianna Delgado

Daniel Hosseinian

Andrew Kim

Gloria Kim

David Li

Scott Massa

Vincent Pennetti

Mehtaab Sawhney

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

Jason Bak

Ryan Chan

Brianna Delgado – 3rd Place, Microbiology

Daniel Hosseinian

Andrew Kim – 3rd Place, Materials and Bioengineering

David Li – 1st Place, Electrical and Mechanical Engineering

Scott Massa – 1st Place, Cell and Molecular Biology

Vincent Pennetti – 3rd Place, Plant Sciences

Mehtaab Sawhney – 3rd Place, Mathematical Sciences

*Special Awards across all categories have yet to be announced*

*All First Place winners advance to International Competition in Los Angeles, California*

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

Jason Bak

Ryan Chan

Emily Chen

Brianna Delgado

Daniel Hosseinian

Andrew Kim

Gloria Kim

David Li

Scott Massa

Vincent Pennetti – 1st Place, Plant Sciences

Mehtaab Sawhney

*\*Students previously accepting First Place Grand Awards at LISEF are not eligible for awards*

**WAC Lighting Foundation Invitational Science Fair**

Melike Akoglu - 3rd Place, Prototype Engineering, Underclassmen

Abinya Anand - 3rd Place, Prototype Engineering, Underclassmen

Brandon Axelrod – 3rd Place, Earth and Environmental Science, Underclassmen

Sustainability Award, Junior Division

Allyson Britt – 2nd Place, General Biology, Underclassmen

Rahul Chakravorty - Honorable Mention, Prototype Engineering, Underclassmen

Ryan Chan – Merit Award, General Biology, Senior Division

Emily Chen – Merit Award, General biology, Senior Division

Daniel Cho - 3rd Place, Prototype Engineering, Underclassmen

Daniel Choi

Jianna Cressy - 2nd Place, Earth and Environmental Science, Senior Division

**WAC Lighting Foundation Invitational Science Fair (Continued)**

Abbigayle Cuomo

Matthew Damiata

Isabella Daquita – Honorable Mention, General Biology, Underclassmen

Alexis Davitashvili – 2nd Place, Prototype Engineering, Underclassmen

Brianna Delgado

Olivia Dubi – Merit Award, Prototype Engineering, Underclassmen

Victoria Ferlauto

Colleen Flynn - Honorable Mention, General Biology, Senior Division

Samantha Gray - Honorable Mention, General Biology, Underclassmen

Vignesh Gunasekaran – Merit Award, General Biology, Underclassmen

Joshua Hardoon - 3rd Place, Earth and Environmental Science, Underclassmen

Sustainability Award, Junior Division

Brian Huang – Honorable Mention, General Biology, Senior Division

Raphael Iskra - 2nd Place, Prototype Engineering, Underclassmen

Raymond Janis 3rd Place, Earth and Environmental Science, Underclassmen

Sustainability Award, Junior Division-

Aryana Javaheri – Honorable Mention, Prototype Engineering, Underclassmen

Daniel Jung

Mikayla Katz

Christine Kim - Merit Award, Behavioral and Social Science, Underclassmen

Helen Koukoulas - Honorable Mention, General Biology, Underclassmen

Angela Kubik - Honorable Mention, General Biology, Senior Division

Briana Kubik - Honorable Mention, General Biology, Senior Division

Sara Kurten - 2nd Place, General Biology, Underclassmen

Anthony LaSala

Daniel Lee  
Ryan Lee

David Li – 1st Place, Prototype Engineering, Underclassmen

William Liu

Joshua Mann

Noah Marinaro

Lucas Marmorale

Ryan McCaffrey – 1st Place, Prototype Engineering, Senior Division

Tara McCaffrey - Merit Award, Prototype Engineering, Underclassmen

Marin Nagelberg – 2nd Place, Earth and Environmental Science, Senior Division

Nicholas Nasis

Eric Nigro

Andrea O’Brisky – 1st Place, Physics and Astronomy, Senior Division

Jin Ho Park - 3rd Place, General Biology, Senior Division

Caitlin Passaro - 2nd Place, General Biology, Underclassmen

Vincent Pennetti – 3rd Place, General Biology, Senior Division

Eric Rizzo

Trevor Rosenlicht - 2nd Place, Prototype Engineering, Underclassmen

Christopher Siegler

Juliana Sikorski – Merit Award, Behavioral and Social Science, Underclassmen

**WAC Lighting Foundation Invitational Science Fair (Continued)**

Anoop Singh – 3rd Place, Prototype Engineering, Underclassmen

Hassam Syed

Victoria Turner

Amy Uthup - Merit Award, Prototype Engineering, Underclassmen

Elizabeth VanLoon

Douglas Verity

John Voiklis

Ryan von Hof

Peter Yu

**SourceAmerica Design Challenge**

Melike Akoglu – National Honorable Mention

Abinya Anand – National Honorable Mention

Daniel Cho – National Honorable Mention

Brianna Delgado – National Honorable Mention

Anoop Singh – National Honorable Mention

**Arts and Science Fair at Nassau Community College**

Monica Cramer

Jianna Cressy

Abbigayle Cuomo

Isabella Daquita – 1st Place, 10th Grade

Michael Delmonaco

Jake Finnell

William Furst

Samantha Gray - 1st Place, 10th Grade

Austin Heller

Mikayla Katz

Helen Koukoulas -1st Place, 10th Grade

Daniel Lee

William Liu

Joshua Mann - 3rd Place, 10th Grade

Brendan McCaffrey

Marin Nagelberg

Chase Schare

Elizabeth VanLoon

Thomas Vetere

Ryan von Hof - 3rd Place, 10th Grade

Benjamin Wolgang

Peter Yu – 3rd Place, 10th Grade

**Noyce Symposium**

*Awards To Be Announced*

Nicholas Bunnell

Kyle Dituro

Jessica Fecht

Vignesh Gunasekaran

Jessica Hastings

Alexa Karadenes

Joshua Kravatz

Anthony LaSala

Joshua Mann

Nicolette McKeon

Jamey Meiotti

Kyle Mitra

Charity Russell

Maxwell Sugarman

Justin Tollin

Douglas Verity

Jeremy Vlacanich

Ryan von Hof

Matthew Wu

Peter Yu

**Long Island Science Congress**

Jung Soo Ahn - To Be Announced

Veronica Borracci - Achievement

Julia Cicalo - Achievement

Michael Delmonaco - Achievement

Joshua Dreilich - Achievement

Gina Ferrara – Honorable Mention

Jake Finnell - Honorable Mention

Austin Heller - Honorable Mention

Daniel Lee - Achievement

William Liu - Achievement

Gabriella Longo - Achievement

Brendan McCaffrey - Achievement

Jayson Mintz - Achievement

Jake Nieto - To Be Announced

Kristin Orrach – To Be Announced

Samuel Petruzzi - To Be Announced

Sarah Samad - Meritorious

Chase Schare - Honorable Mention

Vraj Shah - Achievement

**Long Island Science Congress (Continued)**

Sydney Sirota - To Be Announced

Muzaffer Tasoglu - To Be Announced

Lauren Tuffy - Meritorious

Serena Tulley - Meritorious

Benjamin Wolgang - Honorable Mention

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

Rachel Aitchison

Aaron Angeles

Eric Bass – To Be Announced

Nicholas Biancaniello

Joseph Christian

Monica Cramer - To Be Announced

Claire Drotman - To Be Announced

William Furst - To Be Announced

Vincent Giannilivigni

Elias Gonzalaz

Gabriel Green - To Be Announced

Jason Haber

Christopher Haumann

Alex Horowitz

Austin Izen - To Be Announced

Milenia James

Anthony Jao

Ibrahim Khan

Christine Kim - To Be Announced

Paul Mokotoff

Steven Murrell

Adam Portnoy - To Be Announced

Alinur Rahim

Emily Shin

Charles Sikorski

Juliana Sikorski - To Be Announced

John Simone

Amay Varaganti

Erick Vaysman - To Be Announced

Thomas Vetere - To Be Announced

Johann Yang

Kevin Zhou

**Molloy College Science Fair**

Zack Abrams

Gianna Anderson

Nicholas Bunnell

Gabrielle Cooper

Jordan Cooper

Olivia Dubi

Jessica Fecht

Samantha Gray

Jessica Hastings - Top 10 in Fair, 5th Place Overall

Milenia James

Mikayla Kelly

Helen Koukoulas

Joshua Kravatz

Daniel Lee

Nicolette McKeon – Top 10 in Fair, 5th Place Overall

Jake Nieto - Honorable Mention

Megan Padgett - Honorable Mention

Kelly Page - Honorable Mention

Samuel Petruzzi – Honorable Mention

Charity Russell

Chase Schare

Maxwell Sugarman

Muzaffer Tasoglu - Honorable Mention

Justin Tollin

Amy Uthup

Jeremy Vlacanich

Benjamin Wolgang

Kevin Zhou

**Medical Marvels Challenge**

Zack Abrams – 2nd Place

Julia Bracco

Abbigayle Cuomo

Nicole LaReddola – 2nd Place

Kristin Orrach – 2nd Place

Elizabeth VanLoon

**PUBLICATIONS**

**Recent Patents on Biomarkers**

Brian Huang

**Finger Lakes Journal of Secondary Science**

Abbigayle Cuomo

Elizabeth VanLoon

**IEEE Proceedings -Long Island Section**

David Li

**ABSTRACTS**

**Seniors**

*Rachel Aitchison*

**The Effect of Light Irradiation on the Production of Hydrogen Peroxide**

**From Titanium Dioxide**

It has recently been discovered that certain chemicals that are used in sunscreen products, such as titanium dioxide, react with sunlight to form new compounds such as hydrogen peroxide. The environmental impact of this process has not yet been measured or observed. The purpose of this experiment was to determine the effect, if any, of hydrogen peroxide production caused by light irradiation of titanium dioxide on the hatching and survival of brine shrimp. It was hypothesized that the shrimp exposed to titanium dioxide under a full spectrum light would have the lowest rate of hatched eggs and lowest survival rate. The effect was measured by observing brine shrimp egg development under a microscope. Three beakers containing salt water were placed under standard light and another three were placed under a full spectrum light bulb to simulate sunlight. The brine shrimp exposed to sunscreen, titanium dioxide, and full spectrum light experienced a higher level of hatching and mortality. This experiment is important because it shows the effect light irradiation has on the marine environment and marine organisms.

*Jason Bak, Daniel Hossenian*

**Experimental Assessment of Screen Bias in an Early Arctic Air Temperature Time Series**

Historical surface air temperature records used to reconstruct extended time series for climate studies often lack sufficient metadata to evaluate sources of bias in the recorded data. Occasionally, it is possible to reproduce the original environment to the extent that an objective measure of bias can be obtained and correction factors can be determined to increase the data’s accuracy. There exists a large collection of unanalyzed hourly air temperature data from September 1852 to July 1854 taken near Point Barrow, Alaska by officers of the HMS *Plover* using a thermometer encased in a radiation screen. This data set is especially valuable due to it being recorded extensively in a time and place where data are sparse. This location is only 3 km northeast from the present day location of a NOAA observatory recording meteorological measurements, presenting the opportunity to assess bias of the historical data in comparison to modern data. For this investigation, a platinum resistance thermometerinside a previously constructed replica of the *Plover* radiation screen was placed adjacent to the observatory’s sensors. Henceforth, surface air temperature time series were obtained from both the replica’s and observatory’s sensors. Data show that relative magnitudes of the biases associated with the Plover’s radiation screen are on average 0.35 °C and up to 2 °C, generally varying by the sun exposure of the screen. These seemingly small inaccuracies are significant in the context of climate change, which is on the scale of a few degrees.

*Eric Bass, Gabriel Green*

**The Effects of Environmental and Seasonal Changes on the Diel Vertical Migration of Zooplankton**

Zooplankton are essential to the foundation of most marine food webs and are found in almost every major body of water. Zooplankton stay in deep waters for most of the day to avoid visual predators and migrate to the surface in the evening to find food. Their vertical migration patterns are important to their survival, and thus the functioning of the ecosystem. The differences in seasonal migration patterns between two locations, Saanich Inlet (SI) and Strait of Georgia (SoG) in Southern British Columbia, Canada were investigated. Various biological and physical factors affect the diel vertical migration of zooplankton. Daily and seasonal variations in light and predatory presence have been found to be the primary factors affecting migration patterns (Zaret, Suffern, 1976, Lampert, 1989, Ramos-Jiliberto, R., 2000). Secondary factors include thermal stratification, dissolved oxygen concentration, salinity, and climate. Data from the Zooplankton Acoustic Profilers (ZAPs), operated by Ocean Networks Canada’s VENUS Observatory, is available on the internet and was used to generate graphical representations of the migration of zooplankton. These images were then used to measure the daily times of ascent and descent for 2010. Using the daily ascent and descent times, the seasonal diurnal variations were compared between the two locations and the time spent foraging at the surface were calculated. The migration patterns were found to be almost identical between the two locations, which implied that the secondary variables and differences in environmental conditions had a negligible effect on migration.

*Ryan Chan*

**The Use of DNA Barcoding and Taxonomical Techniques to Identify and Catalog Organisms in the Inner Harbor of Cold Spring Harbor, New York**

DNA barcoding, an innovative method used for classifying organisms, is becoming increasingly prevalent for use in identifying and cataloging organisms. First introduced formally in 2003, barcoding relies on the use of specific reference genes that target highly conserved, standardized regions in short DNA sequences, creating a system for species identification. Alternatively, classical taxonomy uses morphological traits for species identification. Since both DNA barcoding and traditional taxonomic methods have benefits and limitations, this study combined both methods to provide a reliable and more robust basis for species identification. In this study, plant and animal samples were collected from the Cold Spring Harbor area, on Long Island, NY. The DNA from the organisms was isolated and sequenced using CO1 primers for plants, and rbcL primers for invertebrates, with the purpose of uncovering potentially novel barcodes that are not currently present in the BOLD Database, an extensive bioinformatics database containing over 2.5 million barcodes. Out of a total of 23 samples, 12 samples were able to be sequenced (about 50% yield): 4 were narrowed down to a specific genus (in which classical taxonomic methods were used to determine the species), 6 samples were categorized into their appropriate genus and species through barcoding alone, and two unique barcodes were discovered. The results of the study suggest that new primers which target more specific gene regions need to be developed to establish a more reliable method of barcoding.

*Jianna Cressy, Marin Nagelberg*

**Drawing a Correlation Between Multiple Myeloma Incidence, Agricultural Income and Pesticide Usage**

Multiple Myeloma is a monoclonal gammopathy of the plasma cells and is diagnosed when the cell is classified abnormal and the cancer has metastasized. There has been a linkage of multiple myeloma and farmers with high exposure to pesticides such as glyphosate, atrazine, metam sodium and permethrin. The purpose of this experiment was to investigate the existence of a correlation between multiple myeloma incidence by state in all 50 states, the state’s agricultural income and its usage of glyphosate, atrazine, metam sodium and permethrin. Data was collected from the Center for Disease Control and Prevention (CDC) Wonder Program, the United States Department of Agriculture, and the Pesticide Synthesis Project from 2011. Statistical analyses were made utilizing the calculation of the correlation coefficient to test the strength of the data correlation (r-squared). It was hypothesized that there would be a stronger correlation between multiple myeloma and pesticide usage than that between agricultural income and multiple myeloma incidence. Results thus far indicate that the correlation between multiple myeloma incidence and pesticide usage is stronger, as the agricultural income data is inconsistent with multiple myeloma incidence. This is seen in the maps created using QGIS. This study can be used to inform society of the relationship between exposure to harmful pesticides and the risk of diseases such as multiple myeloma.

*Claire Drotman, William Furst*

**The Design and Construction of a Device to Aid Emergency Service Personnel in Utilizing a Bag-Valve-Mask**

A bag-valve-mask is a hand-held device commonly used to provide oxygen to patients who are unable to receive the amount necessary to survive. This basic airway management technique allows for oxygenation and ventilation of patients until a more definitive airway can be established and in cases where endotracheal intubation or other definitive control of the airway is not possible. The basic design of a BVM has remained the same since its development, and can easily be misused. High ventilatory rates and/or inadequate ventilation volumes can potentially cause gastric inflation, gastric distention, hyperventilation or hyperventilation. To assure EMS personnel that they are providing an adequate flow of air to patients, a prototype device was created using a pressure sensor and Arduino Uno to sense the pressure of air exerted into a patients lungs to notify a user if her or she is squeezing with too much or too little pressure, thus increasing the chances of patient survival. The prototype device is operated by a 3-light system, using the colors red, yellow and green. With each squeeze a light is lit depending on the pressure at which the user squeezes the bag. Yellow indicates that not enough air is going into the lungs, red suggests that the user is exerting too much pressure, therefore misusing the BVM, and green advices the user that he or she is squeezing with the correct amount of pressure within the range of 50-70 cm H2O.

*Colleen Flynn, Angela Kubik, Briana Kubik*

**A Study of Antifungal Agents in the**

**Nepenthes ventricosa x sibuyanensis Pitcher Plant**

The purpose of this project was to determine whether any antifungal agents can be found within the pitcher plant species of the *Nepenthes ventricosa* x *sibuyanensis*. The pitcher plant is an insectivorous plant that gains most of its nitrogenous nutrients from the insects in the surrounding environment. Many pitcher plants live in acidic soils that do not have, due to low pH, the nitrifying bacteria, that are needed to convert N2 into usable nitrogen. This lack of nitrogen in the soil is the reason why pitcher plants have evolved the ability to utilize nitrogen from insects. In order for a pitcher plant to receive a substantial amount of nitrogen and nutrients, the plant must endogenously secrete secondary metabolites that assist in fending off other organisms that could interfere with the intake of nutrients in the plant. Scientists suggest that these metabolites could potentially be used as more efficient antifungal agents. Four variables were tested, including two different chitin induced liquids (open and closed pitchers), prey induced liquid, and non-induced liquid. To carry out the study, two open pitchers were exposed to chitin and prey respectively while an unopened pitcher was left alone as a control (without chitin or prey). Samples were taken from each pitcher and preserved. Then the preserved samples of pitcher fluid were analyzed for any presence of antifungal metabolites using UV analysis. It was hypothesized that the chitin induced liquids would show significantly higher amounts of secondary metabolites when compared to the non induced liquid. Results show that more secondary metabolites were secreted in the pitchers that were induced by chitin when compared to the control and the pitchers induced by prey.

*William Furst – See Claire Drotman*

*Gabriel Green – See Eric Bass*

*Daniel Hosseinian – See Jason Bak*

*Christopher Huaman, Anthony Jao*

**Soilless Substrates: Future of Farming**

Soilless substrates are necessary in some communities around the world due to the chance of soiling dying, preventing any form of horticulture. The need for a material to grow plants in areas with dead soil makes it necessary to discover a material that can be implemented into such areas. Ideally the substrate will be able to increase crop growth and yield as well as decreasing the chance of diseases sometimes found when using soil. The substrates would be lightweight, biodegradable, and cost efficient so that it can be transported and easily used. Being biodegradable helps in this aspect as it allows for nutrient enrichment after usage, and removes any need for waste management or environmental safety management. In order to test the efficiencies of materials, seeds will be planted in the substrates and floated on top of an ebb and flow system. This system allows water to cycle and remove the need to constantly monitor the plants. The ebb and flow system also acts as a way to prevent over watering of plants. The purpose of this project is to explore a materials capability to grow plants such in a way to be as efficient as regular farming methods. It is hypothesized that through exploring substrates, a replacement of soil could be found that will have the same capabilities of soil, such as yield and growth rate, while also preventing soil-borne diseases and various other problems.

*Brian Huang*

**The Development of a Model to Describe the Effects of Alcohol and Acetaminophen on NAFLD Livers**

Non-alcoholic fatty liver disease (NAFLD) is range of liver conditions from fatty liver (steatosis) to cirrhosis. If left unchecked, NAFLD may result in hepatocellular carcinoma. An estimated 30% of adults nationwide have NAFLD (American Liver Foundation 2012). In addition, the extent of damage caused by the additional consumption of alcohol or acetaminophen (Tylenol) is unknown. This study evaluated the accuracy of a novel animal model which simulates a patient with fatty liver being exposed to alcohol and acetaminophen. The model was evaluated by using the biomarkers AST, and ALT. Planimetry techniques and Oil Red O staining were also used to evaluate the effectiveness of the model. There was significant increase in liver mass, percent lipid content, cystic index and oil red O assay for the alcohol model. The acetaminophen model was inconclusive and needs further experimentation before a definite conclusion can be made. The alcohol model can potentially be used by researchers to discover disease mechanisms or test new treatments.

*Ibrahim Khan, Alinur Rahim*

**The Design of a Low Voltage, Nitinol Based Biomimicry Device**

Nitinol is a shape-memory alloy discovered by NASA researchers in the 1960’s. Since then, few practical applications have been designed using Nitinol’s physical characteristics. This alloy, composed of nearly equal proportions of Nickel and Titanium, can be programmed to warp to a certain shape under intense heat by repeated cycles of heating and cooling. The Nitinol was coiled around an aluminum rod and held over a flame until the wire glowed orange. This process was repeated until the wire became sufficiently malleable. Four 15 cm long wires were held together with alligator clip wires to create a loop after having been programmed to a 2D-coil like shape. The other end of two of these wires was connected to the terminals of a DC Voltage source for a brief two seconds to short the wires, thereby heating them up considerably and inducing the wires to change shape. The number of wires in the loop and the voltage was varied to observe qualitative changes in this phenomena. It was found that as the number of 15cm wires in the loop increased, the optimal range of voltage required to induce a change of shape nearly instantaneously and without damaging the wires increased non-linearly. These results convey several implications of the feasibility of Nitinol as a biomimicry device. As a biomimicry device such as an artificial muscle would require a more complex design and thus, a much higher required voltage, the material may be at this time unsafe to use.

*Andrew Kim*

**Bacterial Cellulose Membrane for the use of Air Filtration Masks**

 Air pollution is the general pathway of particulates, biological or non-biological, into the Earth’s atmosphere. These particulates, particularly those 2.5µm in diameter or less (PM 2.5) pose serious threats to respiratory health, causing chronic problems such as bronchitis, lung cancer, and asthma. As a result, it is important to protect against these threats. Simple cotton or paper masks are used in many Asian countries as protection against the pollution, but are ineffective against small particulates. I created bacterial cellulose nanofiber-based membranes for filtering out PM 2.5. The bacterial cellulose nanofibers were crosslinked with glutaraldehyde to reorient the fibers and maintain a porous structure within the membrane for air filtration. The crosslinked bacterial cellulose membranes had pore sizes from 0.2µm to 1.0µm, indicating that this membrane filters particulates that are greater than 1µm in diameter. One of the current membranes used today to filter out PM 2.5, which uses closely knit fibers to filter air, has fibers that are separated by more than 2µm. The bacterial cellulose, made from a polysaccharide, has potential to have surface modifications to improve the membrane and is also relatively inexpensive. This, coupled with the greatly reduced pore size has the ability to improve upon current mask designs and protect respiratory health.

*Gloria Kim*

**Synthesis and Characterization of Tetragonal as a Prospective Thermoeletric Material**

The purpose of this study is to refine a method to synthesize zinc tin antimonide in single crystal form, determine its crystal structure, and investigate the influence of crystalline anisotropy on the Seebeck coefficient S =, where is a potential difference produced by the application of a temperature gradient . S is one of several critical characteristics that together determine how well a material will convert waste heat into useable energy. Antimony-based crystal networks have shown potential as thermoelectric materials, therefore the thermoelectric properties of were investigated. A low-temperature flux method was refined to produce large single crystals of tetragonal structure, and clean, smooth surfaces. Crystals of were precipitated from tin flux. X-ray diffraction measurements of the single crystals were performed and analyzed. Comparative analysis of the powder x-ray diffraction data with published structures suggests the crystals synthesized were of the reported tetragonal morphology. Seebeck coefficient were measured along the a-axis and c-axis to test for possible anisotropy. S was found to be 3.2 and 43.2 mV/K along the a-axis and c-axis respectively at temperature T ≈ 300 K. Results have conclusively shown a surprisingly large anisotropy in S, suggesting that further investigation into the thermoelectric properties of ZnSnSb2 single crystals could prove fruitful energy generation applications.

*Angela Kubik – See Colleen Flynn*

*Briana Kubik – See Colleen Flynn*

*Scott Massa*

**The Importance of Endocytosis to Neuregulin1 Back Signaling:**

**Implications in Neuropsychiatric and Neurodegenerative Disorders**

There is currently no cure for neurological disorders such as schizophrenia and Alzheimer’s disease. These disorders have been linked to impairments in critical cellular pathways including Neuregulin1 (Nrg1) back signaling, which regulates neuronal gene expression. This pathway may provide a new avenue for treating neurological disorders. The details of Nrg1 back signaling mechanisms are not understood, and it has been unclear whether endocytosis is required for effective Nrg1 back signaling. This study tested whether endocytosis is necessary for Nrg1 intracellular domain (ICD) translocation in ErbB4-mediated, depolarization-mediated, and basal level Nrg1 back signaling. ImageJ was used to quantify nuclear translocation of ICD based on confocal microscopy images after immunostaining and to quantify ICD production levels based on infrared images after protein immunoblotting. Endocytosis inhibition led to a statistically significant decrease in nuclear ICD levels in ErbB4-mediated Nrg1 back signaling samples (P = 0.01) while ICD production levels were consistent among all samples. In this study, it was demonstrated that deficits in ErbB4 endocytosis result in impaired ErbB4-mediated Nrg1 back signaling and may therefore be associated with the onset of neurological disorders. Deficient ErbB4 endocytosis is a cellular malfunction to be targeted for potential treatments or cures for schizophrenia and Alzheimer’s disease.

*Ryan McCaffrey*

**Creation of a Drug Delivery Mechanism for Dexamethasone Differentiation of**

**Dental Pulp Stem Cells**

As the life expectancy of humans continues to rise, age dependent ailments, such as osteoporosis and osteoarthritis, are becoming of greater medical concern. This study aimed to address an aspect of this problem by designing and testing a biomaterial scaffold that releases dexamethasone, an osteogenic inducing drug, to stem cells sitting on its surface to produce osteoblasts used for bone regeneration. Polyurethane and poly-L-D-lactic acid (PLDLA) scaffolds were synthesized and incorporated with Pluronic® F-127 (PF127) and gelatin hydrogels to create a drug delivering mechanism. Hydrogels were loaded with dexamethasone and tested for dexamethasone release rates with UV visible spectrophotometry and scaffolds were tested for hydrogel absorptivity rates by measuring change of mass. Dental pulp stem cells were plated onto the combined scaffold and hydrogel mechanism and observed under confocal microscopy to determine cell compatibility with the mechanism. Results indicated that the drug release rate of the hydrogels can be controlled for dexamethasone, and that hydrogels can be successfully integrated into biomaterial scaffolds to synthesize the drug releasing mechanism. However, rapid dissolution of the hydrogel in cell media suggests that a cross-linker is necessary for stronger attachment of the hydrogel to the scaffold to improve cell compatibility. The creation of a drug delivery mechanism that hosts and differentiates stem cells would lead to improved methods of bone regeneration by eliminating the necessity to differentiate stem cells prior to plating them on the scaffold.

*Marin Nagelberg – See Jianna Cressy*

*Andrea O’Brisky*

**Understanding Resonance Effects Involved in**

**Creating Single Bubble Sonoluminescence**

Single bubble sonoluminescence occurs when high frequency sound energy emitted from sound transducers focuses in on a bubble submerged in degasified liquid. The concentrated energy within the microscopic sized volume results in periodic oscillations. An eventual collapse occurs, known as acoustic cavitation, during which the bubble reaches temperatures estimated higher than the sun. Within this experiment, electrical and mechanical resonances of a sonoluminescence system were studied in order to increase the voltage running through the system and intensify sound vibrations without the use of an audio amplifier. An atypical flask, spherical with a flat bottom, was used to determine the effect that the geometry of the container used has on the process. Results indicate that when electrical resonance corresponds with an acoustic mode, voltage in the system greatly increases. A strong enough acoustic field was presented during experimentation that bubbles became attracted to pressure antinodes within the liquid along the edge of the flask. However, this field did not occur at the breathing mode, but at the mode correlating with the inductor used to determine electrical resonance. This caused the irregular placed trappings along the edge of the flask in comparison to the breathing mode’s antinode placement at the flask’s center. In order for the breathing mode’s acoustic field to be utilized, the inductance of the system needs to be fined tuned in order to match the electrical resonance frequency of the circuit to the mechanical frequency belonging to the flask. It was additionally determined that flask shape greatly alters the number of modes and the number of irregular mode characteristics present within an acoustic resonance system. These results could be further applied to other circuit systems and the use of acoustic cavitation within the medical field.

*Matthew O’Connell*

**Analysis of El Niño-Southern Oscillation Phenomena’s Effect on the**

**Gross Domestic Product of Western Pacific Nations**

El Niño Southern Oscillation (ENSO) is a climatological phenomenon of the tropical Pacific Ocean which has a direct influence on the climate of western Pacific nations. I evaluated the meteorological effects of ENSO on the economies of Indonesia and the Philippines. This study attempted to verify a commonly accepted hypothesis to prove that decreased precipitation in the western Tropical Pacific region during El Niño events causes decreases in agricultural production in the region resulting in a negative effect on a nation’s Gross Domestic Product (GDP). Furthermore, during La Niña events, when precipitation increases, an increase in the nation’s agricultural GDP and overall GDP is expected. Annual GDP data were obtained from the World Bank and the Bank of Indonesia for 1960-2012. Sea surface temperatures (SST) data, in the Niño 3.4 region, were obtained from the National Climate Data Center of the National Oceanic and Atmospheric Administration (NOAA). Data of the agricultural and total GDP of Indonesia and the Philippines had inconclusive correlations with ENSO signal data. By examining data between smaller time segments of the overall 1960-2012 timeframe, more conclusive results could not be discerned. Indonesia’s quarterly non-oil GDP for 2000-2009 was independently correlated with ENSO providing better insight on the variables’ relationship during discrete ENSO phenomena. The results provided strong correlation coefficients of 0.831 and 0.624 in support of the antithesis (the belief that ENSO held no influence on the GDP of western Pacific nations) as well as -0.421 in support of the hypothesis (that ENSO was influential in a Western pacific nation’s GDP). An economic anomaly known as the East Asian Financial Crisis may have been the cause of the some unexpected correlations but overall, the results demonstrated very weak correlations between studied variables. This study therefore refutes the common hypothesis that these two variables are directly related and calls for new research into the field.

*Jin Ho Park*

**Studying the Assembly of the Short Fimbriae of *Porphyromonas gingivalis* in *Escherichia coli***

This work aims to characterize key components of the fimbrial assembly pathways of the periodontal pathogen, *Porphyromonas  gingivalis*. *Porphyromonas gingivalis* is a diderm-LPS, or gram negative bacteria, responsible for the initiation and the progression of periodontitis. Periodontitis is a complex and chronic inflammatory disease degrading the tooth-supporting tissues which leads to deterioration of the alveolar bone, and eventually, tooth loss. *P. gingivalis* is also an obligate anaerobe, meaning it cannot survive in the normal atmospheric concentration of oxygen, so it requires special handling in the laboratory. We have chosen to study recombinant *P. gingivalis* fimbrial gene clusters in the facultative aerobe, *Escherichia coli*,for ease of handling. We hypothesized that cloning the Mfa1 gene cluster from *P. gingivalis* into an *E.coli* expression vector would enable us to study the assembly of *P. gingivalis* fimbriae in *E. coli* cells.  To test this hypothesis, we cloned either the entire Mfa1 gene cluster or the *Mfa1* fimbrial subunit gene alone into *E. coli* expression vectors, and then detected Mfa1 protein in *E. coli* cells via Western blotting and immunofluorescent labeling and microscopy. First, the gene clusters encoding FimA and Mfa1 were amplified using PCR and custom primers. The products were then digested with two restriction enzymes and ligated into the pTRYC (*E. coli,* cloning vector) vector. The genes encoding for the major structural proteins, *mfa1* and *fimA* were also cloned into pTRYC. Plasmids with *mfa1* and the Mfa1 gene cluster were tested for expression of the *mfa1* protein by using the secondary (indirect) immunofluorescent staining assay. Using this protein detection method, the presence of Mfa1protein in both *Mfa1* and Mfa cluster in *E. coli* was confirmed. Data from the immunoblot suggest that there is more Mfa1produced on the cell surface of the plasmid with the entire cluster compared just *Mfa1.* Also in the western blot, high molecular bands found in the Mfa1 cluster and the absence of them in *Mfa1*, may suggest the assembly of fimbriae. *E. coli* strain carrying the entire cluster has more Mfa1expressed on the immunoblot, possibly due to *Mfa1* being unstable when expressed without the accessory proteins downstream. Some future studies will include detecting assembled fimbriae with super resolution confocal microscope, by using immunofluorescence protocol developed here, as well as by electron microscopy. Also, the assembly of fimbriae in cells expressing *Mfa* gene clusters missing either the major subunit protein, some accessory proteins, or a mix will be studied, and thus possibly characterizing the protein components to a novel outer membrane protein secretion system in *Porphyromonas gingivalis.*

*Alinur Rahim – See Ibrahim Khan*

*Laxshika Raveendran*

**An Examination of Regional Differences of Colorectal Cancer Screening and Mortality**

**in the United States**

In the United States, colorectal cancer (CRC) mortality rates have declined rapidly in the past decade. However, the rate of mortality decline is not uniform among the 50 states. The aim of this investigation was to examine county-specific CRC mortality rates and screening rates to assess regional differences in CRC trends in the U.S. from 2002 and 2010. CRC death rates were obtained from the Surveillance, Epidemiology, and End Results (SEER) database and CRC screening rates were obtained from The Behavioral Risk Factor Surveillance System (BRFSS). SAS-callable SUDAAN release 11.0.1 was used to generate weighted prevalence estimates for screening. SEER\* stat software V8.1.5 was used to generate the mortality rates. Results reveal a moderate negative correlation between CRC screening and mortality. From the 106 counties analyzed, the percent changes (PC) in screening and mortality revealed that the South had the highest proportion of counties with the smallest PC in screening and mortality. The Northeast had the highest proportion of counties with the highest PC in screening and mortality. Thus, insufficient access to and/or a lack of regulations for CRC screening and inadequate screening cost coverage among various regions of the country may have contributed to the imbalance in declining CRC mortality rates.

*Eric Rizzo, John Voiklis*

**Swim Performance and Stress in Radio-Tagged Brook Trout**

The purpose of this study was to determine if the surgical implantation of RFID transmitters (radio-tags) has any effect on the swimming performance and stress levels of Brook Trout (Salvelinus fontinalis). Fifteen Brook Trout were split into three groups of five. One group acted as the control and did not undergo surgery, another group, called the “sham” group, underwent a fake surgery in which radio-tags were not implanted, and the final group underwent surgery and radio-tag implantation. Each trout had its swimming performance tested one day, one week, and three weeks post-surgery. These tests were staggered to allow time for the incision wounds of each fish to heal. The tests were conducted in a LoligoSystems swim tank that allowed the alteration of the flow speed of the water. The fish were acclimated to the tank by swimming at a speed of 10 cm/s (approximately 1 Body Length/second) for 45 minutes. The flow speed was increased by 10 cm/s in 10 minute intervals until the fish became exhausted and lied against the grate in the back of the tank for at least 10 seconds. One day after the one week and three weeks post-surgery swim performance tests, approximately 150-400µl of blood was extracted from each fish. The tests on this blood included measuring red blood cell (RBC) counts, hematocrit, hemoglobin concentration, and cortisol levels. Cortisol is a glucocorticoid that is produced by the fish when they are stressed. Thus, elevated levels of cortisol indicated the stress levels of the fish after the swim performance tests. One week post-surgery each of the fish had similar critical swimming speeds until they reached exhaustion, however three weeks post-surgery the control had the highest, followed by the sham group and finally the tagged group. The results from the blood tests showed similar results from each of the three groups of trout. Their RBC counts, hematocrit and hemoglobin levels decreased from the one week post-surgery test to the three week post-surgery test. The cortisol levels varied greatly for each fish, but after three weeks the control group had the highest cortisol levels, followed by the sham group, and finally the tagged group.

*Nakul Thampy*

**Developing Drugs Against a Master Regulator of Cancer Cell Behavior: Targeting NF-kB**

Nuclear factor-κB (NF-κB) represents a group of transcription factors (p50, p52, c-Rel, RelA/p65 and RelB) which belong to the Rel family of proteins. These proteins form homo- and heterodimers important in innumerable cellular processes affecting most major growth and survival pathways. To date, at least 400 discrete genes have been shown to be regulated by NF-kB family members, including genes involved in cell cycle control, apoptosis, immune and inflammatory responses, secondary lymphoid organ development and osteoclastogenesis. All NF-kB subunits share an approximately 300 residue long homologous domain near their N termini called the Rel homology domain, which is responsible for mediating the transcription factors binding to DNA, its dimerization with other subunits binding, its interaction with IkB, and in facilitating nuclear localization. Activation of NF-κB target genes can be achieved via two pathways, the canonical and alternative. Within the canonical pathway, NF-κB transcription factors are sequestered in their bound and inactive state by the IκB family of inhibitory proteins (IκBα, IκBβ, IκBε, p105/γ and p100/δ). Upon activation of cell surface molecules through various interactions,including but not limited to CD40-ligand, tumor necrosis factor (TNF), and numerous cytokines, IκB kinase (IKK) phosphorylates IκB rendering it a substrate for the ubiquitin ligases, and eventual proteasome mediated degradation. Degradation of the bound IκB allows for nuclear translocation of the NF-κB complex, where it then transactivates its target genes. In the alternative pathway, IKK directly phosphorylates p100 which in turn induces the cytoplasmic processing of p100 to p52, a smaller protein which translocates to the nucleus where it activates its repertoire of target genes. Overexpression of NF-κB has been observed in many malignancies, ranging from breast and ovarian cancer to a host of hematological malignancies. Because of its pivotal role in oncogenesis, NF-κB represents a focal point for an intense compound screening which would target and down-regulate it. Previous work by us and our collaborators reported the discovery of a unique class of benzensulfonamides capable of NF-κB down-regulation in two different and independent screening assays. These assays identified a scaffold core and its derivatives (more than 300 were synthesized) as potent in IκBα stabilization and RelA/p65 translocation inhibition. We have established that select analogs of these compounds induce growth inhibition and apoptosis in diffuse large B-cell lymphoma (DLBCL) models, and that the effect seen is attributable to effects on NF-kB localization within the cell. Western blotting performed in a panel of activated B-cell like (ABC) and germinal center B-cell like (GCB) DLBCL lines treated with these analogs revealed marked reduction of NF-κB subunits in both the canonical (p105/p50) and alternative NF-κB (p100/p52) pathways. Immunofluorescence microscopy showed rapid (within 3 hours following incubation with the compounds) sequestration of the p105/p50 subunit to the cytoplasm in ABC DLBCL lines with constitutive NF-κB activation. These images demonstrated near complete inhibition of NF-kB nuclear translocation. In addition, an in vivo toxicology experiment demonstrated safety of these compounds at doses at high as 10 mg/kg. These data suggest that these analogs appear to exhibit relatively selective effects on NF-kB, which is associated with marked cytotoxicity in in vitro models of DLBCL, while appearing safe in animal toxicology experiments.

*Thomas Vetere*

**The Analysis of OCD Perceptions and the Stigma That Surrounds Mental Illness**

The purpose of this investigation is to study and raise awareness for the stigma and misconceptions of mental illness with a focus on Obsessive Compulsive Disorder (OCD). The motivation for this study came from the researcher’s observed, personal experience connected to the stigma and hardships that others can impose on sufferers. According to the National Institute of Mental Health, many of the mentally ill have felt the discrimination and stigma associated with their disease. Studies have examined the response that people have towards those with mental illness; however, there are few studies that look directly at Obsessive Compulsive Disorder (OCD). OCD is a mental illness in which the sufferer experiences intrusive thoughts that cause severe anxiety or apprehension. To reduce this anxiety, the sufferer engages in compulsions (activities to reduce anxiety). The compulsions can be, but are not limited to, checking, hoarding, or excessive questioning. To carry out this study, a confidential survey (Otto Wahl et al., 2010) was utilized along with additional questions created by the researcher to specifically address attitudes towards OCD. The confidential survey was administered to both adolescents and adults to assess their attitudes towards mental illness and to gauge their knowledge about OCD. The results show that both genders stigmatize the mentally ill to the same extent. In addition, the age groups (adolescents vs adults) stigmatized the mentally ill to the same extent. Finally, the study found that people are rather accepting of mental illness, with many participants scoring on the lower (less stigma) side of the Likert scale.

*John Voiklis – See Eric Rizzo*

##### *Chantel Yang*

**Icephobic Properties of Nanostructured Surfaces Defined by Self-assembling Block Copolymers**

Ice accumulation on aircraft and other equipment pose a great threat to the functionality of machinery and safety of human lives. Icephobicity is an emerging topic of interest that is concerned with the development of ice-repellent surfaces. Current methods to prevent ice accretion include chemical sprays on surfaces, which are costly and resource heavy, since they require periodic application, and potentially environmentally unsafe. The purpose of this investigation was to assess the icephobicity of two nanotextured, superhydrophobic surfaces (feature size ~50 nm) produced with block co-polymer self-assembly consisting of cones and pillars, by comparing them to an untextured hydrophobic and a commercial superhydrophobic surface (feature size ~200 nm). Icephobicity was quantified in four tests: contact angle hysteresis, freezing time, frost adhesion of static droplets, and repulsion of impacting supercooled water droplets. Results suggest that the nanotextured, superhydrophobic surfaces have a superior freezing delay times, reduced work adhesion to remove ice, and repel impinged supercooled water droplets. The novel surfaces, which are easily fabricated by self-assembly, may provide greater icephobicity over conventional textures. Further experimentation with nanotextured surfaces may lead to the development of surfaces with greater icephobic properties

**Underclassmen**

*Zack Abrams, Nicole LaReddola*

**A Study of the Genetic Diversity of Honeybees *(Apis mellifera)* on Long Island, New York**

The purpose of this study is to determine how much biodiversity exists among bee populations on Long Island. Bees are among the most important insects in the world, due to their globally-significant role in pollination. *Apis mellifera*, or Western Honey bees, are found all over Long Island as well as the surrounding area. However, their populations have been declining due to climate change and other factors. Bees were collected from across the region from local beekeepers. DNA was extracted using a Qigankit. The mitochondrial DNA gene is preserved within animal species, and was amplified using PCR. After verifying the PCR product through gel electrophoresis, samples were sent to GeneWiz for sequencing. The sequenced data was then organized into phylogenetic trees through DNA subway. Using this data, we will determine the relative level of bee biodiversity found on Long Island. This data is important because it will contribute to worldwide databases that keep track of the number of species and population of various animals and their diversity. This project allows the knowledge of Long Island’s bees to be accessible to everyone.

*Jungsoo Ahn, Kristin Orrach, Sydney Sirota*

**The Prevalence of Wolbachia on Long Island in Honey Bees (*Apis mellifera*)**

The purpose of this investigation was to determine the infection rate of Wolbachia (*Wolbachia pipentis*), in Honey Bees (*Apis mellifera)* found on Long Island, New York. Wolbachia is a bacterium that lives in insects, and can get passed on from one generation to the next. Wolbachia is found to only infect insects, such as fruit flies, mosquitoes, and honey bees. Wolbachia affects larval development, and can cause feminization of males, parthenogenesis, cytoplasmic incompatibility, or sterility which can result in a decline in the population. This study is important because recent challenges to honey bee health, including dramatic colony losses attributable to Colony Collapse Disorder (CCD), a phenomenon where all male workers suddenly disappear, allowing for the introduction of pests and pathogens into managed colonies. This has been devastating have devastated honey bee stocks worldwide. We utilized PCR (polymerase chain reaction) and gel electrophoresis to isolate the 16 ribosomal DNA gene, specific to Wolbachia, to determine if Wolbachia was present. Out of the collected samples, 2% of the bees were infected with Wolbachia, which is lower than our expected results. The positive sample was sent to be sequenced in order to determine the genetic variation based on a barcoding database. Further investigations could see if there is a link between colony health, and presence of *Wolbachia*.

*Abinaya Anand, Melike Akoglu, Daniel Cho, Anoop Singh*

**OfficeTop**

Our motive for engineering OfficeTop, a device used to increase the independence of people with disabilities in their workplace, was to meet the needs of Mr. Glenn Campbell, an attorney with Quadriplegia. He was physically dependent on his nurses to move the paraphernalia on his desk. Our goal was to engineer a device that would not only allow Mr. Campbell to control his desk in accordance to his commands, but also be aesthetically pleasing. OfficeTop is composed of three stands, one to hold a computer, another to hold a phone, and one to hold a tablet, book, or paper. The three stands are placed on two pieces of Plexiglass each of which is placed on two metal drawer glides, used to move the slides back and forth. Two motors were activated to move the slides when a command is given through an Arduino, which is activated and manipulated through Mr. Campbell’s voice commands. Ultimately, OfficeTop will increase the independence and flexibility of Mr. Campbell’s work environment, satisfying our original goal of engineering an automated tabletop to help a person with a disability.

*Melike Akoglu – See Abinaya Anand*

*Gianna Anderson and Mikayla Kelly*

**The Effect of Artificial Sweeteners on Fruit Fly Behavior**

Humans have turned to the use of artificial sweeteners in hopes of limiting the use of regular sugars. As a result, humans have began uses high amounts of artificial sugars. Previous studies have shown that artificial sweeteners have adverse effects on the human’s cardiovascular system. The purpose of this experiment was to determine if the effect of artificial sweeteners on fruit flies by observing their behavior after consumption. First fruit flies were separated by gender. Next we performed two different tests, the upward light movement and the light maze test next, on the fruit flies before and after consumption of artificial sweeteners. Thus far the data shows both the males and females have similar reaction times, so it is believed gender does not influence the results. By understanding the effects of artificial sweeteners on certain organisms, we may be able to determine how its consumption impacts humans.

*Aaron Angeles, Joseph Christian, Elias Gonzalez*

**Hermit Crab Shell Preference Behavior**

The purpose of the experiment is to study shell preference behavior of hermit crabs, *Pagurus longicarpus*. Hermit crabs are crustaceans that carry around shells that serve as protection as well as concealing their abdomen. Hermit crab come in various sizes and shapes, ranging from a few millimeters in length tothe size of a coconut. Hermit crabs generally live up to twelve years old, but some have been known to live up to 70 years. Like most shell-dwelling crabs, hermit crabs tend to change their shell from time to time. Sometimes, movement depends on the outgrowth of the shells or preference for a cleaner shell. In this experiment, a 180 grid box was used to map the movement of the crabs and track tendencies. The sides were covered with black construction paper. The habitat contained four choices of shells for the crabs to choose from. The shells were arranged independently based on size and color. The hermit crabs movements were mapped and recorded, along with shell preference. Thus far, the results show that the crabs prefered the corners or the edge of the tank.Only some would change shells. We noticed that the crabs were very mobile, and moved to all parts of the tank. As a group we were unsuccessful and didn’t collect much data from the trials that we conducted. We decided that we would incorporate null and alternative hypotheses for our experiment. The null hypothesis stated that it was not dependent on the shell switching. The alternative hypothesis stated that it was dependent on the shell switching. To decide which hypothesis we would accept, we conducted a chi test. The final value for both sets of data was .145 which is higher than .05. This means that the null hypothesis is relevant to our experiment. The significance of the project is to further our knowledge in understanding hermit crab shell preference behavior.

*Brandon Axelrod, Joshua Hardoon, Raymond Janis*

**Identifying the Source of Contaminants in a Major Tributary to the Nissequogue River**

**Using Geographical Information Systems.**

The Nissequogue River, which is located in Smithtown, NY, has several tributaries, one of them being Miller’s Pond. Miller’s Pond is a large, polluted pond, which discharges into the Nissequogue and its other tributaries. The Town of Smithtown is aware of deteriorating septic systems in the area and is concerned that these leaking systems are affecting the groundwater/surface water quality. Using Geographical Information Systems (GIS), the area will be mapped and the homeowner’s septic systems that are potential threats will be pinpointed. We used shapefiles and building permits distributed by the Town of Smithtown to construct the map. From analyzing water qualities that correlate to the residential zones adjacent to the pond, it is evident the pond is polluted by testing for Nitrate, Nitrite, and E-Coli. Using GIS geoprocessing tools and vector data, we digitized a particular area around Miller’s Pond that is believed to be affected by the leaking septic tanks. From compiled vector layers and test results, were able to make predictions on where the aging septic takes lie by matching the results to town records and building permits. With the water samples collected, we will have the ability to determine the regions of property that are polluting the pond. The results will be highly valuable to the town planning department, who will use the results to determine where to construct sewage treatment plants in the future. The sewage treatment plants will replace aging septic systems with systematic wastewater management monitored by the town.

*Veronica Borracci, Julia Cicalo, Gabriella Longo*

**Dissolution Rates of Vitamins in Gastric Juice to Determine Which Type is Best For Bariatric Surgery Patients**

  The purpose of this investigation is to determine which type of vitamin has the fastest breakdown time after being introduced into artificial gastric juice. Determining the fastest breakdown rates of vitamins can be useful to patients who have underwent bariatric surgery. These patients who have had this surgery are in need of a fast dissolving vitamin because the surgery constricted the size of their stomach, therefore sometimes resulting in malnutrition, not absorbing enough of the vitamin for proper nutrition. We hypothesized that breakdown rates of vitamins will vary according to the type and manufacturer. To carry out this study, Centrum chewable multi vitamins and Children’s Gummy Multivitamin Dietary Supplements were dissolved in artificial gastric juice for one hour at 37°C and stirred at 260 rpm. One mL of artificial gastric juice with the dissolved vitamin was filtered through a .45 micrometer filter paper into a cuvette and tested at various wavelengths for absorption levels between 250 nm and 280 nm. This was done to determine the baseline maximum absorption for the study. For the experiment, samples were recorded every 10 minutes for 1 hour to determine absorption levels to indirectly measure dissolution rates of the vitamins in the artificial stomach environment.

*Allyson Britt, Sara Kurten, Caitlin Passaro*

**The Olfactory Sense Perceptions of Fruit Flies *(Drosophila melanogaster)* with**

**Parkinson’s Disease in an Odor Chamber**

Due to improved diagnostic tools, Parkinson's disease has been diagnosed in people than ever before. This disease has also been found to be accompanied or indicated by chemosensory problems, such as smell disorders. The purpose of this experiment was to test the olfactory sense perception of male and female fruit flies that carry the Parkinson’s disease gene analog. We hypothesized that if fruit flies that have the analogous of Parkinson’s disease then the odor receptors will be weaker and less sensitive as opposed to the normal olfactory of *Drosophila melanogaster*. To carry out the experiment, we obtained Parkinson’s disease analogue wild type Parkin and Pink fruit flies and mild type Canton fruit flies for our control. Behavior and activity related to different odors were determined by placing fruit flies into a choice odor chamber and exposed to different scents (repellent and attractive scents of lavender oil and apple-cider vinegar, respectively). The experiment was set up so that the strength of olfactory senses in the mutated *Drosophila melanogaster* was able to be compared to the olfactory senses in the normal *Drosophila melanogaster.* Results show that the odor that the flies are attracted to is dependent on whether or not the flies are normal or mutant, a positive chemotaxic response, for every trial except nothing verse water and oil verse nothing. Results also show that the odor that the male flies are attracted to (when between vinegar and oil) is dependent on whether or not the flies are normal or mutant.

*Nicholas Bunnell, Kyle Dituro*

**An Investigation of the Gas Production of Fracking in Pennsylvania**

The purpose of this investigation was to find the largest producer of fracking shale gas and oil in the state of Pennsylvania. With energy consumption on the rise due to an increasing world population and massive urbanization, the demand for more oil will also increase. As oil sources will eventually be depleted, new sources of energy production will be needed. Renewable energies such as solar, wind, and nuclear energies are currently being developed to provide plentiful, clean energy for the world’s growing population, however, they are currently expensive and inefficient. Hydraulic fracturing is a new process which harvests natural gas stored in underground shale. Since it is currently cheaper than renewable energies, fracking (as it is commonly called) holds more near-future promise for meeting our future energy needs. We gathered data from Pennsylvania, a state which requires by law that all fracking well data be displayed to the public. Then, we then took the amount of oil and gas that was released from each well and divided the amount of oil and gas produced by the amount of days they were produced. This created a rate at which the company produced a certain amount of gas in a period of a single day over the course of two years, 2013 to 2014, which were then compared to each other to determine who determines the most amount of energy over a constant period of time.

*Rahul Chakravorty, Aryana Javaheri*

**Möbius Bridges**

Currently, man-made structures are susceptible to hurricanes, earthquakes, tornados and other natural elements that produce various forces that can weaken and possibly cause structural failure. These natural phenomena can cause forces such as compression, tension, torsion and shear. Although the effect of these forces can be reduced by using more advanced materials such as carbon based composites, the methods used to produce said materials are costly and/or volatile. Because of this and the optimization of standard bridge designs, most new advancements in this field have been on the production quality of steel, which has only been able to result in minute differences in bridge strength. Instead of aiming to use new materials to combat these issues, we can manipulate the designs of these structures. For hundreds of years, most bridges and buildings have been built with a standard design in mind because they have been relatively effective. However, these designs are not the most optimal and can be improved on because they have a moderate susceptibility to natural destruction. The purpose of this study was to observe the possible advantages to building with Möbius strips. Not only could the Möbius structures possibly provide more resilience and durability against natural phenomena, it can do so while using less material as a result of its “never-ending” shape. Because it is one cohesive unit, it also requires fewer joints and bolts for support compared to more conventional structures. Our results indicated that Möbius bridges can be more resilient than the standard bridge, meaning that they can withstand more forces over time and are less susceptible to failure

*Xiaoxuan (Emily) Chen*

**The Effect of Southeast Asian Herb Derived Compounds on Prostate Cancer Cell Lines**

The purpose of this study was to determine the effect of five herb-derived extracts on prostate cancer cell lines*.* After skin cancer, prostate cancer is the most common cancer for men in America, affecting 1 in 7 men in their lifetime. Thus, it is imperative to find targeted treatments of prostate cancer without harming healthy cells in the human body. Extracts from different Southeast Asian plants, Y-15, Y-16, Y-17, Y-18, and DMDD, were chosen for this experiment due to their documented success in alleviating other diseases such as breast cancer. These extracts, especially Y-16, showed significant activity in inhibiting the proliferation of 3 human prostate cancer cell lines, PC-3, LNCaP, and DU145 in comparison with controls of two normal human cell lines, WPMY-1 and RWPE-1. Cell viability assay using AlamarBlue staining revealed a reduction in the viable cell number of the three cancer cell lines treated with various concentrations (0.01 uM, 0.1 uM, 1 uM, 10 uM, 25 uM, 100 uM) of each compound. Flow cytometry assay showed that these compounds altered the cell cycles of cancer cells by arresting them in G1 phase. Furthermore, western blots of cell cycle regulator expression showed the down regulation of Cyclin D1 and CDK2, important proteins that help cells progress into the S phase. P27 and p21, cell cycle inhibitors, increased in expression, as well as AMPK which is activated during an energy crisis when ATP levels are low. These results indicate that these extracts, Y-15, Y-16, Y-17, Y-18, and DMDD, have potential to be used in cancer chemotherapy.

*Daniel Cho – See Abinaya Anand*

*Daniel Somang Choi, Daniel Woojin Jung, Ryan Hoeun Lee*

**A Meta-Analysis of Detecting Mislabeling and Fraudulence in Seafood Products using DNA Barcoding**

DNA barcoding is a method of taxonomy used to identify specific species using organic material. DNA is extracted from the organic tissue, and then the barcode region is isolated, amplified, and sequenced. The sequence is then analyzed, whether the purpose is to ensure authenticity, or to compare species. DNA barcoding is different from other methods of taxonomy because it allows identification of DNA using a pre-existing database rather than comparing organisms to members of its own species, which is important to consumers because it has been used to identify fraud and mislabelling in organic products increasing both overall consumer health and knowledge. The purpose of this study was to conduct a meta-analysis of DNA Barcoding of seafood in order to detect fraudulence. In this study, we investigated and analyzed 15 studies of misrepresentation of seafood and fish products sold in markets. These studies include articles from scientists that are experts in DNA taxonomy that delivers anti-counterfeit solutions and brand authentication. These scientists used DNA barcoding and databases to test the authenticity of several seafoods. A meta-analysis allows the results to be generalized into a larger scale rather than just a certain case, and inconsistency can be measured. The collection and analysis of several works of other scientists helped us to hypothesize that many products sold in markets were indeed sold under fraudulent means, and that the product sold was not the product that was advertised. After thorough analysis, we were able to compact the data into a form that was easily understandable. Upon investigation, all studies showed both restaurants and retail markets had some magnitude of mislabeling in species, some ranging up to 77% mislabeled species.

*Joseph Christian – See Aaron Angeles*

*Julia Cicalo – See Veronica Borracci*

*Gabrielle Cooper, Jordan Cooper*

**The Effects of Caffeine, Nicotine and Alcohol on Olfactory Memory in *Periplaneta americana***

The American Cockroach (*Periplaneta americana)* is one of the world's most common species of cockroach, and in the scientific community it is known for its olfactory memory capabilities. Olfactory memory is the recollection of odors. American cockroaches possess the ability to learn associations with different odors, with olfactory conditioning from single conditioning sessions remaining for up to a week, becoming more long-lived after three sessions. These roaches thus have an excellent olfactory learning capability characterized by rapid acquisition and long retention. Cockroaches are also capable of olfaction sense learning in varying contexts, such as a light and dark. The purpose of this study was to determine how olfactory learning and memory in *Periplaneta americana*  are affected by consumption of common chemical substances such as alcohol, nicotine and caffeine. This was done by first mixing vanilla extract with the cockroach food and water supply, creating the association. The roaches in each test group received water mixed with vanilla and 2 mL of nicotine, caffeine, or alcohol, with the control group having an extra 2 mL of water. After learning the association between vanilla odor and food, test roaches then underwent a timed test of this knowledge, where they must locate the source of the odor, and with it sucrose. By exposing them to the test substance and having them repeat the same timed test as control roaches, we observed how the consumed substance affected their olfactory association and learned conditioning. We have hypothesized that caffeine will enhance olfactory memory capabilities due to results in rats that showed a correlation between caffeine consumption and increased olfactory discrimination, and that nicotine and alcohol will cause deficits in olfactory memory. We can conclude that our hypothesis is was correct, as a Single-Factor ANOVA test showed a significant difference between each data set, with T-Tests further showing significant differences between caffeine and control, as well as between nicotine and alcohol.

*Jordan Cooper – See Gabrielle Cooper*

*Monica Cramer*

**The Effect Increased Levels of Estrogen have on the Mating Behavior of *Drosophila melanogaster***

As women go through menopause, their levels of sex hormones, such as estrogen decrease, making them infertile, and changing their behavior, especially their mating behavior (Bateman, 1972). Flies are model subjects to conduct research on because they share 60% of their genes with humans. Also, fruit flies have a very short time frame between the times when they first emerge as adult flies, to their first mating encounter, so it would be possible to observe their first mating encounter (Christenson,1960). The purpose of this experiment was to find if and how altering estrogen level exposure in fruit flies, effects their sexual behavior. The fruit flies consumed the estrogen, through their food. The fruit flies sexual behavior was compared to that of a normal fruit fly’s sexual behavior. The different steps in the typical mating process were observes, as was the time it took to go from one part of the mating ritual to the next. The typical parts of the mating process for fruit flies includes behaviors such as wing vibration, male licking of the females genitalia, copulation and ejaculation. From the behavior observed, it was found that the female flies exposed to estrogen were more aggressive, and more accepting of copulation attempts from male flies. The male flies took longer to begin orientation of the female flies, and there was less wing vibration from the males when the males were courting the females. Also, the time it took to go from one stage of the mating process to the next, decreased significantly.

*Abbigayle Cuomo, Elizabeth Van Loon*

**A Study of Fuel Moisture and Phenology of**

**Chamise Chaparral (*Adenostoma fasciculatum*) in California**

Fuel moisture is a major component to forest fire behavior and is used as an important factor in determining fire danger. The purpose of this study was to investigate the relationship between fuel moisture and the phenological stages throughout the life cycle of the plant Chamise Chaparral (*Adenostoma fasciculatum*), a densely growing coniferous shrub found in chaparral shrublands in California. Fuel moisture from Elk Creek, Sequoia National Park, was compared to data from other sites in California obtained through the National Fuel Moisture Database and old (one or more years old) and new growth (current year’s growth) samples were also compared. Phenology refers to the reoccurring vegetation cycles of vegetation. If during a particular phenological stage the fuel moisture can be determined, the intensity of forest fires during different seasons could be predicted allowing for better fire prevention and firefighting preparation. The results showed that fuel moisture varied based on its location because old and new growth samples were not the same within sites. A correlation existed between old and new growth in the new growth stages, meaning that in mid-spring when Chamise begins to grow, the fuel moisture will be higher resulting in less intense forest fires when compared to the rest of the year.

*Matthew Damiata, Nicholas Nasis, Eric Nigro*

**The Gua Sha Backpack**

The purpose of this project is to design and construct a device to reduce back pain, and shoulder pain in adolescents using backpacks in school, work and every day activities. Most current backpacks allow students to carry various items including books and binders; the weight is distributed to the middle of the back and shoulders which may lead to strain or irritation. In the United States there are over 21,000 injuries every year related to people wearing backpacks. Short-term effects of excessive weight on the back are muscle spasms and muscle strain which can increase the development of long term problems such as scoliosis. We did a study in our school to find how much weight students were carrying in their backpacks. We found that on average the students were carrying almost 20 percent of their own body weight just in their backpacks. As a result of this information, it is apparent that there is a need to reduce back pain. To combat this, our team designed a frame that redistributes the weight of the backpack into the most durable part of the back. We constructed a wood base and shaped metal rods to keep the middle part of a person’s body off of the backpack. Foam was put on the rods and also on the straps to ensure comfort. This frame aids in reducing back and shoulder pain, while still being compact, stylish, and durable.

*Isabella Daquita, Samantha Gray, and Helen Koukoulas*

**The Effect of Volatile Organic Compounds on *Drosophila Melanogaster***

The purpose of this investigation is to determine whether or not volatile organic compounds (VOCs) have a significant effect on the natural behavior of the fruit fly *Drosophila melanogaster*. VOCs are chemicals that can enter the air through gases of certain solids and liquids and can be found in many household objects including air fresheners, nail polish, and rubbing alcohol. Past studies have shown that VOC exposure is linked to damage of the nervous system, as well as short term effects such as headaches, dizziness, nausea, etc. in humans. Since there are many similarities between the genomes of *D. melanogaster* and humans, we used these flies as our test subjects. We exposed them to varying concentrations of air fresheners, 0g, .05g, .1g and .15g, and then had them perform a distance assay, a phototaxic assay, and upward movement assay on the flies to test if there was any significant effect on its speed, skills and decision making. We hypothesized that *D. melanogaster* will be negatively affected by exposure to VOCs and any decision making will be prolonged or altered. Results, for the most part, show that VOCs at different concentrations have no difference in behavior than a fly not exposed to VOCs with the exception of a couple experiments. The distance assay at 0.15g did show a difference in time compared to the control and chi-sq. test results on the phototaxic assay show that at 0.10g and 0.15g the observed count of light/dark choice disagreed with the expected count.

*Alexis Davitashvili, Raphael Iskra, Trevor Rosenlicht*

**The Design and Construction of a Recreational Foam Dart Launcher for a Person with**

**Duchenne’s Muscular Dystrophy**

The purpose of our project was to design and construct a recreational device that would exercise and preserve the muscle tissue of the body of a person with Duchenne’s Muscular Dystrophy (DMD). DMD is caused by a genetic mutation where the protein dystrophin, a cohesive protein, linking actin filaments to another support protein that resides on the inside surface of each muscle fiber’s plasma membrane is synthesized incorrectly. Our inspiration for this device came from a fellow student who has both autism and DMD, and utilizes a wheelchair. This device will help the student to preserve his muscle tissue while keeping him/her engaged in a fun activity. We decided to design our invention in the form of a modified version of a Nerf gun with a manual reeling mechanism. We chose to use the open space on his armrest to clamp this modified Nerf gun. The reeling mechanism will retrieve the shot foam dart and bring it back to the user without ever having to get up or having assistance. In addition we modified the pull-back loading mechanism so the user can use his/her hands to manually use this device. The devices target was also constructed out of a paper plate hollowed out to give the dart an aiming point.

*Brianna Delgado*

**The Effect of Early-Life Antibiotic Treatment on Intestinal Microbial Communities**

This investigation studies the effects of antibiotic doses on the intestinal microbiota. Gut microbiota has been linked with the development of a human’s immune system and acts as a barrier against foreign pathogens. These microbiota begin to grow and form around infancy and childhood, making this time period susceptible to any external or environmental perturbations. One such perturbation is infantile antibiotic usage. DNA samples were given to the experimenter in order to investigate how antibiotics affected the microbial communities. The samples were from three different groups: two being treated with either Tylosin or Amoxicillin prior to experimentation and a control group. A quantitative polymerase chain reaction (qPCR) was then performed to determine the 16s copy numbers of the groups and to determine if antibiotics decreased the bacterial counts of the intestinal communities. In addition, a Kruskall-Wallis non-parametric test with Dunnetts’s multiple comparisons test was then used to analyze the data received from the qPCR test. The Tylosin significantly diminished microbial populations in the gut compared to the control group, but the Amoxicillin did not have the same effect on the microbiota and did not decrease the total bacterial counts within the microbiota. These varying effects could be caused by the antibiotics’ modes of actions overall demonstrates how Tylosin and Amoxicillin, and therefore different types of antibiotics, effect the microbial community structure in dissimilar ways.

*Michael Delmonaco, Brendan McCaffrey, Jayson Mintz*

**The Effects of Lemon Juice on the Growth of *Escherchia coli***

The purpose of this experiment is to test a claim on the internet that sprinkling lemon on food has a health benefit. To accomplish this, we determined the effect of lemon on the growth of *Escherichia coli* k12 (*E. coli*). *E.coli* is a bacteria found in the digestive systems of mammals and is commonly used in bacterial experiments. *E. coli* has a symbiotic relationship with its host, meaning it uses the host to survive but provides a benefit for the host. We collected data by juicing lemons to a pulp and placing a measured amount in the center of a nutrient plate covered in *E. coli* the size of a blank antibiotic disk. After the second day, we measured the zone of inhibition around the lemon and compared it to a nutrient plate covered with *E. coli* that has an antibiotic disk. Thus far, results show that lemon juice effectively decreases growth or kills *E.coli.* This experiment supports that there is a potential health benefit from using lemons on food. Lemons may be used as a natural remedy to fight infections or prevent infection.

*Kyle Dituro – See Nicholas Bunnell*

*Joshua Drelich, Vraj Shah*

**The Mapping and Determining of Prime Sewage Treatment Plant Locations (STP’s)**

**Within the Town of Smithtown.**

Sewage treatment is an extremely important process that aims to dispose of harmful waste products and minimize the danger to both human and environmental health. When left untreated, sewage can have very damaging effects on surrounding areas and therefore a centralized location is needed to treat the sewage and other waste products. Sewage Treatment Plants are central locations at which wastewater is screened, pumped, aerated, and purified of all sludge and bacteria. The primary purpose of this investigation was to map and determine the areas most suited to develop a sewage treatment plant (STP) within the town of Smithtown. Using Google Earth, 6 possible sites for the STP were chosen and then the coordinates of these sites were imputed into an attribute table on QGIS. Then the sites were examined for factors including (but not limited to) the proximity to major waterways and roads, elevation, and the population density around the site. After the data was collected and each site was assigned a score based off of its ranking for each factor and how each factor was weighted based off of relative importance, a most optimal site was determined.

*Olivia Dubi, Tara McCaffrey, Amy Uthup*

**FoodFriend : A Food Allergy Warning Mobile Application**

The purpose of our investigation was to develop a food allergy warning mobile application. Food allergies occur when food, in a body, is mistakenly identified as a pathogen and is attacked because of an antibody response. There are about fifteen million people with allergies in the United States, and the number continues to increase. Young adults and teenagers with food allergies have the highest risk of fatal anaphylaxis caused by food reactions. Prevention by early recognition of allergens in the environment is crucial. The way to prevent food induced reactions is to stay away from the foods that cause them. Using App Inventor, we created a food allergy warning app for devices that allows users to input any of their food allergies into their devices. They can then scan a barcode from any food item and the app will notify the user if any of the ingredients match up with their allergy profiles. With these valuable tools, this app is an easy way to recognize if certain foods are safe for consumption.

*Jessica Fecht, Alexa Karadenes*

**The Effects of Wounding on the Action Potentials of Plants**

The purpose of this experiment was to determine if plants send out action potentials when wounded and to analyze these signals. These electrical currents, or action potentials, are sent throughout the body of the plant to communicate. They travel through the plant by depolarization and repolarization in ion channels. Several factors are known to disrupt these currents, which include light, water, temperature, and wounding. Wounding of a plant can signal its defense mechanism. Controlling a plant’s action potentials to signal its defense mechanism can improve a plant’s immunity to harmful factors, such as pollution, or other factors that could potentially hurt the plant. Doing this can lengthen the life span of a plant and improve its health throughout its life. To carry out this study we used a Plant Spiker Shield to measure the strength of the action potential through millivolts. We cut the leaves of the plant to trigger an action potential. Thus far we have concluded that if the plants were less than two weeks old, or before they germinated, they showed little to no action potentials. In addition, if the plants were ill or malnourished they also showed no action potentials. The action potentials were at its strongest after two weeks of growth.

*Victoria Ferlauto, Noah Marinaro, Lucas Marmorale*

**The Effect of Taurine Deficiency on the Cerebellum of *Mus musculus***

The amino acid taurine has proven its importance in recent years.  Although this amino acid is one of two that does not form polypeptides, it is used in many bodily functions including regulating osmolality in a cell, acting as an antioxidant in response to free radicals, and it is a key component in bile that aids in the detoxification process in the liver.  In humans, taurine is non-essential, but animals such as cats cannot produce their own taurine.  Cats obtain taurine from their food, but sometimes also suffer from taurine deficiency.  Further research into the effects of taurine deficiency in organs such as the brain will lead to more knowledge on taurine’s effects on the body. The most affected part of the brain in a taurine deficient state is the cerebellar cortex, more specifically the Purkinje and granule cells which are key cells used in motor functions. The data found in this experiment does in fact show that taurine and its deficiency has an effect on the cerebellum of the mouse. The data has shown that the taurine deficient mice show detrimental deformities such as dead or missing Purkinje cells, deformed glial cells with empty cytoplasms (show loss of osmolarity), and deformed granule cells, after only two months. Therefore the data pertains to the question asked as it shows that the taurine deficiency in mice has a large effect on the cerebellum of the mice.

*Gina Ferrara*

**In What Type of Personal Relationship is a Yawn the Most Contagious?**

The purpose of this investigation is to determine if there is a correlation between contagious yawning and the personal relationship between participants. Empathetic connections are any form of acknowledging and feeling the same way, someone else feels. Empathy is found to be associated with having contagious responses. Contagious responses are defined as a response being an after effect of a previously caused phenomenon, such as knowing the exact pain of stubbing one’s toe and not just imagining how that pain feels. To carry out this study, human test subjects were placed in small groups with others that they have close familial connection, non-familial connection, or no personal connection at all, and once in a group the yawn was introduced through a “planted” subject and while in the group they watched a video to mask the experiment as a memory test. The objective was to find out if personal connections due to familial nature played a factor in a “contagious yawn”. This was determined by observing the participants in the different groups to see if they yawn after the “planted” subject yawns. It is hypothesized that since a contagious yawn is more contagious among closer personal connections in people then it is more likely to occur. The level of personal relationship seems to be related to if a person is more likely to yawn. However, due to the small sample size a Chi- squared contingency table test would not have worked because the values were less than five.

*Jake Finnell*

**The Addictiveness of Caffeine to Nicotine Using a Planarian (Dugesia dorotocephala) Model**

The purpose of this investigation is to compare the addictiveness of caffeine to nicotine using a planarian model. Planarian and humans have a number of the same neurotransmitters and are also sensitive to a number of the same toxicants, therefore planarian are a good model to be tested on for nervous system functions and drug-induced effects. The locomotion, ability to move from one place to another, is measured to determine the addictiveness of the planarian. To measure the locomotion of the planarian, they are placed in a clear petri-dish, with 0.5 cm boxed graph paper placed underneath the dish. The amount of lines that the planaria crosses gets tallied up which determines the locomotion of the planaria. If the locomotion of the planarian decreases significantly after the use of the drugs, then this shows a sign of drug withdrawal. Drug withdrawal is when one relies on a certain drug, and then an abrupt decrease or discontinuation of the drugs occurs and one’s psychological or physical dependence is broken when the intake of the drug decreases.

*Elias Gonzalez – See Aaron Angeles*

*Samantha Gray – See Isabella Daquita*

*Vignesh Gunasekaran*

**The Effects of *Hypericum perforatum* and *Ginkgo biloba* on Nicotine Withdrawal Symptoms in Planaria**

This project was designed to assess the effects of St. John’s Wort(*Hypericum perforatum*) and *Ginkgo biloba* on nicotine withdrawal symptoms in planaria. Withdrawal symptoms are a major obstacle for people looking to quit smoking, and recent research has shown that antidepressants are effective in reducing withdrawal symptoms. *Hypericum perforatum* and *Ginkgo biloba* were tested because they are herbal antidepressants. Planaria, which are free living flatworms commonly found in freshwater environments such as lakes and streams,were used for this investigation because they are one of the simplest organisms to have a brain and central nervous system.In this investigation, the planaria were split into 4 groups based on what they were pretreated with: Water (control), Nicotine, *Hypericum performatum*, and *Ginkgo biloba*. After pretreatment, the planaria were placed in a gridded petri dish that contained water, and their movement was measured by counting the number of gridlines they crossed in one minute (withdrawal symptoms were quantified by a decrease in movement). The planaria that were pretreated with nicotine crossed fewer gridlines per minute than those pretreated with water, which shows they are going through withdrawal. In order to see if *Hypericum performatum*, and *Ginkgo biloba* help to reduce withdrawal symptoms in planaria, the planaria exposed to nicotine will be placed in gridded petri dishes containing *Hypericum performatum*, and *Ginkgo biloba* extracts, and the number of gridlines they cross in a minute will be determined. I hypothesize that *Hypericum performatum*, and *Ginkgo biloba* will reduce the withdrawal symptoms in planaria by increasing the number of gridlines crossed. The results I have gathered have shown that *Hypericum perforatum* almost completely reduced withdrawal symptoms in planaria (the average number of gridlines crossed by a nicotine-withdrawn planaria exposed to *Hypericum perforatum* was 70 while the normal average was 77) and that *Ginkgo biloba* had almost no effect on withdrawal symptoms (the average number of gridlines crossed by a nicotine-withdrawn planaria exposed to *Ginkgo biloba* was 39).

*Jason Haber, Alex Horowitx, Charles Sikorski*

**Pollutant Study of the Nissequogue River**

The purpose of this experiment is to find what pollutants are in the Long Island Sound that were discharged out by the Nissequogue River. Previous studies showed that pollutants are being dumped into the Long Island Sound from Connecticut. These include metal contaminations in Connecticut's coastal wetlands and the Long Island sound. There are traces of liquid Hg(Mercury), Cu(Copper), Ag(Silver), Zn(Zinc), Cr(Chromium), Cd(Cadmium), Mn(Manganese) and Pb(Lead). The Nissequogue River has been in great danger over the years concerning pollution, debris and unsanitary waters. We investigated pollutants from old lumber sawmills, fulling mill, the ship industries were being dumped into the river. We used GIS to map out the location of the various industries. Then we created a shape file of the type of pollutants each industry contributed. The significance of this experiment is to show the ecological effects that old industries could have on the Nissequogue River.

*Joshua Hardoon – See Brandon Axelrod*

*Jessica Hastings, Nicolette McKeon*

**The Effect of Caffeine on the Movement and Foot Attachment of Ramshorn Snails (*Planorbis rubrum*)**

The purpose of this investigation is to determine the effect that caffeine has on the movement and foot attachment of Ramshorn snails *(Planorbis rubrum).* These snails are found in many places all over the world. They are usually found in two different skin colors: black or red. Their shells can range in color from varying shades of browns to deep black. The snails instinctively suction to the glass of the tank, or to a rock on the bottom when placed into a new environment. Ramshorn snails are lung breathers that use large folds of skin to trap air in a pulmonary sac. They are also hermaphrodites, which means that they carry both male and female sex cells to create offspring. When the snails are put into a new environment or are exposed to environmental stimuli, they retreat into their shell. In their normal environment, fresh water, they will quickly attach to something in their surroundings using their foot, known as foot attachment. Foot attachment by Ramshorn snails, will be used to test the effects of different dosages of caffeine. Caffeine is a drug that greatly affects the human body, as the ingestion of caffeine affects the metabolism and performances of human activities. The snails will be placed into small separate bowls with different concentrates of caffeine for short term experiments. For long term experiments, one snail will be placed into one of three bubblers each with a different dosage of caffeine for 48 hours. The length of time it takes for the snails to attach to the bowls will show the effect of the caffeine on the behavior of Ramshorn snails. For this experiment, it is hypothesized that with a larger concentration of caffeine in the bowl, the length of time for the foot attachment of the snail will decrease. Results showed that in a short term experiment the .5% caffeine dosage decreased their times and the 1% increased their times. In the long term experiments both were statistically shown to have no difference, however we suspect there actually is, and are going to continue to conduct trials, thus having a larger sample size.

*Austin Heller, Chase Schare, Benjamin Wolgang*

**The Study of How Regeneration Affects Movement in California Blackworms (*Lumbriculus variegatus)***

The purpose of this study was to determine the effect of regeneration on the movement of California Blackworms (CBW). CBW are invertebrates made up of an average of 250 segments, live in freshwater, reproduce asexually and grow to a maximum of 20 mm. CBW are known to swim in different patterns, mostly in horizontal or spiral movements. We hypothesize that regeneration will affect how many spiral movements a CBW will make in 30 seconds. To carry out this study, we cut worms in half and view them once each week. We also chose to see if temperature would affect regeneration. The worms were viewed using a high speed camera and dissecting microscope. We collected data to test if regeneration affects the movement of CBW. Thus far results show that regeneration may not affect the movement of CBW.

*Alex Horowitz – See Jason Haber*

*Raphael Iskra – See Alexis Davitashvili*

*Alex Izen, Adam Portnoy, Erick Vaysman*

**To What Extent Does Salary Affect the Level of Performance of Professional Baseball Players**

WAR, or, Wins Above Replacement is a statistic that represents how much a baseball player contributes to his team’s number of wins. The statistic WAR is calculated by comparing a players season total statistics such as his on base percentage, batting average, slugging percentage, etc. with that of the next readily available player to take his spot. This statistic can be used to determine the impact of a player throughout his career and can be analyzed to determine the impact of a player after he signs a new contract. The purpose of this investigation is to determine if players salary affects how well they play. It is hypothesized that player’s levels of performance is not affected by their salary, but that their salary is simply a reflection on how well they play. Players WAR and annual salary will be collected from various databases. The salary will then be converted into its value in the 2014 economy, so that we have an accurate comparison. The hypothesis that is accepted by both fans and media is that psychologically, players tend to become lazier and less motivated because they think they have achieved greatness, with a higher salary as their proof (Sadler, 2007). They will not need to try as hard as they used to, because they are already getting paid millions of dollars and do not need to work harder to make more money. The WAR and salary will be analyzed to see if there is any correlation between how much baseball players make and their level of performance and to see at what points in their career players typically play better. Our results showed that the majority of the player’s WAR vs Salary correlation was negative and statistically significant. This means that as their salary went up their WAR went down.

*Milenia James, Kevin Zhou*

**A Study of the Aggregation of California Blackworms (*Lumbriculus variegatus)***

Aggregation is a technique used by many organisms across the globe, some of these organisms include; fish, cattle, humans, and many others. Whether it is for protection, or a way to gather food but the main reason is because the ancestors of these organisms have been doing this for so long. One of these organisms are the California Blackworm ( *Lumbruiculus variegatus,* CBW) they aggregate by using “clumping” action where the worms go into a ball shaped mass. The purpose of our investigation is to find the ideal environment for the CBW to aggregate. We will carry out this study by exposing the CBW to different stimuli such as white light and red light; we also intend to expose them to different temperatures and high and low sound frequencies. We hypothesize that; if the worms are exposed to warmer temperatures, under no light and higher sound frequencies. Thus far, the results have shown the worms aggregate faster when they’re under no light.

*Raymond Janis – See Brandon Axelrod*

*Aryana Javaheri – See Rahul Chakravorty*

*Daniel Jung – See Daniel Choi*

*Alexa Karadenes – See Jessica Fecht*

*Mikayla Katz*

**The Effect of Skullcap on the Recovery Rate of Seizure Prone *Drospohila melanogaster***

The purpose of this experiment is to determine if skullcap (*Scutellaria lateriflora)* has an effect on fruit flies *(Drosophila melanogaster)* which have a mutation on the *prickle* gene. In recent studies, the *prickle* gene has been proven to be connected to epilepsy in humans, fruit flies, and other organisms. Skullcap has been used as a natural remedy for years for epilepsy and other disorders like insomnia, anxiety, and strokes. There has been limited research on skullcap as a potential treatment for epilepsy, therefore, the objective of this project is to determine if skullcap could potentially be used to treat epilepsy, and if further tests should be conducted for medicinal use of skullcap for epilepsy. To carry out this experiment, there will be three control sets of flies with a mutation on the *prickle* gene and a control set of flies without the mutation on the *prickle* gene. Then, there will be three control sets of flies with a mutation on the *prickle* gene and a control set of flies without the mutation on the *prickle* gene which will intake skullcap through their food. To induce seizures, each type of fly will be vortexed for 15 seconds in a glass vial, then will be videotaped to see how long it takes for the flies to climb up the vial after vortexing. This climbing assay will be used to compare the amount of time it takes each fly to climb up the vial following the induced seizure. This will be used to determine if skullcap has an effect on the flies with the *prickle* mutation. It is hypothesized that if the fly has a mutation on the *prickle* gene and injests skullcap, then the length of time it takes the fly to recover after vortexing will decrease, and if a fly has a mutation on the *prickle* and does not ingest skullcap, then the length of time it take for the fly to recover will be greater.

*Mikayla Kelly – See Gianna Anderson*

*Christine Kim, Juliana Sikorski*

**The Effect of Mental Imagery on a Figure Skater’s Performance**

The purpose of this investigation was to determine the effect of mental imagery training on a figure skater’s performance. Mental imagery is the visualization of an action before the action is performed. Mental imagery training allows for more efficient visualization and can lead to more self confidence and a better overall final performance. This study allowed us to test and explore the effect of using mental imagery training on young figure skaters of different skill levels. The motivation for this study was the many different competitive skaters that participate in competitive skating who want to advance their skills. The results of this study can be applied to the use of mental imagery training in various other sports. To carry out this study, we had figure skaters of different ages and different skill levels take a survey to test their knowledge and understanding of mental imagery before and after the test. The participants then practiced certain elements used in figure skating and was scored performing their elements in front of judges using the International Skating Union’s Scale of Values. The skaters were then randomly assigned to a group, the group using mental imagery or the group not using mental imagery. The skaters were required to practice their given element for 10 minutes a day for a week. To keep track of their practice times, they filled out a log each time they practiced an element. After a week, all the skaters performed again in front of judges who gave them new scores; the judges were not informed of which skaters did or did not receive the mental imagery training.

*Helen Koukoulas – See Isabella Daquita*

*Joshua Kravatz, Matthew Wu*

**The Effect of Muscle Relaxants on the Rate of Regeneration in Black Planaria**

The purpose of this study is to observe if planarian regeneration is affected by muscle relaxants. Black Planaria (*Dugesia dorotocephala)* are a species of flatworm, which range from roughly 10-30 mm in length. They have very strong regenerative abilities; they are able to fully regrow when cut to 1/300th of their original size, even if the piece lacks a brain. These properties are caused by two main factors: Their abundance of neoblasts, or cells that can morph into other cells, as well as special genes that dictate where regeneration occurs. These special genes, known as position control genes, are extremely common in muscle and especially active after injury. Because muscle relaxants are known to decrease muscle action, we believed that they would also have slowing effects on the genes that instruct regrowth. It is hypothesised that muscle relaxants will have a negative effect on the rate of regeneration in planaria. For our study, we used a cyclobenzaprine hydrochloride solution, the active ingredient in most commonly used muscle relaxants. To carry out the study, we measured the original length of a randomly selected planarian, then bisected it with a razor blade. Following that, we placed the head and the tail into separate petri dishes filled with water. Then, we recorded their rate growth using a microscope and measuring programs such as ImageJ. Tests were then rerun using different planaria and the cyclobenzaprine hydrochloride solution instead of water.

*Sara Kurten – See Allyson Britt*

*Nicole La Reddola – See Zack Abrams*

*Anthony LaSala, Christopher Siegler, Douglas Verity*

**The Effect of Altering Levels of Salinity on the Growth and Development of *Halobacterium sp.* NRC-1**

The purpose of our investigation is to determine if *Halobacterium sp.* NRC-1 can survive in an environment with different salinity levels. We chose to grow *Halobacterium sp.* NRC-1 in this condition to see if it can survive in space, as there is limited Salinity in space. Our previous experiment tested Halobacterium *sp.* NRC-1 in a micro-gravity environment, as this is also the gravity condition in space. Our *Halobacterium sp.* NRC-1 was able to survive and even thrive in the simulated micro-gravity environment. *Halobacterium sp.* NRC-1 is a single cell organism and is considered an archea. *Halobacterium sp.* NRC-1 is a rod-shaped cell usually 5μm in length. *Halobacterium sp.* NRC-1 is also an extremophile or an organism that is able to survive in extreme conditions such as temperature and radiation, so we believe from this it will be able to survive in the altered salinity condition. The molarities of salt varied from 2.3M, 3.3M, 4.3M, which is our control group, 5.3M, and 6.3M. *Halobacterium sp.* NRC-1 typically lives in a molarity of 4.3M, which is why this molarity is the control group. The *Halobacterium sp.* NRC-1 grew for 2 days or 4 days in an incubator at 42 degrees Celsius on a rocker. The amount of growth was determined by measuring the optical density of each molarity using a Spectrophotometer and by counting its CFU’s when diluted and grown on a plate. Our data resulted in the control group (4.3 molarity) always grew the most CFUs, however the high molarity groups had a higher concentration per colony. Among the experimental group, the higher molarities grew more than the lower molarities. Overall, the control group had a greater growth than the experimental group, or all the other molarities. We concluded that the *Halobacterium sp*. NRC-1 grew the most under normal salt concentration than the *Halobacterium sp*. NRC-1 under varied salt concentrations.

*Daniel Lee, William Liu*

**The Correlation Between UV Irradiation and Altitude**

The purpose of this study is to investigate the change of UV radiation with altitude (Altitude Effect) using measurements taken using a weather balloon and comparing those results to other Altitude Effect studies. Ultraviolet (UV) radiation that affects Earth comes from the sun in various wavelengths ranging from 10 nm to 400 nm. Most varieties of UV radiation are absorbed by diatomic and triatomic oxygen (ozone) in the atmosphere. Previous studies utilizing satellites and aircraft have shown that there exists a correlation between UV irradiance and altitude. Knowing the UV light measurements and Altitude Effect is essential as UV-B and UV-A radiation are related to health complications such as skin cancer and eye damage which increase at higher altitudes. As population continues to increase, population density will also increase resulting in more people living at higher altitude increasing the intensity of UV exposure. To carry out this study, a weather balloon collected data for us which was then smoothed and used to calculate the Altitude Effect. For the overall flight the global irradiance Altitude Effect for the ascent path was about 7.4 and 6.2 percent per kilometer which resembles previously calculated Altitude Effects in Greece, Alps, and Andes who had ranges of 6 to 20 percent in global irradiance Altitude Effects. Overall the results indicate that the weather balloon is a flexible and accessible platform to conduct future research on the Altitude Effect.

*Ryan Lee – See Daniel Choi*

*David Li*

**A Device for the Tracking of At-Home Medical Equipment during Natural Disasters**

Electrical durable medical equipment (DME), such as dialysis machines, patient monitoring devices, and ventilators, are life-sustaining machines that are used extensively by patients at home. This investigation was aimed to design and implement a prototype system capable of tracking at-home DME and securely reporting the GPS location, status, and patient information to a nearby hospital during power outages. This system designed herein consists of two parts: a hospital Basestation device and multiple User Nodes connected to the DME in each patient’s home. The Basestation and User Nodes each consist of a Teensy microcontroller, a GPS receiver module and an Xbee radio implementing the Zigbee protocol. Additionally, each User Node contains a status LED and a lithium battery connected by a charge controller. User Nodes are programmed to obtain the GPS location of the patient, monitor the DME status, relay information, and transmit the data when the power is lost. When a power outage is detected, the User Nodes communicate with other nearby nodes and relay encrypted information about the DME and the patients through an ad-hoc network the nodes form, to the Basestation device, which is programmed to receive and convey the information to a hospital computer through a USB connection. This system is independent of infrastructure, such as cell towers, which are unlikely to be operable during natural disasters, and allows hospital personnel to monitor the at-home DME to provide help needed during power outages.

*William Liu – See Daniel Lee*

*Gabriella Longo – See Veronica Borracci*

*Joshua Mann, Ryan von Hof, Peter Yu*

**An Investigation into the Effects of Bulkheads on the Rate of Erosion at**

**Sunken Meadow State Park in Long Island, New York**

The goal of this investigation was to determine how the rate of coastal erosion along the Long Island Sound was impacted by the presence of bulkheads. Bulkheads are small, privately built structures intended to prevent flooding on houses near major bodies of water. Due to widespread belief that bulkheads may lead to an increased rate of erosion, many townships throughout Long Island have prohibited the building of bulkheads. However, numerous structures still remain. Data was collected from both Callahan Beach in Fort Salonga, an area in which many bulkheads are located, and the shore of the Nissequogue River in Kings Park, a less industrialized area. The Suffolk County Online GIS Viewer was used in conjunction with the archives of the Smithtown Planning Board to view aerial photographs taken at intervals beginning in 1947. It was hypothesized that the presence of bulkheads would increase the rate of erosion due to its disruption of the natural homeostasis of the shoreline and its role in the prevention of normal tidal changes. This investigation can have future implications in that findings can be applied to other geographic regions to determine the potential environmental hazards in the construction of bulkheads near shorelines.

*Noah Marinaro – See Victoria Ferlauto*

*Lucas Marmorale – See Victoria Ferlauto*

*Brendan McCaffrey – See Michael Delmonaco*

*Tara McCaffrey – See Olivia Dubi*

*Nicolette McKeon – See Jessica Hastings*

*Jamey Meotti, Charity Russell*

**The Effects of Sleep Deprivation, Alcohol, and Caffeine Consumption on Seizure Prone Fruit Flies (Drosophila Melanogaster)**

The purpose of this investigation was to investigate the effects of caffeine intake on seizure prone fruit flies (*Drosophila melanogaster)*. Fruit flies are model organisms for many human studies, they are easy to care for,  and flies require minimal space. Approximately 75% of human disease genes have a recognizable match in the genome of fruit flies. Epilepsy is a common disease found in humans, it affects over 3 million Americans of all ages. An epileptic seizure is a change in behavior that takes place when there is abnormal electrical activity in the brain. Fruit flies have the ability to have seizures similar to humans. During our experiment we used two types of fruit flies, Oregon-R (OR) for our control, and an epileptic seizure mutant fruit fly (Bss1). The fruit flies were divided into two groups, a control group and fruit flies that were introduced to a caffeinated diet. Each group was placed into a scientific vortex for thirty seconds, next, the amount of time that it took for the fruit fly to recover from the seizure or climb five centimeters up the test tube was recorded. The fruit flies remaining on the bottom of the test tube were classified as not being able to recover from the stimulated seizure. Results were recorded and analyzed for statistical significance.

*Jayson Mintz – See Michael Delmonaco*

*Kyle Mitra, Justin Tollin*

**Analysis of Microclimate in the New York Metropolitan area (NYC & LI, NY)**

This project was designed to determine the effects of human interactions, such as urbanization and suburbanization, on the climate changes of New York Metropolitan microclimates, a local atmospheric zone where the climate differs from the surrounding area. Every microclimate has its own unique climate as well as its own human influenced, physical environment. This environment has been modified due to a change in the ratio of buildings and concrete mass to the amount of forests and grasslands present today. Urbanization has altered this ratio resulting in a different environment from 70 years ago. Islip, Setauket, West Point, Central Park, and Westhampton were selected as the microclimates chosen to study in this investigation. To compare these locations, we collected data from NOAA weather stations. Then, we will calculate the average temperature of each station for the months of January, May, and August both before and after land development occurred. We will search for a correlation between the temperature changes that have occurred and the land development changes that have occurred due to urbanization and suburbanization. The results of this experiment will show if the build-up of cities and suburbs has affected the climate change of individual microclimates throughout New York. We hypothesize that the temperature data we collect will correlate to the changes in land development that have occurred throughout the New York Metropolitan area over the previous 70 years. This information can help us understand the relationship of our surroundings to our climate, helping us predict future changes based on the current rate of urbanization.

*Paul Mokotoff, Stephen Murrell*

**Easy Entry Door Opener**

The purpose of this project is to design and construct a door opener that allows an individual with Parkinson’s Disease, Alzheimer’s Disease, Tremors, or an individual who is aging to open a door more easily. Individuals that fall into these categories can have trouble gripping and manipulating small objects, such as a door knob. This invention allows the user to open a door without any assistance. By allowing the individual to open a door by themselves, this invention encourages a person’s independence. Also, the user can feel confident knowing that they can do a simple task on their own. The door opener will latch to the door knob or handle, and the user will twist the invention to the desired angle of choice to open the door. The user would then pull on the door allowing it to open and ultimately take off the invention from the door. Research was conducted and prototypes were constructed to determine which materials would be used. The prototype met all of the project requirements. Materials for the real invention were ABS Plastic and Neoprene Rubber. Testing was used to observe how the door opener works and how it can be improved upon. The door opener met all of the project requirements, but could be improved upon by making it more portable. Overall, the invention was a success and has the chance to make an impact on many individual’s lives.

*Stephen Murrell – See Paul Mokotoff*

*Nicholas Nasis –See Matthew Damiata*

*Jake Nieto, Samuel Petruzzi, Muzaffer Tasoglu*

**A Comparative Analysis of Phytoplankton Populations and the Variables that Influence them in the Arctic and Pacific Northwest**

The purpose of this meta-analysis was to compare and determine the variables effects of water temperature and solar radiation on phytoplankton populations using data from Ocean Networks Canada (ONC) between two sites. Phytoplankton is an umbrella term for a wide variety of aquatic photosynthetic microorganisms. Phytoplankton is often referred to as the foundation of the ocean food web due to the fact that a wide variety of animals feed on it. Rapid growth of phytoplankton is referred to as an algal bloom, they occur annually. To perform this experiment we collected data from Mill Bay, Vancouver Island (48°N, 123°W) and Cambridge Bay, Victoria Island (69° N, 105° W) from between January 1st, 2013 to July 1st, 2013. The phytoplankton population density was determined by the chlorophyll data, chlorophyll is positively correlated to the phytoplankton population density. The chlorophyll was compared to the other variables using graphs made from ONC’s plotting utility, and then the variables were compared to themselves using data from the two stations. We hypothesized that higher values for the temperature and radiation would lead to higher phytoplankton populations. In addition, we hypothesized that, due to its extreme latitude, Cambridge Bay would have lower measures for the temperature and radiation leading to smaller phytoplankton populations. The significance of this research is due to the fact that as climate change continues our variables will change and continue to affect phytoplankton populations. This research can help to better understand how climate change will affect phytoplankton and the ocean ecosystem.

*Eric Nigro – See Matthew Damiata*

*Kristin Orrach – See Jung Soo Ahn*

*Megan Padgett, Kelly Page*

**An Exploration on the Sequential and Structural Diversity of Antibodies**

The purpose of this investigation was to study the sequence and structure of 16 antibodies and function variation between various antibody Protein Data Bank Codes by using Python (a high-level computer language, which helps navigate other programs such as the computational program, PyRosetta to study antibodies) and the database Clustal Omega. Determination of 3D models of proteins or their tertiary structure has been a challenge faced in molecular biology for many years. Knowing this information can aid in understanding the structure and function of antibodies and can be helpful in creating, for example, vaccines and medication against certain problematic diseases . Advancements are not as great concerning three-dimensional structures of proteins as the advancements being made in determination of protein sequences. Approximately 5.3 million protein sequences have been deposited in Uniprot, a repository of protein data, while only about 44,000 protein structures are obtained by the database PDB (protein data bank), as of 2005. Less than 1% of protein sequences have legitimate protein structure models, and the gap continues to widen. We curated a group of 16 antibodies all determined through x-ray crystallography and within 4 angstrom resolution.  
We also compared various combinations of these proteins using Clustal Omega a protein sequence alignment database, showing sequence similarity. For this project we also used RMSD or root mean square deviation to compare structural similarity. Sequence homology testing can help in discovering three dimensional structures of proteins, lessening the gap between sequence and structure determination.

*Kelly Page – See Megan Padgett*

*Caitlin Passaro – See Allyson Britt*

*Vincent Pennetti*

**Traditional and Biotechnological Development of New Clover (*Trifolium spp*.) Plants**

The objectives of this study were to: 1) cultivate and crossbreed clover manually; 2) grow and micropropagate various species of *Trifolium in vitro*, including the endangered species *Trifolium amoenum*, and; 3) to develop protocols for the genetic manipulation of white clover, *Trifolium repens, in vitro*. White clover plants are natural nitrogen fixers that are widely cultivated cover crops, provide nutritional benefit for surrounding plant and animal life, add essential nitrogen to the soil, and supply a desirable nectar source for honeybees. Being that clover is a self-sterile hermaphrodite, cross pollination is necessary to create viable seed from genetically different parents. As a result of exposing white clover plants to 6-benzylaminopurine, BAP-6, in vitro, adventitious shoot formation was initiated and it was observed that a concentration of 1mg/L BAP-6 is most successful in adventitious shoot initiation. Other species of *Trifolium* responded similarly to that of white clover while cultivated *in vitro*. Two chemical mutagens, Colchicine—a gout medication that causes chromosome doubling—and Surflan—a herbicide which doubles as a cell mutagen—were used successfully in the mutation of clover plants. The plants exposed to these mutagens demonstrated physical mutations such as an increase in leaflets per clover, and thicker petiole tissue. This observation, coupled with the results from the BAP-6 trials, provide evidence that this cytokinin could be used to micropropagate *Trifolium amoenum*, as well as chemically induced mutations.

*Samuel Petruzzi – See Jake Nieto*

*Adam Portnoy – See Alex Izen*

*Trevor Rosenlicht - See Alexis Davitashvili*

*Charity Russell – See Jamey Meotti*

*Sarah Samad, Lauren Tuffy, and Serena Tulley*

**The Antimicrobial Properties of Common Food Products on the**

**Growth of *Escherichia coli***

The purpose of this investigation was to determine the effectiveness of common food products on the growth of *Escherichia coli*. *E.coli* is found in the intestines of healthy people and animals. Certain varieties are also known to cause stomach pains, diarrhea, or no symptoms at all. *E.coli* K.12 is one of the forms that is not harmful to humans or animals. In this study we used human-derived *E.coli* K.12 and selected honey, garlic, lemon juice, basil and onions as our test food products. Some cultures have used teas as folk remedies for respiratory illnesses. Various types of food such as teas, ginger, Kudzu and other herbs have been used to treat many different types of illnesses. Other food products such as honey and basil have been used as an alternative to using antibiotics. Using natural remedies is important because bacteria are now becoming resistant to antibiotics. Bacteria becomes resistant through mutations in the DNA code causing certain bacteria to be selected over others when exposed to antibiotics. Since bacteria reproduce through mitosis, the one resistant cell can make many copies of itself within a short time period. It is known that antimicrobial properties of natural microbials can inhibit the growth of bacteria. In this study we tested various household food products including honey, lemon juice, onions, garlic, and basil. We hypothesized that all the products in this experiment will inhibit the growth of *E.coli* K.12 at different levels. To carry out this study we placed a sterile paper disk containing the test substance on the nutrient agar plate, using the Kirby-Bauer method. Then we measured the zone of inhibition after 2 days of growth and compared this to the growth of the control. The Kirby- Bauer method is a system to test the susceptibility of bacteria to antibiotic agents based on the size of zones of inhibition. Thus far results show Garlic inhibited the growth of *E.coli* K.12 most effectively.

*Mehtaab Sawhney*

**A Study of Length Equivalence Classes on a Pair of Pants**

Length equivalence classes on a pair of pants, a figure that is topologically equivalent to a sphere with three holes, are intricately linked with the study of an equivalent linear algebra problem, and an associated topological problem on a punctured torus. Therefore understanding the length equivalence classes on a pair of pants has direct applications to these other mathematical problems. In most previous papers, both algebraic and geometric methods have been used to explicitly construct certain length equivalent classes and prove necessary but not sufficient conditions for two curves to be length equivalent. This study uses elementary geometric methods in order to first rederive a result of Leininger and then to extend this method to prove another necessary condition for two curves to be length equivalent. Furthermore I propose two conjectures that suggest a general structure for length equivalence classes on a pair of pants, and which may allow for the explicit construction of all length equivalence classes.

*Vraj Shah – See Joshua Dreilich*

*Emily Shin, Johann Yang*

**The Relationship Between a Person's Competitiveness and their Persistence and Frustration**

**While Playing a Labyrinth Game**

The purpose of this study was to determine how the level of competitiveness a person has affects his/her persistence and frustration while playing a Labyrinth game. Competitiveness is the desire for success in any situation. Due to competitive nature, people can be very persistent to achieve success, and their persistence will either lead them to become successful, or develop frustration by not being able to win. This can be seen when people let out their frustration verbally or by physical gestures. To carry out this study, each participant received a competitiveness questionnaire that estimated their level of competitiveness. Each participant’s competitiveness score was calculated and recorded. Participants were given no time limit for the experiment in order to get the best results, but were timed for how long they wanted to play the Labyrinth. Data was collected during the study, including the recording of verbal gestures or actions, the length of time participants chose to play, and a numerical grade of frustration. This frustration grade was given by a single question pertaining to frustration after the end of the study. We hypothesized that the more competitive a participant, the higher the level of frustration and the length of time they decided to play was. We found however, that in general, the more competitive a participant was, the lower their frustration score and the longer he/she decided to play. We also found a weak correlation between frustration and length of time, which led us to believe people will continue playing despite being frustrated.

*Chase Schare – See Austin Heller*

*Christopher Siegler – See Anthony LaSala*

*Charles Sikorski – See Jason Haber*

*Juliana Sikorski – See Christine Kim*

*Anoop Singh – See Abinaya Anand*

*Sidney Sirota – See Jung Soo Ahn*

*Maxwell Sugarman, Jeremy Vlacancich*

**A Study on the Effect of Environmental Noise Pollution on the Behavior of Marine Hermit Crabs (*Pagurus longicarpus*)**

This project was designed to test if pre-recorded ship noises affect the daily behavior of marine hermit crabs in a stable environment. *Pagurus longicarpus*, the long-armed hermit crab, is a small western Atlantic hermit crab and one of the most common shallow-water decapods along the US east coast and Gulf of Mexico. Bioacoustics is a science dealing with the sounds produced by or affecting living organisms. Marine hermit crabs do not hear in the same way as we do, but have microscopic hairs on their exoskeleton and on their antennae that sense vibrations. The specific behavior we will be testing is the shell selection process by the *Pagurus longicarpus,* with shells variable by color. Our experiment is designed to see if environmental obstructions such as noise pollution affect the ability to complete the task of shell selection. The crabs are maintained in filtered marine tanks. During experimentation, we place the crabs in a shallow tank and place a grid below the tank to as a reference to the crabs’ shell selection process. From our observations, we concluded that the horns drove the crabs to distraction, hindering their ability to effectively select suitable shells. This experiment determined that environmental noise pollution interferes with behavioral instincts of marine hermit crabs, and with that knowledge we can possibly provide protection from perceived threats, and take action such as implementing cruiser horn reductions to protect the *Pagurus longicarpus* in their natural environment.

*Hassam Syed*

**A Study of the Relationships of Children with Siblings in the Autism Spectrum**

The purpose of this study is to determine whether or not there is a correlation between time spent and quality of relationship with each other for siblings, one of which has Autism Spectrum Disorder (ASD). ASD is a neurodevelopmental syndrome that includes deficits in social skills such as communication as well as repetitive behavior and speech. It is usually diagnosed in children at the age of three. Sibling relationships are crucial to children’s development as they can help each other’s social skills through their own interactions with each other. In this study, children, ages 12 to 18 years, will be asked to voluntarily complete the Positive Affect Index survey on the website Qualtrics, evaluating their relationship with their sibling with ASD. The results can include the following possibilities: First, that having a sibling with ASD increases the quality of the relationship, reflected by a longer amount of time spent with each other. Second, that having a sibling with ASD decreases the quality of the relationship, reflected by a shorter amount of time spent. Third, having a sibling does not have any effect on the relationship of the siblings; there is no associated time factor. All of these possible accounts are in comparison to “control” siblings, neither of whom has been diagnosed with ASD, who will be asked to complete the survey as well.

*Muzaffer Tasoglu – See Jake Nieto*

*Justin Tollin – See Kyle Mitra*

*Lauren Tuffy – See Sarah Samad*

*Serena Tulley – See Sarah Samad*

*Victoria Turner*

**The Effect of Enhanced Amounts of Hydrogen Peroxide on the Kidney Bean Plant (*Phaesolus vulgaris*) While infected with the *Tobacco Mosaic Virus***

The purpose of this study is to make qualitative observations on how enhanced amounts of hydrogen peroxide effect cell death on the red kidney plants (*Phaseolus vulgaris*) while being infected by the *Tobacco mosaic virus*. In recent studies, results have shown that enhancing the amount of hydrogen peroxide on a plant while being infected by a virus increases the amount of cell death in the local region, surrounding the pathogen invasion (Greenberg 1996). The plant goes through many mechanisms such as resistance response, hypersensitive response, and oxidative burst and many structures are used such as xylem vessels and the phloem, in order to prevent the pathogen from feeding off its nutrient supply. This investigation will be performed by infecting a plant with the *Tobacco mosaic virus*, allowing the virus to spread on the leaves. Then, hydrogen peroxide will be injected into the same location where the virus was injected. Qualitative observations will be taken after some time has pass by looking for colored spots on the plant, indicating the presence of the virus or dehydrated areas on the leaves and indicating the commencement of hypersensitive response. It is hypothesized that enhancing amounts of hydrogen peroxide and on the red kidney plants while infected by the Tobacco Mosaic virus will have increased cell death in the local region surrounding the pathogen invasion.

*Amy Uthup – See Olivia Dubi*

*Elizabeth VanLoon – See Abbigayle Cuomo*

*Erick Vaysman – See Alex Izen*

*Douglas Verity – See Anthony LaSala*

*Jeremy Vlacancich – See Maxwell Sugarman*

*Ryan vonHof – See Joshua Mann*

*Benjamin Wolgang – See Austin Heller*

*Matthew Wu – See Joshua Kravatz*

*Johann Yang - See Emily Shin*

*Peter Yu – See Joshua Mann*

*Kevin Zhou – See Milenia James*

**Alumni Updates**

**Class of 2014**

*Anthony Bisulco, Northeastern University*

Undergraduate researcher at the Sensing, Imaging, Control and Actuation Department of Homeland Security Laboratory

MIT Lincoln Laboratories in the Intelligence, Surveillance and Reconnaissance group as a research intern

*Hugh Han, Johns Hopkins University*

Summer intern at the Johns Hopkins University Applied Physics Laboratory

Late summer Software Engineering Intern in China

*Tracey Rosenlicht, Stony Brook University*

Volunteer in the Oncology department, Stony Brook Hospital

*James Whittaker, Lehigh University*

Pennsylvania Governor's School for Engineering and Technology

*Joshua Zweig, Columbia University*

Work with Microsoft at the New England Research and Development Center

**Class of 2013**

*Trinity Russell, Wesleyan University*

 Yale School of Medicine Summer Medical and Dental Education Program

**Class of 2012**

*Rachel Gross, Northeastern University*

Six month paid at New England Baptist Hospital doing clinical research and shadowing surgeons

*Rajkumar Pammal, Harvard University*

Work with Qur, healthcare start-up in Boston

*Rebecca Alford, Carnegie Mellon University*

NIH fellowship at Johns Hopkins, Chemical and Biomolecular Engineering in Jeff Gray's Lab.

**Class of 2011**

*Jesse Badash, Vanderbilt University*

Google

*Matthew Katz, Washington University*

Deloitte consulting

*Matthew Kim, Columbia University*

Dropbox

*Sonal Nanda, Carnegie Mellon University*

RPI's Nuclear Engineering PhD Program

*Erica Portnoy, Princeton University*

Berkley University for Graduate School in computer science

*Savitha Racha, Boston University*

Medical School

**Class of 2011 (Continued)**

*Arpon Raksit, Harvard University*

Master’s program in Math at Cambridge University

Fall PhD program in Math at Stanford University

*Karen Schaub, Cornell University*

Retirement Actuarial Analyst at Towers Watson in Stamford, CT

*Asli Sinar, NYU*

*Marni Wasserman, Johns Hopkins University*

Insurance Services Offices, Actuarist

*Aaron Wilson, Bucknell University*

Attending medical school

**Class of 2010**

*Alexis Tchaconas, Columbia University*

Attending medical school

*Robert Schuman, Duke University*

Materials and Process Engineer, Boeing

**Class of 2009**

*Jason Gross, MIT*

MIT Graduate school

**Class of 2004**

*Elizabeth Bloomfield, Yale, Columbia, London School of Economics*

Investment banking at Morgan Stanley

*Sarah Fink, Williams College, Cambridge University*

BioDuro Senior Scientist

**Class of 2003**

*Brandon Imber, Harvard University*

Attending medical school

**Class of 2001**

*Christina (Chang) Hung, Harvard University, University of Pennsylvania*

Associate Director of Investments at Bucknell University

**Class of 2000**

*Jennifer Danielson, Johns Hopkins University, NYU School of Medicine*

Anesthesiologist

**Class of 1999**

*Grace Tan, MIT, New York School of Optometry*

Private Optometry Practice, Northport

*John Egan, SUNY Geneseo, Emory University*

Attorney at Seyfarth Shaw, New York

*Sandra Nudelman, Harvard University*

McKinsey & Company, Management Consulting Firm

**Class of 1996**

*Dominick Rosa, Yale University*

Anesthesiologist

**Class of 1992**

*Robin Niles, Cornell University, Boston University School of Medicine*

Senior Associate Scientist at Biogen Idec

**Class of 1989**

*Michael Maitland, Yale University, Albert Einstein College of Medicine*

Associate Professor of Medicine, University of Chicago

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