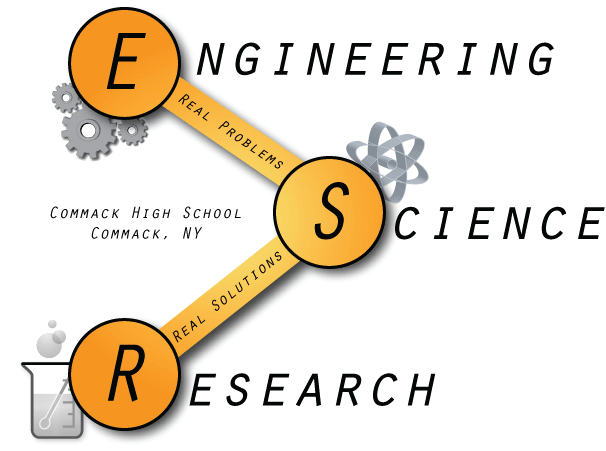
***The Research Dragon***





**Commack High School’s**

**Research Yearbook**

**2017 - 2018**

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

**Thursday May 24th, 2018**

**6:30 pm**

**Evening Events**

Poster Presentation of student projects

Slide Show Presentation… Matthew Damiata, Nicholas Nasis, Mia Serritella

Introduction…………....….Victoria Pensiero

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

Director of Science, K-12

Student Reflections..….….Joshua Brodsky, Keira Spahn

Alumni Comments……….Charity Russell, Class of 2017

Guest Speaker………….. Mr. John Mruz

Engineer

Honoring Our Seniors…...Kristen Chao, Aria Eghbali

Senior Picture Compilation….Melike Akoglu, Paulina Buchta

Closing Remarks…..…….Victoria Pensiero

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 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 our students for their involvement and participation in the Commack High School science research program.

Thank you.

*Research Staff*

Ms. Jeanette Collette

Dr. Daniel Kramer

Mr. Richard Kurtz

Dr. Stephanie O’Brien

Dr. Lorraine Solomon

Ms. Andrea Beatty

Dr. Alison Offerman-Celentano, Director of Science, K-12

*With gratitude, we would like to acknowledge the following people who have helped our staff and students in so many ways throughout the year to make our research program successful.*

Eric Biagi, Anthony Capiral, Diane Cotter, Lisa DiCicco, Chris DiGangi,

Susan Fanwick, Fran Farrell, Susan Formica, Janet Husted, Carolyn Gallogly,

Paul Giordano, Dolores Godzieba, Camille Horak, Dr. Barbara Kruger,

Dr. Fred Kruger, Dr. Susan Lee, Brenda Lentsch, Diana Lerch, Daniel Meeker, John Mruz, Frank Musto, Margaret Nappi, Bill Patterson, Pat Quigg,

Dr. Samantha Raimondi, Richard Schramm, Genny Sebesta, Gary Shaw,

Victoria Stack, Laura Tramuta, Lois Webster, and Frann Weinstein.

The Covanta Corporation

Michael Litterello, Marc Caruso, Robert Dubriske, and our fabulous custodial staff.

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

Dr. James, Ms. Newman, Ms. Ryan, Ms. Goldberg, Mr. Kolahifar, Dr. Inforna, Mr. Amato, and the members of our Board of Education for their support and recognition of our program.

**Science Fair Participation**

**Regeneron Science Talent Search**

Daniel Lee - National Semifinalist

Anoop Singh – National Semifinalist

**INTEL International Science and Engineering Fair**

**Raphael Iskra**

**Pragati Muthukumar**

***Awards to be Announced***

**Junior Science and Humanities Symposium**

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

Gabriel Chan

Aria Eghbali – 1st Place, Engineering - Advancing to Regional Competition

Yeil Kim – 1st Place, Engineering - Advancing to Regional Competition

Daniel Lee

Delina Levine

Anoop Singh – 3rd Place, Earth and Space Science

**Junior Science and Humanities Symposium, Northeast Regionals**

Aria Eghbali – 4th Place, Engineering – Advancing to National Finals

Yeil Kim – 4th Place, Engineering – Advancing to National Finals

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

*Awards to Be Announced*

Aria Eghbali

Yeil Kim

**Toshiba/NSTA Exploravision Program**

Jayson Bromberg – National Honorable Mention

Gavin Cressy - National Honorable Mention

Liam Cummings - National Honorable Mention

Brianna Han - National Honorable Mention

Evan Li - National Honorable Mention

Nikhita Mudium - National Honorable Mention

Jack Petit - National Honorable Mention

Craig Pilkhar - National Honorable Mention

Marlee Reither – National Honorable Mention

Cole Schwartz – National Honorable Mention

Rohan Surana - National Honorable Mention

Tryphena Zareif - National Honorable Mention

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

**The Conrad Challenge**

*Team 20/20 Diagnostics* - National Semifinalist Team

Christine Kong

Kimberly Liao

Michael Parinello

Louis Viglietta

**Medical Marvels Challenge**

Wonjeong Choi

Alexis Maikowski

Alexandra Ramotar

*As a group, Commack was awarded Best Presentation by the Feinstein Institute*

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

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

Kathy Cao

Aria Eghbali

Raphael Iskra

Maheen Khan

Yeil Kim

Daniel Lee

Joshua Lee

Delina Levine

Pragati Muthukumar

Sean Pak

Yasemin Sahin

Anoop Singh

Kyle Spinelli

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

Aria Eghbali – 3rd Place, Engineering Mechanics

Yale Science and Engineering Award

Raphael Iskra – 3rd Place, Microbiology

Yeil Kim - 3rd Place, Engineering Mechanics

Yale Science and Engineering Award

Daniel Lee – 3rd Place, Environmental Engineering

NASA Earth Systems Science Award

Delina Levine – 3rd Place, Earth and Environmental Science

American Meteorological Society Award

American Women Geophysicists Award

Pragati Muthukumar – Society for InVitro Biology Award

Sean Pak – 2nd Place, Engineering Mechanics

INTEL Excellence in Computer Science Award

Yale Science and Engineering Award

Anoop Singh – NASA Earth Systems Science Award

Kyle Spinelli - 2nd Place, Engineering Mechanics

INTEL Excellence in Computer Science Award

Yale Science and Engineering Award

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

Anthony Citera

Theresa Haupt – 3rd Place, Behavioral Science

Charlson Kim – Honorable Mention, Cell and Molecular Biology

Christine Kong

Kimberly Liao

Abigail Pace – 3rd Place, Behavioral Science

Funda Sahin

Ethan Sontarp

Louis Viglietta

Mariam Zahran

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

Kathy Cao

Aria Eghbali – 3rd Place, Engineering Mechanics

Raphael Iskra – Lightning Round Participant

1st Place, Microbiology

Maheen Khan

Yeil Kim – 3rd Place, Engineering Mechanics

Daniel Lee – 3rd Place, Environmental Engineering

Joshua Lee – 3rd Place, Computational Biology

Delina Levine – Lightning Round Participant

2nd Place, Earth and Environmental Science

Pragati Muthukumar – Lightning Round Participant

1st Place, Plant Science

Sean Pak

Yasemin Sahin

Anoop Singh

Kyle Spinelli

*First Place Winners advance to represent New York State in the INTEL International Science and Engineering Fair*

**WAC Lighting Foundation Invitational Science Fair**

Melike Akoglu – 2nd Place, Chemistry

Candace Arneaud - The Vladimir Brezina Award for Imagination, Initiative, and

Independence in Science

Kathy Cao

Kaitlyn Cestaro

Gabriel Chan – 1st Place, Physics and Astronomy

Kristen Chao

Daniel Czop

Gabrielle D’Agostino – Merit Award, Prototype Engineering

Michael Delmonaco

Emily DiPrima

Adam Dubi - 2nd Place, Prototype Engineering

Aria Eghbali - Honorable Mention, Prototype Engineering

Mikayla Elferis

Matthew Feigenbaum – Honorable Mention, General Biology

John Finnie-Maloney – Honorable Mention, Biochemistry and Molecular Biology

Theresa Haupt

Raphael Iskra – 3rd Place, Biochemistry and Molecular Biology

Maheen Khan

Charlson Kim – 3rd Place, General Biology

Yeil Kim - Honorable Mention, Prototype Engineering

Christine Kong

Daniel Lee – 2nd Place, Computer Science and Modeling

Joshua Lee

Delina Levine

Kimberly Liao

William Liu

Izza Malik - The Vladimir Brezina Award for Imagination, Initiative, and Independence

In Science

Emma Matz

Brian Mokotoff - 2nd Place, Prototype Engineering

Paul Moon - 2nd Place, Chemistry

Pragati Muthukumar

Jake Novello – Honorable Mention, Prototype Engineering

Abigail Pace

Sean Pak – Honorable Mention, Computer Science and Modeling

Victoria Pensiero – 2nd Place, Biochemistry and Molecular Biology

Paige Robinson – 2nd Place, Prototype Engineering

Yasemin Sahin

Deniz Sinar – 3rd Place, General Biology

Anoop Singh – 1st Place, Earth and Environmental Science

Ethan Sontarp

Kyle Spinelli – Honorable Mention, Computer Science and Modeling

Carly Tamer

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

Muzaffar Tasoglu

DeVaughna Tulloch

Shawn Uthup – Honorable Mention, General Biology

Louis Viglietta

Benjamin Wolgang - 2nd Place, Chemistry

Tasneem Zahran

Kevin Zhou

**Molloy College Science Fair**

Candace Arneaud

Wonjeong Choi

Anthony Citera – 1st Honors

Emily DiPrima – 1st Honors

Mikayla Elferis – 1st Honors

John Finnie-Maloney – Honorable Mention

Theresa Haupt

Andrew Kassnove

Christine Kong

Corey Levy

Kimberly Liao

Alexis Maikowski

Izza Malik

Abigail Pace

Samuel Panes

Funda Sahin

Ethan Sontarp

Louis Viglieta

Mariam Zahran

**Long Island Science Congress – Junior Division**

*Awards to be Announced*

Joshua Brodsky

Michael Chacon

Annika Chang

Kevin Chen

Faith Chi

Alyssa Collado

Jodi Consul

Gavin Cressy

Grace Cutrone

Ethan Dettmann

Erica Fenty

Elena Gnilitskaya

Brianna Han

Emma Hatcher

Annabelle Hohne

Soad Hossain

Jeremiah Jerome

Hailey Katz

Jun Ko

Erika Kraft

Dylan Krukowski

Joshua Lang

Nicholas Leahy

Amy Liu

Cole Margaries

Michelle Mojsa

Nikhita Mudium

Jessica Murrell

Naru Nakamura

Paul Park

Jayden Prestiano

Jason Sicoli

Rohan Surana

Catherine Tawadros

Olivia Vasselman

Caroline von Hof

Jordan Walsh

Tryphena Zareif

Chapin Zerner

**Long Island Science Congress – Senior Division**

*Awards to be Announced*

Jasmine Bajaj

Riley Bode

Gabriel Chan

Christopher Collado

Tyler Conforti

Ethan Darvin

Emily Della Pietra

Cathleen Deutsch

Gillian Evers

Rahim Faizali

Matthew Feigenbaum

Brian Flynn

Mia Goren

Christopher Ioannou

Emma Karadenes

Marina Khan

Vishwanath Madhavan

Sophia Mastroianni

Maheen Naseem

Isac Park

Teja Sundar

Meghna Thampy

Caitlin Tolentino

Shawn Uthup

Jenny Won

Michael Zareif

**New York State Science Congress**

*Awards to be announced*

Rohan Surana

Jordan Walsh

Chapin Zerner

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

*Awards to be announced*

Karen Abruzzo

Ariana Aghili

Aaron Angeles

Jonathan Appel

Nathan Cheung

Tyler Chipetine

Jonathan Collado

Elizabeth Demacopoulos

Emma Downey

Dylan Feldman

Nicholas Gembs

Elias Gonzalez

Nicholas Greco

Amy Held

Austin Heller

Hamza Khan

Philip Kwiecinski

Ruth Lee

Casamira Lopez

Mustafa Naseem

Sarah O’Connor

Alexandra Ramotar

Shamtej Singh Rana

Jordana Resnikoff

Trevor Rosenlicht

Chase Schare

Ryan Schoenfeld

Joseph Strickland

Ryan Tedesco

DeVaughna Tulloch

Tasneem Zahran

Angela Zavala-Yanes

**SAAWA Fair**

Candace Arneaud – 3rd Place, Biological Sciences

Michael Chacon

Kristen Chao – 2nd Place, Chemistry

Nathan Cheung

Daniel Czop – 2nd Place, Chemistry

Aria Eghbali

John Finnie-Maloney

Mia Goren

Emma Karadenes

Marina Kan

Yeil Kim

Christine Kong

Erica Kraft

Joshua Lee

Joshua Long

Izza Malik – 3rd Place, Biological Sciences

Jane Maloney

Michelle Mojsa

Nikhita Mudium

Jessica Murrell

Pragati Muthukumar

Sean Pak

Victoria Pensiero

Jayden Prestiano

Alexandra Ramotar

Deniz Sinar

Ethan Sontarp

Kyle Spinelli

Rohan Surana – 1st Place, Physics

Caitlin Tolentino

DeVaughna Tulloch

Louis Viglietta

Carolyn von Hof

Jordan Walsh – 1st Place, Physics

Tryphena Zareif

Chapin Zerner – 1st Place, Physics

**Harvard Research Conference**

Kathy Cao

Elizabeth Demacopoulos

Emily DiPrima

Mikayla Elferis

Amy Held

Raphael Iskra

Emma Karadenes

Maheen Khan

Marina Khan

Jake Nieto

Ethan Sontarp

Louis Viglietta

Mariam Zahran

**PLOS One Journal**

Jake Nieto, Student contributor

***Plant Genomes & Biotechnology: From Genes to Networks*, Cold Spring Harbor Laboratory Conference**

Pragati Muthukumar, Student presenter

**IEEExplore Conference**

Daniel Lee, Student presenter

**Student Summer Research Placements**

*Each year, Commack students participate in a variety of summer research opportunities. These diverse experiences include;*

SUNY Stony Brook Simons Summer Research Program

SUNY Stony Brook Laboratories

SUNY Stony Brook Biotechnology Summer Camp

Brookhaven National Lab High School Summer Research Program

Cold Spring Harbor Internship Program

Cold Spring Harbor Laboratory DNA Summer Camp

New York University Biology Department

ICaRe Cancer Research Program at SUNY Old Westbury

Dr. Bessie F. Lawrence International Summer Science Institute

Independent research laboratory assignments

**ABSTRACTS**

**StanMack Program**

***Gianna Anderson, Nicholas Bitonti, Paulina Buchta, Matthew Damiata, Ryan Dery, Mikayla Kelly, Nicole LaReddola, Amanda Loo, Nicholas Nasis, Zachary Peare,***

***Mia Serritella, Lauren Tuffy***

**Exploring the Function and Development of Insulin-producing cells in *Drosophila melanogaster* with the Goal to Improve Diagnosis and Treatment of Diabetes.**

*Drosophila* are highly suitable for research since they serve as a model for studying the role of the transposable element. Mechanisms of glucose homeostasis are conserved between flies and humans, and the fruit fly allows for easier access for conducting genetic manipulations when compared to the common rodent model.

The goal of this project is to create a stable stock of *Drosophila* with a gene analogous to the human gene. By the end of this project, a unique line of fruit flies could be used to study insulin producing cells in *Drosophila*, comparable to the human gene. The Transposons are sequences of DNA that move from one location in the genome to another using a cut and paste mechanism. This transposable element would migrate from the X chromosome to the second or third chromosomes. This project began by creating an F0 cross using females from the Bloomington *Drosophila* Stock Center (BDSC) fly stock line (StanEx1) and males with the gene for transposase, this cuts out the transposable element and allows it to jump into another part of the genome. From this cross jump starter males were found, that carried the StanEx1 gene and crossed with Double Balancer virgin females. From the F1 cross, males with the StanEx1 gene transposed from the X chromosome to another were found. These males were crossed with at least 6 virgin Double Balancer females. Afterwards, a brother-sister cross was performed using the offspring from the F2 generation to make F3, where the stock would then become stable and only contain flies who have the StanEx1 gene either on chromosome 2 or 3.

After stable stocks were achieved, these were crossed with stocks that contained the reporter p-element, LexAop:GFP. Brains were removed from L3 larvae of the offspring, cleaned, fixed, and stained with different stains to visualize gene expression of Insulin-producing cells in the *Drosphila* brain. These strains will be sent to Stanford for verification and potential submission into BDSC fly stock, as well as use in Stanford’s ongoing research. Successful students have the opportunity to achieve publishable research.

**SENIORS**

***Melike Akoglu, Jiwon Paul Moon, Benjamin Wolgang***

**Synthesis and Analysis of N-Layered Perovskite Single Crystals**

In the world today, the increasing application for superconductor materials is consistently growing and need for lower temperature superconductor materials is increasing at the same rate because of the wide application they serve, such as producing large-volume, stable, and high-intensity magnetic fields required for Magnetic Resonance Imaging (MRI). One group of crystals that are capable of low temperature superconductor tendencies are the N-Layered Perovskite Single Crystals. One specific type of N-Layered Perovskite Single Crystals are Ruddlesden-Popper phase single crystals. Ruddlesden-Popper phase single crystals are a family of single crystals consisting of two-dimensional perovskite slabs interleaved with cations. The purpose of this experiment was to grow single crystals that follow the Ruddlesden-Popper phase formula and exhibit superconductive properties. To create samples, compounds were explored through Pearson’s Crystal Database and if they weren’t previously synthesized, necessary components for the synthesis were sought. After stoichiometric volumes and atomic masses were calculated, the components (Cr2O3, MnO2, and Sn) were measured out into a boron nitride crucible and placed into a furnace for a previously calculated amount of time and temperature, and melted into a flux, followed by a cool down time. Finally, the samples were examined under a microscope for crystals and found crystals were mounted onto a metal slab in a veil for x-ray diffraction measurements. After that, the crystal was analyzed in a Raman microscope to determine the ability to conduct electricity without any resistance at low temperatures. The results confirmed that the crystal synthesized did in fact have low temperature superconductivity capabilities.

***Abinya Anand***

**Can Vitamin D Reduce Withdrawal Symptoms in Planaria?**

Depression, defined as feelings of prolonged sadness and anxiety, is a very common mental illness with multiple causes. In the United States alone, 10% of the entire population suffer from depression, leading to feelings of loneliness, anxiety, and even suicidality. One common behavior linked to depression is substance abuse, and/ or intake of any other central nervous depressant. The correlation between depression and drug addiction (known as Dual Diagnosis) has been observed in Planaria, an invertebrate flatworm, in the form of anxiety, which can be quantified using the Conditioned Place Preference Test (CPP). While there have been various medications proven to help treat depression and anxiety, studies have shown that vitamins can also aid in easing the symptoms. One such example is Vitamin D3. Receptors in the brain (chemical commanders) have been found, which may aid in increasing serotonin*,* which in turn improves and maintains mental health*.* However, the correlation between Vitamin D and mental health does not necessarily prove causation. In order to test for causation, Planaria were first submerged in an alcohol solution to induce symptoms of depression and anxiety. This was to keep all experiments consistent in levels of mental health, and eliminate any lurking variables. Next, they were entered into a solution of D3 and water in order to find whether it decreased symptoms of depression and anxiety, or not. Thus far, while results showed tested planaria reacting to alcohol, reaction to Vitamin D3 is yet to be recorded.

***Aaron Angeles, Ryan Schoenfeld***

**What Factors Have the Most Influential Effect on NBA Free Agents Signing Decisions?**

The main goal of every NBA team is to win the championship. In recent years, numerous NBA teams have tried to do this by acquiring top players in order to build a “superteam”. A superteam is a team composed of multiple superstar level players who has a strong chance of winning the championship. If a team can successfully predict where a free agent will be signing and what factors most impact their decision, they will be able to recruit potential free agents more effectively. The purpose of this study is to determine which factors have the most influence on a free agents signing decision. To carry out this study, multiple factors were analyzed, these include head coach strength, prior year team success, contract value/expected salary and franchise market value. A sample of about 40-50 players and their top four teams in contention to sign them was collected from basketball-reference.com. Each NBA team in contention was ranked 1-4, based on the strength of the analyzed factor in signing a certain player, with 1 being the strongest of the four teams. The weighting of each factor was determined by analyzing histograms using player data for each factor and determining what factor played the largest role in free agent’s decisions.

***Jasmine Bajaj, Christopher Collado***

**A Comparative Historical Analysis of Climate**

**In the Northeast Region of the United States (1940’S – 2000’s)**

Climate change has affected the Earth’s environment in many ways. Depending on the location, many areas have experienced extreme climate fluctuations which have resulted in increased global flooding, extreme weather and abnormal temperatures. Many scientist attribute man made sources for climate change including burning of fossil fuels, and deforestation due to over-population. The goal of this investigation was to use historical weather data to study climate trends in the northeastern United States comparing geographical and temporal data in rural, urban, and suburban areas from 1940 to 2005. Data was obtained from the National Climate Data Center and analyzed by comparing temperatures among three locations in New York State including Manhattan (urban), Mineola (suburban) and Bridgehampton (rural). To carry out this investigation the temperatures from each location were compared for the months of January and July. Data from each year that contained the minimum and maximum temperatures was used from each location and the differences in temperature were compared among 7, 10 year time intervals for July and January. Results showed that there was an overall increase in mean temperatures within each location. The greatest temperature increase occurred in the urban area with 72 days reaching temperatures over 95 degrees during the month of July between 1995 and 2005. Overall the temperature of the urban area was warmer than the suburban and rural areas.

***Christopher Collado – See Jasmine Bajaj***

***Jonathan Collado, Elias Gonzalez***

**Investigating the Effects of DEET-Containing Bug Spray on Planaria Locomotion**

All throughout spring and summer every year, millions of people all around the world take measures to protect themselves from mosquitoes and ticks. Bug and mosquito bites can spread extremely harmful, and sometimes fatal, diseases include malaria, dengue fever, and West Nile virus. In order to protect themselves from these possible diseases, many apply bug spray/repellent on their body. Many people believe this bug spray to be harmless. Most bug repellents contain a chemical called DEET as an active ingredient that repel bugs. The purpose of this project will be to examine the effects of DEET containing bug sprays on the locomotion of Planaria, in order to gain a better understanding of its effects humans. For this investigation, Planaria were placed into petri dishes filled with pond water and a certain concentration of DEET-containing bug spray ranging from 0 to 20 microliters. Locomotion was measured by placing a 0.5 by 0.5 centimeter grid under the petri dishes, and recording the number of lines crossed by the planarian. After conducting trials of two minutes, we concluded that; as the concentration of DEET increases, the locomotion of the Planaria will decrease due its presumed harmful effects on the human body. Results show that our hypothesis was true, as locomotion decreased from approximately 89 lines crossed at 0 microliters(control) to just 32 lines crossed at 20 microliters throughout the 100 trials. Future trials utilizing different concentration and brands of bug spray must be done in order to gain a better understanding of the effects of DEET.

***Alexis Davitashvili***

**The Design and Self-Assembly of Multi-Turn DNA Tensegrity Triangle**

In the 1980s, Nadrian P. Seeman discovered that the reliable self assembly of DNA could be useful for the scaffolding of microstructures, which led to the creation of the field DNA Nanotechnology. One of the main goals in structural DNA nanotechnol­ogy is to design 3D macroscopic objects with an underlying robust structure. Previ­ously, it was demonstrated that a DNA triangle motif can self-assemble via sticky-end interactions to form 3D crys­tals. The reported lattices using the two-turn tensegrity triangle had uniformed dimensions in all three directions (2, 2, 2 motif). The present study investigates the design and self-assembly of a 2, 2, 3 motif, which has 2-turn on two sides and 3-turn on the one side.

***Mike Delmonaco, William Liu, Kevin Zhou***

**Creating a General Convolutional Neural Network for Consumers**

Convolutional neural networks are very powerful statistical learning models, but too complicated for the average person to make themselves. The power of convolutional neural networks should be brought to the consumer in a way that is intuitive and easy to use. Our objective is to create a novice-friendly user interface to build, train and use convolutional neural networks. We accomplished this by creating a blueprint for a convolutional neural network and have the user create an instance of that blueprint: a neural network ready to be trained and used. Google’s inception model was used and retrained using a technique called transfer learning, saving time on training. Our results were the accuracy rate and training times of various neural networks’ predictions created from within the application. This data indicated the efficiency and accuracy of the neural networks created within the application. This project is important because it allows consumers and tech-novices to use the power of neural networks without needing any knowledge of programming. It is also useful for teaching about neural networks by having an intuitive example. This project is not intended to reveal anything more about neural networks, but simply makes them more accessible to the public.

***Elias Gonzalez – See Jonathan Collado***

***Austin Heller, Chase Schare***

**Can Planarians Make a Behavioral Association Between Vibration and Nicotine*?***

Learned actions are usually an advantageous response to some form of stimulus within the environment that an organism may reside in. Organisms learning to respond the same way to a repeated action is known as classical conditioning. Planaria have successfully been put through trials of classical conditioning in the past where conditioned planarians recognize their food was always in lightened areas. As a result, these learned behaviors were retained and passed on because the offspring were able to know to go to a lightened area to find food. The purpose of this experiment was to see if classical conditioning occurs when a vibration is occurring while an addictive substance, nicotine, is given to the planarians. Additionally, this experiment was aimed to see if these learned behaviors will be passed down through typical planarian asexual reproduction. After several repeated trials of pairing a vibration with subjection to nicotine, the vibration occurred without the exposure to nicotine. The behavior of the planaria without nicotine was observed and compared to the behavior of the same planaria while subjected to nicotine. It was hypothesized that planarians will associate vibrations with receiving a dosage of nicotine. Studies have found that other drugs of abuse produce sensitisation in planarians, and that withdrawal in planarians, which is visible by sporadic movement of the planarians, can be augmented or made more apparent based on dosage.

***Raphael Iskra***

**The Effects of Nitazoxanide on Bacterial Virulence Factor Assembly by the Chaperone/Usher Pathway**

Antibiotic misuse has caused bacteria to evolve resistance, raising the potential for widespread, devastating health crises. Novel therapeutic alternatives to antibiotics seek to target virulence factors, which facilitate bacterial pathogenesis and are secreted by outer membrane complexes. The chaperone/usher (CU) pathway is a conserved assembly and secretion system in Gram-negative bacteria that is responsible for the biogenesis of many virulence factors. The anti-parasitic small molecule nitazoxanide (NTZ), has been shown to decrease surface expression of several CU assembled pili in E. coli, suggesting its action against the pathway. In a previous study, it was shown that NTZ also caused a dose-dependent decrease in surface expression of the fraction 1 (F1) capsule, a CU virulence factor utilized for host immunoevasion in Yersinia pestis, the causative agent of bubonic plague. The purpose of this study was to determine how NTZ inhibits the formation of the F1 capsule by examining the drug’s effects in different stages of F1 capsule biogenesis. Through analysis of periplasm and outer membrane (OM) fractions of treated bacteria, it was discerned that NTZ's inhibitory effects are due to fewer OM usher molecules, rather than fewer F1 capsule subunits being produced by the bacteria. These findings demonstrate that NTZ has a unique mechanism of action against CU assembled virulence factors, and likely targets a common biogenesis requirement in Gram-negative bacteria. Further investigation into NTZ’s interaction with CU systems may lead to the development of a novel class of therapeutics to circumvent the development of antibiotic resistance in pathogenic bacteria.

***Daniel Lee***

**Wind Field Estimation using Deep Convolutional Neural Networks**

Accurate estimations of wind fields, cloud direction and speed, are crucial for reliable solar irradiance predictions. Since current wind field models require impractical expensive instrumentation, computational geometry algorithms based on low-cost solar irradiance sensor-networks have been developed. However, these estimations are unstable due to noise sensitivity and inability to account for complex dynamic weather conditions. To overcome such problems, a sensor-based deep learning wind field model, named WFnet, was proposed using an adapted Convolutional Neural Networks. There are two major challenges in developing the estimation model: 1) sensor spatial locality information must be encoded within input data, and 2) careful tuning of deep learning structure is necessary to optimize performance. To resolve these challenge, novel spatial-temporal sensor data mapping schemes were implemented and a customized deep learning architecture was developed. WFnet was trained and evaluated from realistic simulation data and adapted historical Long Island Solar Farm data. The developed deep learning model significantly outperformed previous wind field estimation models with up to four times error reduction. This demonstrates promising potential for practical deployment of WFnet on solar farms.

***Alex Horowitz, Brendan McCaffrey, Eric Nigro***

**Determining an Optimal Transition Metal to Split Water into Oxygen Gas**

The need for efficient renewable energy sources is greater than ever. Solar energy is an abundant source of energy of clean energy. Each hour 430 quintillion J of energy from the sun hits the Earth. In comparison, the total amount of energy that all humans use in a year is 410 quintillion J. The purpose of this project was to find materials that when exposed to light split H2O molecules into O2 molecules, H+  protons and release renewable energy. Currently, solar cells use a semiconductor that absorbs the light energy and pulls an electron off the hydrogen. The issue with the production of hydrogen or oxygen from water is the lack of efficient, inexpensive, and stable semiconducting metals. Trends in research suggest that transitional metals are more successful in yielding O₂; however, the material is not the only determinant for successful oxygen production, but the ratio of the metals to each other can also affect how efficient water is split. A mock solar cell was created using a chosen group of three metals that were combined in a 5mL 0.005M solution, as well as a reference solution of Nickel, Iron, Cobalt. The glass plate was heated then baked at 500°C. Afterwards it was placed in a box where a UV light (to simulate the sun) was shone upon it and pictures were taken at 10 second intervals for 30 minutes. Data was analyzed by ImageJ software.

***William Liu – See Michael Delmonaco***

***Brendan McCaffrey – See Alex Horowitz***

***Paul Moon – See Melike Akoglu***

***Jake Nieto***

***In Silico*Analysis of Bioactive Ligand Binding to**

**Human Liver Fatty Acid Binding Protein (FABP1)**

Usage of cannabinoids for their analgesic, antiemetic, and appetite stimulating effects have increased due to the continued legalization of medicinal marijuana in the United States. Tetrahydrocannabinol (THC) is the primary source of marijuana’s psychoactive properties, and medicinal properties. THC is a highly hydrophobic molecule and very insoluble in cytosol, so metabolism in hepatic cells require the assistance of carrier proteins, such as the liver fatty acid binding protein (FABP1). FABP1 inhibitors block THC cellular uptake and THC metabolism. Lowering THC metabolism increases THC levels in the blood and brain, which amplify THC’s medicinal effects. Understanding how THC and other ligands bind to FABP1 can point the way to future cannabinoid-based drug therapies, and uncover potentially harmful drug-drug interactions. FABP1 binding is studied by comparing key interactions between FABP1 residues and its ligands. Ligand docking simulations were generated and used to predict binding poses for FABP1 ligand complexes. These poses were used to conclude which ligand structures lead to the strongest binding, and design a potential synthetic FABP1 inhibitor (Mod CBD). From this study, an improved understanding of FABP1 ligand binding was gained, an essential step towards uncovering potentially dangerous drug-drug interactions and creating more effective patient therapies.

***Eric Nigro – See Alex Horowitz***

***Samuel Petruzzi***

**A Novel Generator Configuration Utilizing a Permanent Magnet Array**

An increasingly larger sector of the economy has become focused on renewable energy sources. Wind power is promising due to renewability and the variety of locations where it can be generated, but the expense involved is a large hindrance. Further optimization of wind power generators may be able to counter this expense, allowing further growth of this clean energy. Two types of wind turbines exist, classified as vertical or horizontal. Vertical wind turbines have an axis transverse to the wind’s direction. Vertical wind turbines are advantageous due to the fact that they do not need to be pointed in any specific direction and the generator component can be located on the ground for easy access. This study is concerned with the construction of a generator for vertically oriented wind turbines through the use of a novel internal structure. The structure utilizes an axis of magnets arranged with opposing poles facing one another to generate power via rotation when surrounded by coiled wires. In this study, the generator’s design and materials were first described using Finite Element Method Magnetics software. A finite element analysis was then performed and the structure was analyzed to verify its success if actually constructed. The final goal of this study is to construct the generator and test its success via a motor attached to the rotary axis that would mimic the rotational force applied by the wind. If successful, a patent will be filed and the technology will start to be implemented in turbines.

***Trevor Rosenlicht, Nicholas Greco***

**The Strength of Fantasy Football Projections for Quarterbacks**

**In the 2016-2017 Regular Seasons**

This project was designed to compare predictions made each week for quarterbacks by Fantasy Data API to the actual results that occured in each of these weeks in the 2016-2017 regular seasons. Fantasy football is a very popular form of fan involvement and about 33 million people participate in fantasy football each year. The four major statistical categories that were analyzed were passing yards, touchdowns, interceptions, and total fantasy points. These categories are critical on measuring the performance of a quarterback and people rely on these predictions for how they decide what players to draft, play, or pick up out of free agency. There were 10 quarterbacks analyzed. Through the utilization of Microsoft Excel formulas for calculating the root-mean-square deviation (RMSD), a correlation between the predictions versus the actual for the four major categories were calculated in order to assess the accuracy of the predictions and to provide insight on whether people should purely rely on these predictions when making decisions. RMSD is a frequently used measure of the differences between values predicted by a model or an estimator and the values actually observed as well as for measuring for accuracy, to compare forecasting errors of different models for a particular data and not between datasets, as it is scale-dependent.

***Chase Schare – See Austin Heller***

***Ryan Schoenfeld -See Aaron Angeles***

***Anoop Singh***

**A Multilinear Approach to Forecasting the El Niño Southern Oscillation**

The El Niño Southern Oscillation (ENSO) is a teleconnection located in the mid-Pacific. Due to its global effects, forecasting ENSO is a component for predicting global climate patterns, including extreme phenomena. Understanding these events is of critical importance for the concerted effort in understanding and preparing for climate change. However, because of ENSO’s extreme variability it has proven to be difficult to forecast. Previous ENSO forecasts have used nonlinear and chaotic modelling approaches, however, studies have attempted forecasting ENSO using linear forecasting methods, proposing the randomness associated with ENSO occurs from external factors (Thompson and Battisti, 2000). In this study, a multilinear approach was implemented in order to forecast ENSO. Four climate systems were proposed to accurately predict the phenomenon. The predictors used in this study were found to contribute to the occurrence of ENSO, which could help further explain the phenomenon as well as demonstrate the external contributors to ENSO. The models in the study are statistically stronger than the predictor sets in Pegion *et al.* (2017), a review discussing the importance of sets of predictors and a linear approach to forecasting ENSO. In the future, the efficient procedure outlined in this study can be used to predict all ENSO seasons up to one year in advance.

***Cuneyd Tasoglu***

**A Study of Storm Surges in NYC and Their Meteorological Causes**

Despite the high population density of modern New York City (NYC), the current drainage system is a century old and lacks modern safety standards. The system cannot handle more than a few inches of rain per hour, indicating that there is a high risk for damages that could arise from flooding. For example, flooding caused by Hurricane Sandy, resulted in 72 deaths and property damage in excess of 50 billion dollars. One consequence of storms is flash flooding, which is a cause of concern, due to the high economic costs and fatalities associated with it. As there is not a lot of research that has been conducted on flash flooding in NYC, the aim of this study was to find meteorological patterns associated with flash flood events to improve predictions. It was hypothesized that atmospheric instability is a major contributor to flash flood events. Data from various databases such as three rain gauge locations in NYC and satellite data were used to look for a connection between extreme precipitation events (>50.8 mm) and flash flood events. Additionally, weather images from the NARR Dataset were generated to observe meteorological patterns that occur during flash flood events. Results thus far have indicated that some flash flood events occur during extreme precipitation events. However, not all extreme precipitation events coincided with flash flood events. This provides evidence that NYC’s drainage system was unable to contain less extreme precipitation events that lasted for a few days.

***Benjamin Wolgang – See Melike Akoglu***

***Angela Zavala***

**Does the Presence or Absence of a Hydroxyl Group Affect**

**Bacterial Growth Using Thymol or p-Cymene?**

The purpose of this study was to determine which compound, thymol or p-cymene, has a greater antimicrobial properties. Thymol is a monoterpene phenol found in thymus essential oils, it is known for its potent antimicrobial activity. P-cymene is also a monoterpene and is found in over 100 species of plants, and is known to have a range of biological activity including antimicrobial effects. The antimicrobial properties are due to destabilization of the membrane of bacterial cells. I hypothesize that thymol due to having a hydroxyl group will have a greater effect on bacterial growth than p-cymene. As the hydroxy group will cause a decrease in pH gradient across the cytoplasmic membrane, resulting in alterations of membrane permeability and in leakage of intracellular materials. To carry out this study, I tested the same range of volumes starting from 75ul-500ul of both thymol and p-cymene to compare the antibacterial activities of both extracts. LB and E. coli was added to all the tubes of thymol and p-cymene respectively. The control group had only bacteria and LB. All culture tubes were placed in the incubator overnight at 37 °C. The next day the absorbance was measured with a spectrophotometer. Both thymol and p-cymene data showed they had some antibacterial property as the volume increased the absorbance decreased showing less bacteria were in the culture tubes. Thymol results were more prominent.

***Kevin Zhou – See Michael Delmonaco***

**UNDERCLASSMEN**

***David Abbe, Dev Dokania***

**Cabbage for Caterpillars:**

**A Study of How Temperature Affects Eating Habits of *Pieris rapae***

Cabbage White Caterpillars and maybe even more insects might have different eating habits under different temperatures. They are found in many places such as North America, Asia, Europe and much more. The caterpillars were fed cabbage and the different temperatures that were chosen were 17 degrees Celsius, room temperature, and 33 degrees Celsius. They were kept in a cup with a mesh cover over it, throughout all the experiments. The first couple of times we did the experiment it did not go so well. All the caterpillars had died. We thought they were dying because they did not have any water do drink. The next couple of times we did the experiment we put water and cabbage in their cup. Some of the caterpillars were still dying while some were surviving. One reason may be that cabbage may contain too many pesticides for them. In future research we will add water and organic cabbage or any other organic vegetable that Cabbage White Caterpillars eat. This project might help others preserve their vegetables that they grow from these Caterpillars.

***Ethan Abbe***

**The Wreck of *The Richmond* and its Effect on United States Salvage Law**

The whaling ship The Richmond was wrecked in 1849, on an island in the Behring Straits, over 5000 miles away from the nearest safe port. The master of the ship, Phineas Winter was persuaded to 'sell' the cargo of the ship instead of it being considered salvage in exchange for transportation for him and his crew to a safe port and homewards. This transaction of the cargo of the Richmond to the salvor ships had no bill of sale. The libellants, or the original owner of the Richmond and its goods, filed a libel suit under the district court of Brooklyn, New York, eventually carrying the case up to the circuit court of New York. The libel suit was filed on the basis that the cargo should have been considered salvage, and as such given a percentage of the profits to the original owner, under the claim that the master of the ship was forced to sell the cargo of the Richmond under distress and fearful for his and his men's lives. This case eventually was brought before the Supreme Court of the United States, who maintained the circuit court's decision, citing the fact that the master of the ship was under distress and could not have made a reasonable decision to sell at the time of the original sale, thus proclaiming that that it was considered salvage.

This case helped to expand the definition of when something was considered salvage. To carry out this study, I searched through the archive of the Cold Spring Harbor Whaling Museum, organizing and studying the Richmond files. I also have looked through law briefs from the time period, concerning the case of the Richmond, as well as the background of the Richmond leading up to the wreck. In the end, the Supreme Court agreed with the circuit court in that this was considered salvage, as any sale of cargo without the corresponding bill, while under reasonable duress, will not be considered valid.

***Karen Abruzzo***

**Determining 2 Pallas's Orbit Using Multiple Observations**

2 Pallas is the third largest in the system with a diameter of 512±3 km. It became the second asteroid to be discovered on March 28, 1802. Although it has been over 200 years since 2 Pallas’s discovery, characteristics of the asteroids such as the orbit change over time and it is important to make sure the data is up to date. There are many factors that can affect an asteroid’s orbit, such as gravitational disturbances from other planets and collisions with other objects. Tracking these changes may lead to a better understanding of the Solar System and how it formed. I used Stellarium, a program that uses public data on objects in space to estimate their position in the sky, to locate an area around where I could spot 2 Pallas. I used a modified canon camera and a Celestron C6 telescope to take five minute exposures of Asteroid Pallas. I took exposures on four nights over a four month period. I then removed the noise from the exposures caused by the camera and the telescope lense using DeepSkyStacker. These images, along with coordinate data and time stamps, were uploaded into Find\_Orb, a program that uses a set of observations to determine the orbit of an asteroid, comet, or natural or artificial satellite.

***Ariana Aghili, Shamtej Rana***

**Food of the Future: Oyster Mushrooms as an Alternative Food Source**

This project was designed to determine the most effective habitat for growing Oyster Mushrooms (Pleaurotus ostreatus), with the intention of the seeing if food for human consumption can be created from trash. The Oyster Mushroom was chosen because it needs little to no nutrients to thrive. If recycled paper and trash are composted, then an abundant supply of the Oyster Mushrooms could potentially be grown because they require even less nutrients than the trash provides. The Oyster Mushroom is a common, commercially grown mushroom used in food production that is also helpful in mycoremediation. Mycoremediation is a process that occurs in mushrooms and allows them to break down toxins and decontaminate an environment. A five-pound block of mushroom spawn was reduced to five sections, which were grown in separate containers. One section was taken apart and was used to plug holes in two separate logs and allowed to grow as a control group, since the logs represented the mushrooms natural growth habitat. The remaining three sections were placed in separate bowls, one for each experimental group, these included 50% paper/50% trash, 100% paper, and 100% trash. Every week, measurements for surface area of mushroom growth, and density of the bowls were recorded.

***Aryaram Anand, Eric Huang, Luke Maciejewski***

**The Effects of Volatile Organic Compounds on the Growth of *Raphanus sativus***

Volatile organic compounds (VOCs) have a negative impact on the environments they are exposed to. In this project,seeds of *Raphanus sativus* (radishes)were sprayed with various VOCs such as hexane, heptane, methylene chloride and ethanol. Petri dishes were set up with radish seeds and sprayed with various VOCs. These were observed as they grew and measured. In our findings we found that all VOCs killed the radishes quickly, but hexane accelerated plant growth for the first two weeks, but were not in good health. For example, the longest plant sprayed with hexane was 5.8 centimeters, while the longest plant sprayed with only water was 3.6 centimeters after 2 weeks. Although hexane made the radishes grow faster, it killed them within a few weeks. When we tested methylene chloride only 2 plants were alive at two weeks and measured 1 cm and 0.5 cm long. However those two plants eventually died. With the ethanol, the plants were dead in a matter of days. This project supports the idea that VOCs are harmful to plants.

***Jonathan Appel, Philip Kwiencinski, Joseph Strickland***

**NASA Challenge: Micro-expulsion**

Microgravity, or weightlessness, has distinctive effects on physical and biological phenomena which can inform exploration-related research questions and advance our knowledge of Earth-based processes, including insights into fundamental scientific investigations. Researchers from around the world study the effects of microgravity on physical phenomena such as developing technology for future space missions. The purpose of this experiment was to design and build objects that sinks in water in normal gravity but can be expelled as far as possible from the water during a free fall. The expulsion from the water had to result from the hydrophobic properties of its surface. During testing, the objects were put into vessels of water and dropped 79 feet in NASA’s drop tower. During the fall, objects and water experienced 2.2 seconds of apparent near weightlessness. Thus far the project is still being tested by NASA.

***Candace Arneaud, Izza Malik***

**Allelopathic effects of *Fallopia japonica* tested on the Common House Plant**

Japanese Knotweed (*Fallopia japonica*), a prominent invasive species in North America, is known for its unique allelopathic properties, specifically rhizome activity. Rhizomes, from Japanese Knotweed, are responsible for stunting the growth of neighboring plants in the area. This property contributes to the plant's ability to sporadically grow and obtain the qualities of an invasive species. The purpose of this experiment was to determine whether the allelopathic properties of the rhizomes can be successfully extracted and used as a natural herbicide to stunt the growth of neighboring plant communities and also determine if leaves have an allelopathic effect. The juice and powder were then mixed together. Extracts were then made into several dilutions (1%, 10%, and 20%). To carry out this study, leaf and root derived extracts were tested separately during experimentation and applied at specific times. Radish plants were grown until sufficient height was obtained. Afterwards, the radishes were sprayed with either leaf or root extract. Observations were recorded on a daily basis, while watering conditions and sunlight exposure remained constant. It was hypothesized that the rhizomes extracted from both leaves and roots would stunt the existing radish populations' growth, because Japanese Knotweed contains a chemical inhibitor within its rhizomes, but root effect will be greater. The results of our experiment revealed that there was a significant difference in plant heights between the different dilutions. At the end of the fifth week period, the average number of leaves for all dilutions decreased at a steady rate until zero. Plants sprayed with 20% dilution experienced the most rapid decline in growth, but plants sprayed with 10% had the least impact. Also, all dilutions displayed a decline in at least half of their original population.

***Riley Bode, Faizali Rahim, Vishwanath Madhavan***

**Tropic Response of Radish Plants to Light**

Phototropism is a plants growth response towards light. A light is required for plants to grow by allowing it to produce glucose through photosynthesis to provide energy for its life functions. Therefore plants have adapted a mechanism to capture as much light energy as it can. The purpose of this experiment was to test for optimal plant growth under different light source locations. Radish seeds were chosen because they are easily accessible and they have a short germination period. Seeds were placed in petri dishes for about forty-eight hours to begin the germination process. The petri dishes were then moved to a specially designed growing chamber that exposed them to light from above and/or below. Two boxes were placed over the setup to block out additional light influences. Light locations were varied to test for how location affects the growth of radish seeds. Seeds were grown for about one week and the height was recorded. Our hypothesis is the radish seeds will grow towards the top light source when only one the top light source is on and will grow towards the bottom light source when the bottom light source is on.

We reject our null hypothesis and accept the alternative hypothesis due to the p-value of the single factor ANOVA being greater than 0.05. The p-value was 0.22, meaning that there was no difference between the growth of the seeds in the various lighting conditions.

***Joshua Brodsky, Ethan Dettmann, Soad Hossain***

**Behavioral Patterns of Planarian Based on Different Light Stimuli**

Ancient humans had to spend a lot of time outdoors to hunt and gather, they were constantly outside out of lack of surplus resources. Within the last couple of centuries humans have been spending more and more time inside due to technological advancements and even more recent is the invention of artificial light. Some studies have shown that the artificial light may be hurting humans and affecting their behavior. In this study to test the effects of artificially colored light on organisms, planarians were tested using many intensities and colors of light. Planarians have two photoreceptors on their head that can detect different light intensities and color variations. To test the reactions of the planarians the following was recorded, speed, movement, and amount of time the planarian spent in each color intensity. The planarians were tested in a petri-dish with specific colored light, with half the petri-dish being covered by a thin sheet of saran wrap with the same color as the light to vary intensity of the color. The results show that the planarians’ movement and speed do not depend on the color or intensity of the light. Even though the planarians movement wasn’t dependent the amount of time spent in the intensity of light is. The amount of time spent on the intense red light compared to the weak red light was significantly higher than the other colored lights. This leads the observer to believe that the planarians preferred intense red light the most.

***Jayson Bromberg, Jack Pettit, Craig Pihlkar, Marlee Reiter***

**Backpack-O-Tron 5000**

According to KidsHealth, doctors and physical therapists recommend that students carry no more than 10-15% of their body weight in their backpacks. However, numerous students carry more than that amount. When a backpack is placed incorrectly on a student’s back, the weight may be pulling them backwards. As a result, the student may arch their back. This makes the spine compress unnaturally which leads to back, neck, and shoulder pain. Students also find it difficult to keep their bag organized. Our backpack will help to decrease these back problems while refining organization. Many different gadgets improved these everyday problems. Our bag is lightweight, has a massage feature along with memory foam for back and shoulder support. It also has a metal frame for stability which was designed for back pain by a pervious student team. We included USB ports to charge electronic devices, a light inside the bag so the user is able to see when it is dark, and multiple pockets and holders to enhance organization. The bag contains drink holders along with being waterproofed to protect the backpack against spills, and an insulated pouch to keep food warm or cold. We incorporated all of these ideas into one bag, essentially creating a revolutionary bag that will decrease back problems and improve organization.

***Anthony Cancro, Soobin Lee***

**The Effect of Novel Objects on the Hermit Crab (*Pagurus longicarpus*) Behavior**

Boldness is a willingness to get things done despite the risks. It involves elements of exploration and risk-taking. For example, when an organism encounters a novel object, it includes a degree of risk to explore the new stimuli as there is a potential it could be dangerous. Studies have shown boldness to be repeatable, heritable, and positively correlated to aggressiveness. Boldness is measured in different ways depending upon the species and context of interest, with the most common methodologies being exploratory behavior in a novel environment, investigation of novel objects and recovery time when startled. The purpose of our investigation was to determine the effect of novel objects on hermit crab behavior. Three colored shells from different gastropods were obtained (blue, red, bronze) and used as novel objects. One was placed in a tank that had a piece of graph paper underneath and outlined into quadrants. A hermit crab was placed into the tank with the shell and the behavior was video recorded for 5 minutes. This was repeated for each shell. Afterwards, the video was analyzed for movement and how long the crab spent in each quadrant. We hypothesized the red shell would elicit a more exploratory response as it resembles the natural color of the hermit crabs shell, while blue and bronze would elicit minimal to no exploratory response as the hermit crab would perceive it as a predator. Thus far results show that the crabs spent much time at the Red colored shells over the uncolored shells. Due to large error bars we are not confident in these results and need to run further tests. Due to time constraints we were unable to test the blue and bronze shells.

***Kathy Cao, Maheen Khan, Yasemin Sahin***

**Analysis of the Cellular Stress Response of *Acinetobacter baylyi* to the Loss of lnt, hslJ, and yjiM Function**

Over time, bacteria have evolved to gain antibiotic resistance. Antibiotics function by targeting different areas of cells, such as DNA, ribosomes, and the cell wall. Since antibiotics constantly target the same areas, those areas are more likely to gain resistance. Because of antibiotic resistance, alternative targets are needed to eliminate bacteria; one such target is Lnt. For the purposes of this study, Lnt will refer to the enzyme, lnt will refer to the gene, and Δlnt will refer to the mutant in which the gene lnt is removed. Lnt is an essential enzyme in the synthesis of lipoproteins, which have vital functions in the cell. When the lnt gene is removed, other genes are upregulated as a stress response. These upregulated genes include hslJ, a gene that codes for a heat shock protein, and yjiM, a gene with an unknown function. The purpose of this study was to analyze the cellular response of Acinetobacter baylyi to the removal of genes (hslJ and yjiM) that are expressed at higher levels in response to the deletion of the lnt gene. Acinetobacter baumannii, a pathogen that causes nosocomial infections such as bacteremia, ventilator-associated pneumonia, and meningitis, has exhibited multidrug-resistance in many case studies. A close relative of A. baumannii, A. baylyi is non-pathogenic, Gram-negative, and able to survive the removal of the lnt gene. Both A. baumannii and A. baylyi are able to survive the removal of the lnt gene. It was hypothesized that if a mutant of A. baylyi was constructed lacking the hslJ or yjiM genes, the cell would survive, but not grow as well as wild-type (WT). To test this hypothesis, the following experiments were conducted: an antibiotic disc-assay experiment, a growth rate experiment, and a temperature shock experiment. The antibiotic disc-assay experiment indicated that antibiotics that target cell wall synthesis in earlier stages are more effective in eliminating Δlnt. The growth rate experiment indicated that ΔhslJ and ΔyjiM have similar growth rates to WT, while Δlnt has a slower growth rate. The temperature shock experiment indicated that ΔhslJ and ΔyjiM grew less in extreme temperatures when compared to WT. This data partially support the hypothesis that ΔhslJ and ΔyjiM grow less than WT since they grow as well as WT in ideal temperatures but not in non-ideal temperatures.

***Kaitlyn Cestaro***

**Essential Oils: The Mental Health Edition**

Mental illness is a taboo topic that affects about 20% of the population in the United States. These illnesses range from anxiety disorders to schizophrenia and bipolar disorder. Unfortunately, people who suffer from mental health disorders tend to be at higher risk for other medical conditions like depression, and suicide. If untreated, they are more likely to become unemployed, drug-dependent and apathetic. Pure essential oils are derived naturally from plants. These plants have been around for thousands of years. Essential oils can be diffused or inhaled, applied topically, and ingested. People use the oils to improve their health and well-being. Young Living is a popular essential oil manufacturer that creates pure, therapeutic grade essential oils. In today’s society, technology is occupying everyone’s lives. The purpose of this experiment was to create an app using MIT App Inventor that would allow users who are experiencing symptoms related to their mental health disorders to easily identify the triggers and correlate them to the essential oil that would best benefit the user’s needs. For example, if an app user was feeling restless and having a difficult time sleeping, the app would tell them that the essential oil lavender would be helpful and give them information on using the essential oil. The app will link directly to a website I created with essential oil information as well as the Young Living website. It focuses on the most common, most accessible essential oils and the most common, identifiable symptoms of mental illnesses.

***Michael Chacon, Joshua Lang***

**Conditioning of Crabs**

Operant conditioning is a learning process through which the strength of a behavior is modified by a reward or a punishment, and it is used for studying cognitive aspects of brain function. B.F. Skinner was the father of operant conditioning and creator of the operant conditioning chamber. He would place a rat in the chamber and when the rat correctly performed the desired behavior, the chamber would deliver a reward. Operant discrimination learning was studied in invertebrates, by training green crabs to press a lever for a food reward and the American lobster was conditioned to discriminate light stimuli of different intensities. They were given a food reward every time their claw gripped a sensor bar of the correct light intensity and they were able to recondition the crab to identify a different light intensity. The purpose of our experiment is to see if we can condition green crabs to knock over a blue colored dowel for a food reward, then see if they can identify the colored dowel among other different colored dowels. A crab was put into a testing station with a blue dowel and was timed how long until the dowel was touched or knocked over, where it was then given a reward. Afterwards, the crabs were tested to see if they could identify a colored dowel among many other colored dowels. Our hypothesis was the crabs will be able to knock over a dowel within a minute. Our results showed our hypothesis was supported and the crabs were able to knock over the dowel within the designated time. This experiment will help further our knowledge of conditioning on invertebrates.

***Gabriel Chan***

**Using a Neural Network to predict Solar Flare Flux and CMEs**

Coronal mass ejections (CMEs) are giant clouds of solar plasma released from the Sun during strong, long-duration solar flares and filament eruptions (1). When these clouds of magnetic plasma interact with the Earth’s magnetic field, they can disrupt electrical installations resulting in events such as the 1989 Quebec blackout, which took down the entirety of Quebec’s power grid for 12 hours. Although early prediction of CMEs can prevent large scale damage, a major problem for astronomers is that there is a lack of models for early prediction of CMEs.

The goal of this project was to predict CME events using computer learning (2). First, a Long Short-Term Memory (LSTM) recurrent neural network (NN) was coded in Python (3). Then, the NN used the CME data recorded by the SOHO-LASCO satellite to predict the occurrence of a high-flux solar flare. Since high-flux solar flares are typically accompanied by large CMEs, this allows for the prediction of potentially dangerous CMEs (4).

Using the SOHO-LASCO database, data on all CMEs in the years 1996 to 2017 was obtained (5). The neural network was coded to extract a) data on CMEs for each 24 hour period and b) whether or not a high-flux solar flare occurred during this time period. The neural network was trained with this data from October 2003 and July 2012, when major CMEs occurred, and January 2017 and May 2015, when no major CME events occurred.

The NN was then used to predict the likelihood of a high-flux solar flare for the month of August 2016 using data from July 2016. The NN predictions were compared to predictions made by a simple best fit line. Preliminary results show a 76% accuracy for the prediction algorithm as compared to 34% for the best fit line.

***Annika Chang, Jodi Consul***

**The Effect of pH on Regeneration on Planaria**

Ocean acidification is a significant problem in our world today, as it can affect all parts of the ocean deep and coastal. These effects can include the decreases in an organism’s survival, growth and development. The organisms presented here are planarians which are good models to show how ocean acidification can affect organisms, based on their regeneration. To see how planarian regeneration can be affected by increasing levels of carbon in the oceans, hydrochloric acid and sodium hydroxide were used to change pH levels of Artificial Pond Water (APW). Before our experiment, we also tested the survivability of planarians in different pH's. The levels that allowed for the planarian's survival ranged from pH 4 to pH 11. Then planarians were placed into the different levels of pH solution and cut in half, transversely, and examined for their regeneration time. Regeneration counted once obvious eyes formed on the tail part of the planarian. Our hypothesis was that the planarians will become stressed, which results in a longer regeneration time, if the pH of APW increases or decreases. Based on the results, there was no statistically significant trend showing a relationship between the pH levels and the regeneration.

***Kristen Chao, Daniel Czop***

**Testing the Efficiency of Different Metal Catalysts in Water Electrolysis**

With the world’s rapid consumption of finite resources, integrating alternative forms of energy is crucial for reducing our carbon footprint and preserving the environment. A promising alternative is the electrolysis of water to hydrogen and oxygen, as the gases produced can be used as a fuel source. Since the water oxidation process is sluggish due to the energy required to complete the half reaction, the focus of this project was to determine which catalyst groups generated the most oxygen in electrolysis, as that would be analogous to its aptitude as an oxidation catalyst. Using the HARPOON (Heterogeneous Anodes Rapidly Perused for Oxygen Overpotential Neutralization) experiment setup, catalyst groups consisting of transition metals were tested to analyze their effectiveness in a water electrolysis experiment. Oxygen production was observed in a degassed field for each group. The levels of oxygen produced were analyzed in the computer program JMAP, using a processor to determine the most successful solution ratios by measuring “brightness values.” These values were recorded as there is a direct correlation between catalyst efficiency and brightness value.  Results demonstrated that catalyst groups consisting of Iron and Nickel had the most success in this investigation, thus highlighting their high catalyst potential in water oxidation. Research regarding the incorporation of sustainable, alternative energy sources is critical as non-renewable resources continue to diminish. Thus, an extensive understanding of effective catalysts that can be utilized in the water oxidation process can help expedite the transition into cleaner energy.

***Kevin Chen, Jack Flanagan, Paul Park***

**The Effect of Diphenhydramine on Planaria**

Diphenhydramine (Benadryl) is a first-generation antihistamine used to alleviate allergy symptoms, however, it also has a sedative side effect. Antihistamines work by blocking histamines, attaching to receptors, preventing the compound from carrying out their functions. First-generation antihistamines don’t discriminate between which histamine receptors they block, causing an effect on the regulation of sleep and wakefulness, causing drowsiness. The purpose of this project was to determine the effects of diphenhydramine on planaria. Planarians were chosen because they have similar neurobiology to humans and are a model organism for assessing toxicity. We hypothesized that diphenhydramine would have a negative effect on the motor functions of planarians causing less mobility due to its calming and relaxing effect. Planarians were placed in petri dishes with various percentages of diphenhydramine. A line crossing assay was performed where the number of lines crossed in 5 minutes was recorded. Artificial pond water alone was used for the negative control. The data gathered supports our hypothesis that Diphenhydramine has a negative effect on the motor functions of the planaria. This study was conducted to show that planaria will react to the side effects of medicine in a similar way as humans do, and because of this can be used in future tests to determine possible side effects of medicine.

***Nathan Cheung, Alexandra Ramotar, Tasneem Zahran***

**The Effect of Dietary Restriction on the Physiological Aging of the Digestive Tract of *Drosophila*.**

Scientists have been using model organisms to compare and better understand human behavior and anatomy. *Drosophila melanogaster*, or fruit flies have been commonly used to compare with humans physiologically. The similarity between *drosophila* and human gastrointestinal (GI) tracts have made them extremely valuable in studying GI characteristics. As flies age, the cells within the GI tract become increasingly degraded and begin to malfunction, allowing the cells to become more permeable malformed. By adding blue food dye into the fly food the progress of the degradation can be tracked by quantifying the amount of blue present in the GI tract of the fly, this is commonly referred to as the "Smurf Protocol". The purpose of the experiment was to determine if dietary restriction upon flies affect the physiological aging of the fly. This was done by separating 15 male flies into 4 groups all with blue food dye. The first group contained standard fly food, the second group had only oats, the third group had both oats and bananas, and the fourth had bananas, oats, yeast and sucrose. The nutrient intake of the drosophila was restricted as the alternate food sources did not contain all the nutrients needed by the drosophila in order to survive. After 30 days the guts of the flies were dissected, photographed under similar lighting conditions, and analyzed in Adobe Photoshop to measure the saturation of blue. We hypothesized that the more restrictive the diet, the higher the amount of blue will be present, showing an older physiological state. The most restrictive diet is the group with only oats because it contains only one food source. The flies with only oats will have the most deteriorated GI tracts and the most blue would be shown. Data is currently still being collected.

***Faith Chi, Hailey Katz, Olivia Vasselman***

**How do Algal Blooms Affect Oxygen Levels in Water Incorporated with TAP Media?**

The purpose of this experiment is to investigate how algal blooms affect oxygen levels in water incorporated with TAP Media (freshwater).  We chose this project because it correlates to where we live. Long Island waters are filled with algal blooms due to its highly populated area. Long Island’s great population causes an excess amount of waste, (fertilizer, detergents, food and human/animal waste). This waste ends up in runoff that that travels through sewers and streams to local waters on, and surrounding Long Island. These bodies of water already have algae naturally growing in them, so when the contaminated runoff is poured in, it provides excess nutrients which forms a “bloom”. To test this we added different amounts of fertilizer to four flasks with Chlorella algal culture. After 12 days the dissolved oxygen (D.O.) content was measured in each flask. In the control had 8 ppm D.O., flask #2 (0.5 grams of *Scotts Fertilizer*) 7.7 ppm D.O., flask #3 (1 gram of *Scotts Fertilizer*) 4.7 ppm D.O., and flask #4 (1.5 grams of *Scotts Fertilizer*) 2.5 ppm D.O. As the amount of fertilizer added increased, the dissolved oxygen content decreased. In conclusion the decreased dissolved oxygen content was due to the nitrate and phosphate found in the fertilizer. They fueled the excessive growth of algae. When the algae died and decomposed, this decomposition of the algae lowered the dissolved oxygen in the water.​

***Tyler Chipetine, Nicholas Gembs***

**The Effect of Household Remedies on *Serratia marcescens* and Other Bacteria Commonly Found in Urinary Tract Infection.**

Since ancient times, people have been using natural remedies to heal wounds, burns, and infections (Kessler, 2017). Urinary Tract Infection (UTI) is a bacterial infection that commonly occurs and reoccurs in women due to a vulnerability of a smaller urethra, giving bacteria a shorter distance to travel to reach the lining of the bladder, giving the immune system less time to eliminate the bacteria. UTI can be treated with antibiotics, but these often have side effects such as nausea and are susceptible overtime to antibacterial resistance. Many studies have shown that home remedies such as cranberries can be used as natural and more cost-efficient treatments than common antibiotics. The purpose of this study was to test how different theorized home remedies associated with UTI performed in preventing the growth of common forms of bacteria associated with UTI (*Escherichia coli, Serratia marcescens, Citrobacter freundii*). One method used was the zone of inhibition test which was done to calculate each substance’s effect on the growth of the bacteria. Ten trials for each variable were done against each bacteria. Once the effective remedies were identified, mechanism-specific extraction experiments were performed to isolate the antibacterial agents. It was hypothesized that ampicillin, the positive control, would be the most effective in stopping the development of the bacteria and cranberry juice would be the most effective household remedy due to the presence of proanthocyanidins, natural antibacterial agents found in certain plants. The second method of mechanism-specific testing included isolating proanthocyanidins of cranberries and phenols of maple syrup using nonpolar extraction solutions dimethyl sulfoxide and hexane in order to determine the specific agent of antibacterial properties in the home remedies. Results show that the ampicillin was the most effective in reducing the development of *E. coli,* but maple syrup was the most effective against *Serratia marcescens.* Also, cranberries were less effective than the ampicillin, but was the most efficient against *E. coli* out of all of the household remedies.

***Wonjeong Choi, Corey Levy , Alexis Maikowski***

**The Effect of Physical Trauma on Behavior of Planarians**

Planarians are free-living flatworms that are often used as an animal model for neurological research due to similar nervous systems and regenerative abilities. Physical trauma to the brain can be the root of degenerative diseases such as chronic traumatic encephalopathy (CTE). The disease causes brain tissue to deteriorate and is caused by repetitive physical trauma to the head. It is seen in people who have experienced multiple injuries to their brain, such as American football players and veterans. Some symptoms are changes in behavior. The purpose of this experiment was to test whether or not physical trauma has an effect on planaria. Planaria were exposed to 24 hours of light while resting in either artificial pond water or a 0.01% glucose solution. The planaria were conditioned with twenty-four hours of light exposure in the glucose solution to associate glucose with light. Afterwards they were dropped from a height of one meter for ten times to stimulate physical trauma and “brain damage”. Next, a planaria were placed in a half-covered petri dish and a conditional place preference test was performed and the light-dark crossings were recorded. Two trials were performed and new planaria were used for each trial. It was hypothesized that the light-dark crossings would increase when compared to the control group. Results have shown that the hypothesis was not supported; experimental planaria and the control planaria experienced the same amount of light-dark crossings.

***Anthony Citera***

**Exploring the Properties of Antibubbles**

Antibubbles are the inverse of regular soap bubbles, meaning they form an underwater bubble. Unlike regular soap bubbles, antibubbles have a gas film with liquid on the inside and surrounding the outside. The data collection was based on the antibubbles’ behavior, size, and the number of bubbles produced. Changing the salt concentration of an identical solution controlled the densities of the antibubbles. They were produced in a one liter solution containing glycerin, water, and liquinox. From this, a duplicate solution was created to make the antibubbles and manipulated by changing the salt concentration. There were two different trials where the salt change was the same, but one data collection was based on using a surface film filter to pulse through while the other data collection did not have the filter. Overall, the antibubble size increased, fewer were produced and as the concentration of salt increased, the antibubble formed tended to sink rather than stay right below the surface. The method without the filter produced large antibubbles, but in a smaller amount. While the opposite had happened with the filtered method, where small antibubbles were produced in larger numbers.  These antibubbles could one day lead to new medical advances, as drugs can be encapsulated by this antibubbles loaded with magnetic nanoparticles to allow the antibubbles to be guided to a targeted site.

***Alyssa Collado. Emma Hatcher***

**Vitamin and Protein Impact on Butterfly Development**

Butterflies behavior is influenced by external and internal stimuli. Development decisions can be from adaption, resulting from natural selection and growth performance. Some things that affect their development are environment, food, genes, and the five senses. The Butterflies life cycle consists of 4 stages, egg, larva, pupa, and adult. The most changing happens throughout the larva stage. During the larva stage, the butterflies are most vulnerable to changes. This stage is a short stage and during this stage they mostly eat. During this stage is when we will give them their food. The purpose of this project is to see how protein and vitamins can impact the cabbage white butterfly. We hypothesis if we add vitamins and proteins implements into a cabbage butterflies diet, then the butterflies will develop faster and grow larger, because vitamins and protein can fortify the structure of an organism. Vitamins are often a factor to help proteins which are part of many chemical reactions in the body. For our research project we took three sets of six butterflies and putting them in different conditions. In one set the butterflies had a normal diet. In the second set protein was implemented into their food. In the last set soluble vitamins were put into their food. We added the protein and vitamins into the meal by soaking the cabbage in both the vitamin and protein for at least a week. Thus results show vitamin and protein have a negative effect on the Cabbage White butterfly. Caterpillars that had vitamin and protein put into their diet shrunk and turned a black color. The control group had a longer survival rate and the vitamin and protein caterpillars died before they became butterflies.

***Christopher Collado – See Jasmine Bajaj***

***Tyler Conforti, Emily Della Pietra***

**Effect of Artificial Sweeteners on Associated Learning Retention Time in Earthworms, *Eisenia fetida***

*Eisenia fetida* are used in associative learning studies. In addition, they are commonly used as biomarkers in soil pollution and contaminant studies. The effect of artificial sweeteners on earthworms has not yet been investigated. The aim of this project was to discover the effect of artificial sweeteners on the habituation of earthworms and fill this gap in study. Evidence could help predict the effect of artificial sweeteners on human responsiveness. Earthworms were sprayed everyday with three different concentrations of Splenda, Sweet’N’Low, and Equal. Earthworms were After one week of spraying, earthworms were poked until stimulation stopped eliciting a response characteristic of poking. It was predicted that if concentration of sweetener increased, habituation time decreased. Results will been observed in the following week.

***Jodi Consul – See Annika Chang***

***Joseph Cramer, George Li, Aidan Spahn***

**The Effect of *Penicillium* Bread Mold on Skin Microbiota From**

**Different Skin Sites (dry, moist, sebaceous)**

*Penicillium* is a group of molds which can cause many foods to spoil and health problems in humans. *Penicillium* was discovered by Alexander Fleming from the *Penicillium chrysogenum* fungus which was purified and ended up saving many lives from bacterial infections. The purpose of our experiment is to investigate the antimicrobial effects of *Penicillium* mold from spoiled bread on skin microbiota from different skin sites (dry, moist, and sebaceous). We obtained nutrient agar plates for growing skin flora. We grew the *Penicillium* mold on orange peels and bread and maintained them in a warm and moist environment. We swabbed each area and plated the bacteria on the appropriate plate. We added equal pieces of the mold to each nutrient agar plates and sealed them with parafilm. We used ampicillin disks as a control. After 48 hours the zone of inhibition was measured.

***Gavin Cressy, Brianna Han, Nicholas Leahy***

**The Effects of Hormone-Derived Supplements on the Growth and Development of Kidney Beans**

Supplements and medicinal remedies, though made to be beneficial, could pose a problem to the environment. Specifically, incorrect means of disposing supplements could lead to their presence in groundwater through sewage systems, and therefore in local vegetation. The purpose of this experiment was to see what effects these hormone-related substances had on the growth of kidney bean plants. We hypothesized that hormones and hormone supplements would have a detrimental effect on the growth and development of kidney bean plants. Since hormones regulate bodily functions, the imbalance may interfere with the homeostasis of functions of the organisms. To test this hypothesis, we filled two tubs with solutions of 0.165% estrogen and testosterone booster respectively. The testosterone supplements were crushed and then mixed with water. The estrogen was added to water. A third tub was filled with plain tap water as a negative control. Later, they were planted in regular soil in pots with openings at the bottom. The pots were placed into the tubs, and the heights and weights were measured for each plant. There was a trend in the data that supported our hypothesis that hormone supplements would stunt the growth of kidney bean plants. Though, our analysis showed that there was no difference in the data since their T-Test values were greater than 0.05.

***Liam Cummings, Evan Ni, Cole Schwartz, Rohan Surana***

**SPS: The Future of School Positioning Technology**

When students and adults enter Commack High School, they look forward to finding their designated rooms as efficiently as possible. Unfortunately, with currently existing maps, finding one’s way around the school can be quite confusing for visitors and new students. We believed the main problem is associated with the poorly designed paper maps of our school layout. Trying to fit details of hallways and classrooms onto a small piece of paper results in a map that may be hard to see and comprehend. We found that there may be a practical solution to this problem. In a world where almost all the information a person may need is available digitally, providing an easy to use virtual map is not difficult to achieve. We have developed a school map using App Inventor that can be downloaded as an app on phones and tablets by students and adults who are part of the Commack School District community. Instead of having all the information on one screen, search icons on the map can be used to locate specific points of interest within the school. Users can also zoom in and out to adjust their view of hallways and classrooms. But, to keep the map safe from unauthorized personnel, implementation of safety features for the app has remained a top priority. One possible solution for this was to create a password protected login page, which can also be done using App Inventor. We created sequences of code blocks for the login page that are being tested using school tablets. The tests for this feature have been successful where only the usernames and passwords included in the coding of the app are accepted by the login system.

***Grace Cutrone, Erika Fenty, Catherine Tawadros***

**The Effects of Exposure to Addictive Substances on the Trail-Following Ability of Termites**

Termites use various pheromones to interact within their colonies. The trail following pheromone can be mimicked by pen ink, as they have similar chemicals properties. Previous research has shown that exposure to addictive substances affects small organisms’ behavior: caffeine, being a stimulant, increases the activity of many organisms, while nicotine often improves memory, and alcohol usually slows or impairs most organisms. The purpose of this experiment was to determine the effects of different addictive substances on the behavior of termites. In order to test this, we sprayed a small amount of caffeine, nicotine, and alcohol onto respective filter papers and placed them into a petri dish, and then put a termite into each petri dish for ten minutes. Afterwards, the termites were placed into a new petri dish with a fresh filter paper that had a Papermate ballpoint pen ink thin line. We measured the amount of time each group of termites spent on the line for a period of two minutes. We hypothesize that the nicotine and caffeine exposure will help the termites stay on the trail for a longer period of time, while alcohol exposure will allow them to stay on the trail for less time. So far, results have shown that the termites that have been exposed to any of the addictive substances recorded more time on the line, which has led us to conclude that the addictive substances have improved their ability to track pheromones.

***Daniel Czop – See Kristen Chao***

***Gabrielle D’Agostino***

**Non-Newtonian Vehicle Side Impact Damage Reduction System**

As the car industry continues to make technological advances in safety systems and the number of fatalities from head-on collisions decreases, deaths from side impact crashes remains the same. Current side impact protection systems do not adequately address side impact safety. One major void exists in the door structure. Due to the lack of space or the minimal distance of the occupant’s seat to the point of impact, there leaves no crumple zone at the side of the vehicle, thereby causing the occupants to be vulnerable during this type of accident. The goal of this project was to create a novel impact curtain made from non-Newtonian fluid to significantly reduce the risk of injury and fatality. The non-Newtonian fluid has the capability to significantly reduce the effect of the impact from a side hit. A non-Newtonian shear thickening material consisting of water and cornstarch was placed in an 8-millimeter polyurethane bag which was designed to fit between door panels. Varying thicknesses of shear thinning material consisting of a viscoelastic foam were placed underneath the polyurethane bag to determine which size would best absorb the impact. The integrity of each size was tested using high velocity impact of an anvil drop. An accelerometer attached to the anvil recorded the G-force of the weight impacting the materials. The 2-inch-thick foam proved the most effective in reducing the G-force of the impact. This technology can be placed in car door panels to protect passengers in side impact crashes.

***Ethan Darvin, Chris Ioannou, Michael Zarief***

**The Effect of Different Color of Light on Planarian Movement over Time**

Due to their simplistic visual system and conserved eye photoreceptor cells, planaria are used as a model organism for investigating eye biology. Previous studies have shown that planarians have a photophobic response to light, except those studies were done using white light which is a combination of multiple wavelengths. Few studies of looked at the behavioral responses of planaria to individual wavelengths. The purpose of this study was to determine the planarians response to different wavelengths of light. Planaria were placed in a petri dish and 1cm x 1cm graph paper. A line crossing assay was preformed where the number of lines crossed in 5 minutes was recorded. The experimental group used blue, red, and yellow bulbs, while white was used as the control. It was hypothesized that the planarian will move faster when exposed to shorter wavelengths based on previous study that found the uv wavelengths (shortest) caused the most intense photophobic responses while IR wavelengths produce no effect (longer). The planaria observed during the line crossing assay within yellow light crossed a higher average of lines than blue by and slightly higher average of red by 4.7 lines per minute consistently each trial. This shows that planaria are found to move around more in lower wavelengths because less irritation was found in those wavelengths for the planaria to move in.

***Emily DellaPietra – See Tyler Conforti***

***Elizabeth Demacopoulos, Amy Held***

**The Effect of Omega-3 on the Gene Expression on egl-19 and egl-36 in *Caenorhabditis elegans***

In this study, we observed the effect of Omega-3 on the gene expression of egl-19 and egl-36 in *Caenorhabditis elegans*. *C. elegans* are multicellular nematodes which are easy to maintain and have a short life span. In this experiment, *C. elegans* will be used as a model organism for Brugada syndrome, as its pharynx or feeding tube, beats rhythmically like a human heart and has similar electrical properties. We hypothesized that if *C. elegans* consume Omega-3, then their gene expression of egl-19 and egl-36 will increase. Egl-19 and egl-36 are the closest homologous genes to the gene SCN5A. Low expression of this gene causes Brugada Syndrome. This syndrome causes irregular beats in the lower chambers of the heart, called ventricular arrhythmia, which can cause fainting, seizures, difficulty breathing or sudden cardiac arrest. Omega-3 has been shown to improve cardiac health, in humans, and is an antiarrhythmic. We tested gene expression by extracting RNA from the *C.elegans* that have been exposed to Omega-3. The one group was a control group receiving no exposure to Omega-3, a second group received exposure for just 3 hours, and a third group for 3 days. Then, we used rtPCR for 30-40 cycles to amplify the RNA and reverse transcribe it into DNA. Gel electrophoresis was run and the intensity of gel glow was measured using a Gel Analyzer software to analyze the light intensity of the bands in the gel to see the how much the genes are being expressed.

***Ethan Dettmann -See Joshua Brodsky***

***Cathleen Deutsch, Teja Sundar***

**The Effect of Melaleuca (Tea Tree oil) on the Inhibition of *Serratia marcescens***

*Serratia marcescens* is an opportunistic pathogen responsible for causing many nosocomial infections such as UTI, respiratory tract infections, wound infections, and bloodstream infections. A common treatment for these types of infections include antibiotics such as ampicillin, gentamicin and macrolides. Bacteria, however, have been developing a resistance to these antibiotics. Natural remedies, such as melaleuca, have shown promising treatment against bacteria, due to terpinen-4-ol levels within the oil. The purpose of our experiment was to see the effect melaleuca has on the inhibition of *Serratia marcescens*, as a more natural remedy for combatting infection. In order to conduct our experiment, we spread the *Serratia marcescens* onto nutrient agar, then placed disks containing H2O(control), ampicillin, and melaleuca onto the plate. We stored it overnight and used calipers to measure the zone of inhibition around each disk. We hypothesized that if *Serratia marcescens* was exposed to melaleuca, bacterial growth would be reduced, just as with antibiotic exposure. Results show that the tea tree oil had a small effect on the zone of inhibition of Serratia marcescens, while the ampicillin had a much larger effect.

***Emily DiPrima, Mikayla Elferis***

**The Effect of Natural Antimicrobials on *E. coli***

The purpose of this experiment was to investigate the antibacterial properties of honey and oregano oil on *Escherichia coli*.  Honey displays qualities that slow down or halt the growth of bacteria such as low pH and ability to produce hydrogen peroxide.  Oregano oil contains a compound known as thymol, which has shown to have antimicrobial activity by targeting the cytoplasmic membrane, unlike the action of many modern antibiotics. Bacteria have evolved to become resistant to many types of antibiotics, therefore, natural antimicrobial remedies may be more promising and effective in treating bacterial infections. To carry out this experiment, a culture of *E. coli* was spread on an agar plate.  Antibiotic disks coated in honey alone, oregano oil alone, and a mixture of honey and oregano oil were used as the experimental variables. Ampicillin was used as a positive control and distilled water was used as a negative control. Disks were arranged on the plate, equidistant from each other.  Plates were placed in an incubator at 37°C for two days. Afterwards, the zone of inhibition was measured with an electronic caliper. It is hypothesized that the combined honey and oregano oil will have a synergistic effect on inhibiting the growth of *E. coli*.  The honey and oregano oil also had a larger zone of inhibition than ampicillin, supporting their antibiotic strength and potential to be used as alternative antimicrobial treatment.  The results supported our hypothesis that honey and oregano oil have synergistic effect on killing the bacteria.

***Dev Dokania – See David Abbe***

***Emma Downey***

**An Investigation of Biomarkers in Glioblastoma Multiforme Brain Tumors**

The molecular basis of brain tumors is not well understood. Only in May 2016 was a database created to input molecular data for this type of cancer to be better understand the molecular causes to specific tumor types. Biomarkers are measurable substances or processes that can identify the presence or severity of a disease. In brain tumors, biomarkers can be used to identify the type of tumor, possible treatment, or probable response to treatment. An aggressive form of brain cancer called glioblastoma multiforme (GBM) has many identifiable biomarkers. These include O6-methylguanine-DNA methyltransferase (MGMT), which can predict the effectiveness of chemotherapy in certain patients, and epidermal growth factor receptor (EGFR), which can predict the spread of the tumor. The purpose of this experiment was to use the database to identify patterns and trends in malignant brain tumor biomarkers for the composition of particular tumors. The data was obtained from the Ivy Glioblastoma Atlas Project, which specifically looked at parameters in GBM. The data was imported into Excel and included the patient gender/age, molecular subtype, extent of resection, and gene expression details. Pivot Tables were used to identify and categorize the data. Conclusions can be drawn that the presence of MGMT and the absence of EGFR Amplification allows for a greater survival rate. The tumors with these characteristics resulted in 43% survival while the reversed characteristics resulted in only an 11% survival. It was found that patients with the absence of multifocality, patients without PTEN deletion, and patients with a higher KPS all had a more survival days (on average), and had a higher chance of survival. In addition, based on this data, tumors in the frontal lobe had the best prognosis for survival. Knowing the biomarkers involved can potentially predict survival rates and possibly produce a more personalized treatment.

***Adam Dubi, Brian Mokotoff, Paige Robinson***

**Device for Organizing Papers for People with Physical and Cognitive Disorders**

People with disabilities often have difficulty with cognitive tasks such as folding paper. The purpose of this project is to aid individuals who suffer from physical and cognitive disorders, to be more effective in the workforce. A device was developed to aid a group of individuals responsible for folding flyers of varying sizes and shapes. It is often difficult for them, resulting in a slower output time. Their main challenge is making a perfect one-third fold, so this device was created with the intention of aiding them on this task. Several prototypes were designed to determine the best suited device. Non-disabled participants were timed on their ability to fold a paper while utilizing the device and without it. All papers folded were given a score for even creases and equidistant folds. The score between the papers folded free-handed verse those with the aid of a device were compared and the one with the most efficient score was selected to be built. Other factors considered in the design included cost, material weight and durability. With this new device, this particular group of people should be able to complete their jobs in an easier and more timely manner, and eliminate any frustrations they may have had.

***Aria Eghbali, Yeil Kim***

**The Development of an Enhanced Wide-Band Antenna System Capable of Detecting RF Radiation of All Polarizations at Varying Frequencies with High Directivity and Sensitivity.**

The scanning of an area to measure and locate RF (radio frequency) radiation for unusual or pernicious emitters can prove to be beneficial by locating clandestine or possibly illegal transmitters. In addition, a device capable of detection over a large bandwidth would have practical applications in health safety protocols as human tissue damage can be attributed to excessive RF exposure. Commonly employed narrow band RF detectors are incapable of being utilized in such scenarios. We propose an antenna system with a large bandwidth and high gain, capable of detecting all RF polarizations. To give the system its directionality and large bandwidth, a Log Periodic Dipole Array (LPDA) with a frequency range from 950 MHz to 10 GHz was designed and implemented. The incorporation of a parabolic reflector and a mechanism which moves its fixed focal point across the array of driven elements of the LPDA enhances the gain of the antenna at all frequencies of its bandwidth. To allow the antenna to detect all polarizations, a motorized system which would spin the LPDA on its lengthwise axis was developed. Data collection using the parabolic reflector and LPDA show that the systems gain and directionality were enhanced by the composite system.

***Katerina Efthymiou, Emily Hartman***

**Personal Sea Wall: The Design Of Hyperlocal Structures As A Defense From Storm Surge**

Hurricanes are very destructive and cause billions of dollars to be spent on damage repair each year. The most dangerous component of a hurricane is storm surge, which is the large rise of water caused by strong winds. This project was proposed to create a protection barrier around houses to potentially reduce the damage repair coast annually. By creating an easy to install and easily affordable seawall, we can protect people's homes from flooding. Initially, the seawall was modeled in Autodesk Fusion 360. A model of the seawall was then constructed and tested in a fish tank. It had pipes extending in to the ground that were connected to a pump to remove the water. In order to test the design, a continuous flow of water was poured into the tank while the pump was running. Water level indicators were placed behind the wall to measure the water table. If successful the water table would not rise.

***Mikayla Elferis – See Emily DiPrima***

***Gillian Evers***

**The Effect of Age and Gender on the Rate of Degradation of Fingerprints**

Knowing the age and gender of an individual based on many situations, including one’s fingerprint can be helpful in narrowing down suspects in a crime. The purpose of this investigation was to test whether the age or gender of an individual had an effect on the rate of which their fingerprints degraded. To carry out this study, fingerprints were collected from five different age groups, with two males and two females in each group. The fingerprints were then dusted, and a picture was taken of the fingerprints once a week, over a course of five weeks. The features in the fingerprints were then compared to previous weeks to determine the rate of degradation. It was hypothesized that the fingerprints of the younger age groups will degrade faster than the fingerprints of the older age groups. All fingerprints contain volatile fatty acids that cause fingerprints to degrade over time. However, children's fingerprints contain more cholesterol, cholesteryl esters, and straight-chain fatty acids, while adults' fingerprints contain more squalene, wax esters, and branched fatty acids. The contents of children's fingerprints are more volatile than the contents of adults' fingerprints, causing them to degrade faster. The effect of age and gender on the rate of degradation of fingerprints was tested in this experiment. Once the effect is determined, the age and gender of the individuals can potentially be determined based on their fingerprint. This can be helpful when narrowing down possible suspects.

***Matthew Feigenbaum, Shawn Uthup***

**The Effect of Heavy Metals on the Respiration Rate and Growth of**

**Germinating Radish Seeds**

Technology is a vital part of everyday life just about everywhere in the world. Technology such as cars, and factories have allowed for urbanization. This often has come at the expense of the environment and wildlife. Pollution of the environment is a major global issue that can contaminate water, air, and soil. Soil pollution, such as heavy metal contamination, is caused by chemicals being improperly disposed of and leaching into the soil. The purpose of this investigation was to see how heavy metals affect plant respiration. Respiration is the process in living organisms involving the production of energy, typically with the intake of oxygen and the release of carbon dioxide. To carry out this study, 20 radish seeds were soaked in a container filled with 20 mL of one of the following solutions; 10% lead solution, 5% copper solution, and distilled water. Microwaved seeds were also used as a control. Each time one of these solutions were tested it was compared to a control group of seeds soaked in distilled water. After 48 hours of initial germination the seeds were tested using a respirometer. The respirometer measured the ‎O2 consumption of the seeds. A piece of cotton was placed down the syringe, and KOH was placed on the cotton to absorb the CO2. The seeds were placed in the syringe, and four times every five minutes for a total of 20 minutes the amount of consumption was recorded. It was hypothesized that if radish seeds are germinated in liquid infused with lead or copper then the respiration rate and growth of the germinating seeds would be negatively affected. Results concluded that the seeds soaked in the distilled water had higher respiration rates and more growth than the two heavy metal groups. Seeds soaked in lead nitrate experienced some respiration and some growth, while the copper group had minimal respiration rates and no growth. The growth of the seeds corresponded to the respiration rates. Heavy metals have been known to disrupt the balance between antioxidants and reactive oxygen species. Studies have shown that increased ROS production can do major damage to plants, which is most likely why the respiration and growth of the seeds exposed to the heavy metals were negatively affected (Bohler, S., et al, 2011).

***Dylan Feldman***

**The Effect of Magnetism on the Germination of Radish Seeds**

Climate change has been affecting plant growth with extreme temperatures, modifying the soil composition and water availability. With a decrease of available growing days, scientists are looking for new ways to improve crop production and shorten germination time. One such area that has been investigated is the effects of magnetism. The purpose of this project was to further explore magnetism on radish seeds. I hypothesize that radish seeds exposed to low magnetism will grow at a faster rate and in a shorter amount of time than the control group, but at higher magnetism there will be negative effects on plant growth. Radish were chosen because they were easy to cultivate, sprout in 3 to 5 days, and have a high germination rate. Seeds were exposed to various numbers of magnets to study its effects germination time and growth rates. Four small petri dishes were obtained. Three radish seeds were placed on a moist paper towel and placed inside. One petri dish had no magnets, as this served as the control (0 gauss). The next petri dish had two magnets (200 gauss), the next had four magnets (400 gauss) and the last had eight magnets (800 gauss). The seeds were watered every other day through holes drilled into the petri dish, and observations were recorded. So far, my results are inconclusive due to many limitations that caused inadequate data collection

***Erika Fenty – See Grace Cutrone***

***John Finnie-Maloney***

**Development of RubisCO Models to Represent Possible RubisCO Structures**

**That are Advantageous in Nature**

RubisCO is the world’s most abundant protein and is responsible for the carbon fixation of CO2 within 97% of the plants on Earth. However, RubisCO is inefficient in its job and suffers from many problems such as deactivation after reaching temperatures above 35 ℃ , due to an influx of competitive inhibitors that may be bound to the functional groups of the enzyme, and the fixation of O2 causing a net loss in energy. The purpose of this computational study was to develop trends and continuities in conserved domains of RubisCO in all RubisCO form I and II. Then to develop possible mutations that could be used to increase structural stability of both the small and large subunits of RubisCO using the database Swiss-PDB Deep view. In addition, any kinks in secondary structure or steric hindrance formed as a result of residue mutations would be known as destabilizing changes and were not used. If a break in helical trends and steric overlap was present, the enzyme, in vivo, would destabilize and not function at all. Thus far, data regarding continuities in RubisCO structure throughout different species has been collected as well as pattern expressions which will be used as starting points in determining the possible mutations that can be made to the large and small subunits of RubisCO. One model of RubisCO has been developed using the mutation method in which Val 331 is mutated to Ala and Thr 342 is mutated to Ile. I discovered that the reduction in catalytic efficiency from the alanine mutation is cancelled out by the Van der Waal forces produced from the mutated isoleucine which stabilize the entire loop 6 structure. Further research will be conducted to view any areas where the cancelation effects similar to the Val and Thr mutations can occur.

***Jack Flanagan – See Kevin Chen***

***Brian Flynn***

**Effects of Acidification on Flora and Fauna in a Closed Ecosystem**

With our continued reliance on the burning of fossil fuels, the levels of sulfur dioxide and nitrogen oxides in the atmosphere are increasing. These chemicals react with water and oxygen, to form sulfuric acid and nitric acid, otherwise known as “acid rain”. When acid rain reaches the ground, it flows across the surface in runoff water, enters water systems, and sinks into the soil harming plants and animals. It deprives the soil of essential nutrients and releases toxic aluminum into the soil. In the water, it alters the water chemistry affecting the life cycles of many organisms, especially those at the lower end of the food chain. The purpose of this experiment was to determine the effects a decreasing pH has on a closed ecosystem. Four identical mesocosms were set up, consisting of a terrestrial layer with radish seeds, a decomposer layer with earthworms, and an aquatic layer with shrimp, duckweed, and algae. The upper layers were given equal amounts of water with varying pH’s (4, 5, 6, and 7 respectively), and observations in changes in flora and fauna were recorded. It was hypothesized that the flora and fauna would decrease in decreasing pH, as it is believed that many organisms will not be able to adapt to the quickly changing acidification conditions.

***Nicholas Gembs -See Tyler Chipetine***

***Mia Goren, Emma Karadenes***

**The Biodiversity of Ants in Commack, NY**

There are over 12,000 species of ants, each with their own unique characteristics which allow them to survive in their own environments. Recently, ants have been used as a model to study disease transmission. Some ants species, such as the Pharaoh ant, can carry pathogens that are harmful to humans. The purpose of our study is to investigate the biodiversity of ants in Commack, NY. We performed DNA Barcoding utilizing Polymerase Chain Reaction (PCR) to isolate the Cytochrome Oxidase I gene within the mitochondrial DNA region. Gel electrophoresis was performed to verify DNA was obtained. Afterwards DNA was sent to be sequenced and analyzed through the DNA Learning Center's DNA subway. We will then look at the ants phylogeny to classify them.

***Elena Gnilitskaya, Annabelle Hohne, Amy Liu***

**The Effect of Sugar and Sugar Substitutes on Regeneration in Planaria**

*Dugesia tigrina* (planaria) are a species of flatworms credited for the similarity of their nervous system when compared to that of humans, and are often used as models in addiction and regeneration studies. Sweeteners are known for their addictive and energizing effects. This experiment was initiated to determine if planarians regenerate faster when exposed to various sweetener solutions. A planarian was cut in half and placed in a petri dish, with a sugar or sugar substitute solution, and sealed. The solution was .01% Stevia, sucralose, or sucrose. The negative control group was artificial pond water (APW). The planarians were observed whenever possible to see if the planarian’s eye spots had regenerated. There were five trials for each sweetener solution. 100% of the Stevia planarians died before day ten. 80% of the sucralose and 80% of the sucrose regenerated after ten days and 60% of the APW planarians regenerated after day 10. After exposing the planarians to the different solutions of sweeteners, the data showed that some sweeteners speed up regeneration in planaria because compared to the APW control group, the planarians with sweeteners had more planarians regenerate within ten days. This study is important because it is shown that sweeteners can increase a planarian’s rate of regeneration and that planarians respond to an increase in sweetener intake.

***Daniel Graf, Thomas Parangelo***

**The Effect of Oil Contamination on an Ecosystem**

The purpose of this project was to determine the effects of oil contamination on an ecosystem. Oil has been used to fuel machines which make our lives easier, however if spilled, this oil can pollute and destroy natural habitats. Oil spills typically occur when people are careless and make mistakes causing devastating effects to the environment. Oil is toxic and can spread a thin layer over the surface of an environment. In water, this stops the oxygen from getting to the plants and animals, and on soil it kills organisms necessary for environmental balance. A self-sufficient mesocosm was constructed with three separate levels, a terrestrial layer with seeds, a decomposing layer with earthworms, and an aquatic layer with algae, shrimp, and snails. There were three experimental set-ups with varying concentrations of oil added, while the fourth was a negative control. Changes in water pH, color and health of the plants and animals were recorded. It was hypothesized that the stronger the concentration of oil the more negative consequences in the ecosystem.

***Nicholas Greco – See Trevor Rosenlicht***

***Emily Hartman – See Katerina Efthymiou***

***Emma Hatcher – See Alyssa Collado***

***Brianna Han – See Gavin Cressy***

***Annabelle Hohne – See Elena Gnitlitskaya***

***Eric Huang – See Aryaram Anand***

***Theresa Haupt, Abigail Pace***

**The Response of Planaria to Novel Objects**

Novel objects are new objects placed in an environment that an organism has yet to interact with. The novel object recognition test is an assay that has been done with animals, such as rodents, to test their cognition, memory, and preference for novelty. Novelty has been used to test recognition memory when an animal is placed in an environment with an object of familiarity. Novelty studies have yet to be done using Planaria, a species of aquatic flatworms commonly used in neurological and pharmacological studies due to similar nervous systems to humans. The purpose of this study was to observe Planaria's responses towards novel objects in their environment and how ethanol influence affects it to test their cognitive behavior and preference for novelty. The Planaria were placed in petri dishes over lined paper and set up for 4 conditions; one for habituation (control) and three for different novel objects. Each trial was recorded for 15 minutes and observed to determine the number of times the Planaria crossed the lines on the graph paper and the time spent around each object in its environment. Image.j, a computer program, was used to track the Planaria's movement in the petri dishes. It was hypothesized that when a novel object was inserted, Planaria would become increasingly active and spend more time around the novel object than the familiar. Thus far results indicate that Planaria spend more time around the novel object, which supports our hypothesis that Planaria favor novel objects over familiar objects.

***Amy Held – See Elizabeth Demacopoulos***

***Soad Hossain – See Joshua Brodsky***

***Christopher Ioannou – See Ethan Darvin***

***Jeremiah Jerome, Tryphena Zareif***

**Which has a Greater Influence on Mung Bean (*Vigna radiata)* Growth:**

**Cocklebur Extract or Fertilizer?**

The purpose of this experiment is to determine if positive allelopathy from Cocklebur extract shows a greater positive influence than fertilizer on the growth of mung beans. Allelopathy is a biological phenomenon by which organism produce biochemicals that influence the growth, survival, and reproduction of other organisms. These biochemicals are known as allelochemicals and can have beneficial effects on target organisms. The allelochemical promotes plant growth and speeds up metabolic processes by communicating between native plants. This is aiding scientists to develop a natural fertilizer that does not contain nitrates, since nitrates poses various environmental risks. If an allelopathic extract can show a positive influence on plant growth over fertilizer, it could revolutionize the agricultural field. To test this we planted 33 mung bean (*Vigna radiata*) seeds; for 11 we added cocklebur extract for allelopathy, another 11 received fertilizer as a positive control, and the remaining 11 we grew with no additives as a negative control group. We recorded the heights of these plants and hypothesized that mung beans grown with Cocklebur extract would show greater mung bean growth compared to natural and fertilizer. The results show that the plants grown with Cocklebur extract grew both the tallest and the quickest. These findings were supported by the unpaired t-test that showed statistical evidence (p-value < 0.05) that allelopathy grew faster than the water control group, but the difference between fertilizer and allelopathic influence must still be studied to find out which is more positively influential.

***Juvin Johnson, Kevin Tuzinowski, William Yuk***

**How Will Different Concentrations of Lead(II) and Ethanol Affect**

**Planarian Regeneration Time?**

Lead(II) nitrate, Pb(NO3)2, sodium fluoride, NaF, and ethanol, C2H6O, all neurotoxins, have shown detrimental effects on the human nervous system. Planarians go through a type of regeneration called bidirectional regeneration This allows the planarian to reproduce asexually, with the use of many stem cells to replace the lost body part. A planarian would begin regenerating once transversely cut, and finish once the eye spots were visible through a compound microscope. Pictures were taken at the beginning, and at the end of the planarian regeneration process. Lead (II) nitrate at a concentration of .002%, did not kill the planarian while it was regenerating. For ethanol, the exposure at a concentration of .0625%, did not kill the planarian while it was regenerating. Planarians that were killed by the higher concentrations of neurotoxins all had one similar behavioral characteristic: contorting their bodies into a C-shape. Sodium fluoride, after a week of diluting the solution, still killed the planarian within a few minutes. This data supports the conclusion that sodium fluoride had the greatest toxicity out of the three toxins tested upon. Lead (II) nitrate had the second greatest level of toxicity, due to needing a lower concentration than that of ethanol to allow the planarian to regenerate. Use of neurotoxins on planarian regeneration time gives insight into the different levels of toxicity affecting humans today.

***Emma Karadenes – See Mia Goren***

***Andrew Kassnove, Samuel Panes***

**The Effect of Artificial Turf on Planarian Regeneration Time**

Artificial turf is used to replace grass because it is easier to maintain and provides a soft, padded surface for athletes using the turf. The artificial turf consists of a layer of crumb rubber infill with a layer of grass-like fibers over it. The crumb rubber layer may be dangerous to humans because of the substances it consists of and releases, including deadly carcinogens, lead and other metals and even small doses of carbon monoxide, at times. The Planaria Dugesia dorotocephala was used for this experiment because of its availability and the fact that it can regenerate its head if it is cut off. In this experiment, we measured the regeneration times of transversely cut planarians in containers consisting of various amounts of crumb rubber infill and artificial turf fibers. Each container contained 50 mL of artificial pond water. We found that only the planarians in the control container and the container additionally containing 50 blades of fibers survived, each taking 10 days to regenerate. In the other three containers in which the planarians did not survive, there were 5 grams of infill, so we decided to conduct another experiment. The containers in this experiment contained 50 mL of artificial pond water and various amounts of infill. Only the planarians in the containers with .62 g, .32 g and .16 g survived and regenerated with the planarians in .62 mL of infill taking 12 days to regenerate and 10 days in the other two. We can conclude that the infill of the turf had an effect on the planarian survivability, with the planarians not being able to survive in large amounts of infill, only in the amounts .62g and less. The infill may not have had an effect on the regeneration time, though, because the times were very similar in all containers with surviving planarians. We can also conclude that the turf fibers had little effect on the regeneration.

***Hailey Katz – See Faith Chi***

***Hamza Khan, Mustafa Naseem***

**The Effect of Sleep Deprivation on the Response of *Drosophila melanogaster***

**To Light Stimuli**

The lack of sleep in today’s fast paced and demanding environment is a large problem, with over 30% of Americans consistently sleeping less than 7 hours a day. The effect that a lack of sleep has is often dependent on the amount of sleep lost. Experiments in sleep deprivation often use the drosophila melanogaster fly species, due to their similarities to humans in behavioral changes after sleep deprivation. Past experiments have demonstrated that the Drosophila displays extremely similar effects to humans regarding sleep deprivation. Our experiment uses the Drosophila melanogaster in order to assess the effects that varying periods of sleep deprivation have on reaction time, and to pinpoint the amount of sleep at which reaction time begins to be affected. A common stimulus used to assess drosophila response is light, as the flies exhibit a positive phototaxis, or attraction to light. Our experiment applied a mechanical sleep deprivation. We first accustomed the flies to a 12 hour light/dark cycle, then mechanically sleep deprived for varying lengths of the 12 hour dark period. One group of flies was not sleep deprived, remaining in the 12 hour light day cycle and serving as a control group. Both groups of flies were then be allowed to recover separately for approximately 30 minutes, before being transferred to the end of individual dark tubes, for the assessment of reaction time. A light was lit on the opposite end of each tube, and the number of flies in each region of the tube were assessed for a period of 5 minutes. The number of flies closer to the light source at given times depended on the amount of sleep deprivation. The greater the movement or reaction of the Drosophila to the light, the less the effect of sleep deprivation on reaction time. The control group was compared to the experimental group in order to ensure that a change in reaction time is occured. The data was graphed to provide an accurate analysis of the effects of varying sleep deprivation periods. The results indicate with specificity which periods of sleep deprivation begin to impact reaction time as well as any unexpected trends.

***Maheen Khan – See Kathy Cao***

***Marina Khan, Caitlin Tolentino***

**Paint a Picture with Nature**

Paint is used to mark trails and roads as well as cover boats and houses. Most paints contain harmful chemicals such as VOCs that are carcinogenic. In addition, these VOCs contribute to the greenhouse effect by creating bad ozone when it reacts with oxygen and is exposed to sunlight. The goal of this project was to develop a safe and ecofriendly way of creating sustainable paints that are risk free to the environment, decreasing pollution. Paint is comprised of three main components, pigment, solvent and the binder. Iron (III) Oxide pigment was used to give the paint its red color, glycerin was used as the binder and gum Arabic powder was used as a solvent. Two layers of the red paint were painted on three different wood blocks that were labeled numbers. Each block was placed in different light exposure- circumstances. #1 was placed under UV light, #2 outside in direct sunlight and #3 in the dark that served as the control. The paint did not start to change until the fourth week. When #1 was observed there was a slight fading of the paint. The rest of the blocks, #2 and #3 remained the same. #2 did not begin to fade until the sixth week. #3 remained the same throughout all the weeks. By the tenth week #1 had faded even more and #2 faded slightly more than before.

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***Charlson Kim***

**Dopamine Hypothesis in Neuropsychiatric Disorders: A Schizophrenia Model to Determine the Effect of Dopamine on Gene Expression and Behavior in *Drosophila melanogaster***

Schizophrenia is a disabling brain disorder affecting 1% of the population with no definite cause. Among Schizophrenic patients, researchers have found candidate genes such as Akt and Dysbindin whose mutations are believed to spur symptoms such as effects in memory attention and delusions. The basis of this project was the Dopamine Hypothesis which states that excessive levels of dopamine often cause psychotic symptoms such as hallucinations, delusions and a schizophrenic-like paranoid state, making it a potential cause. The purpose of this study was to determine the effects of antioxidants on the expression of the candidate genes using biotechnology techniques in *Drosophila*. The *Drosophila* were overdosed with vitamins B6, B9 and C to simulate excessive dopamine levels and the RNA from each group was then extracted and quantified using a Nano spectrophotometer. Both genes were amplified using RT-PCR and run under gel electrophoresis. Behavioral assays were conducted to evaluate the effects of excessive dopamine levels on synaptic plasticity and memory phenotypes. It was hypothesized that increasing dopamine levels caused by an overdose in antioxidants would reduce the expression of the candidate genes, resulting in negative effects in memory and synaptic plasticity. Thus far, results display an increased expression of the dysbindin gene in the experimental groups and hyperactivity and abnormal behavior in the behavioral assays, establishing a potential connection between candidate gene expression and excessive Dopamine levels and thereby indicating that excessive Dopamine levels may be a potential cause of Schizophrenia.

***Yeil Kim – See Aria Eghbali***

***Jun Ko, Naru Nakamura, Jason Sicoli***

**The Effects of *Drosophila Melanogaster* and their Preference of Different types of Sugars (fructose, sucrose, glucose)**

The following study examined the preference of *Drosophila Melanogaster* for certain kinds of sugar. The experiment was performed to better understand fruit flies eating habits and their diet. Following our question, we decided to do research into the backgrounds of our three selected sugars fructose, sucrose, and glucose. After coming up with our question and doing some research into the topic we posed our hypothesis; that sucrose would be the *Drosophila's* preferred sugar. The main reason behind our hypothesis was that fruit flies are attracted more towards overripe fruit. Overripe fruit contain a large quantity of sugar, specifically sucrose. However, while researching sucrose we also found that it is partially made up of glucose and fructose. To perform our experiment two different types of tubes were made. We made control and trial containers, each containing the same number of flies, food, and water. The only variables were that each control contained no sugar while the trials each contained either sucrose, fructose or glucose. This was done so the feeding quantity of their food without any added sugar could also be measured and compared. After waiting ten days for each trial and constant, the data was recorded and compared. Our hypothesis was proved to be correct and sucrose was consumed the most. On average the difference of weight over ten days for the three different sugars was 3.6806 grams for sucrose, 3.0394 grams for fructose and 2.9961 grams for glucose.

***Christine Kong, Ethan Sontarp, Louis Viglietta***

**An Evaluation of the Effects of Commercial Enzymatic Supplements on**

**Gluten Proteolysis In Vitro**

The goal of this evaluation was to determine if certain gluten supplements currently on the market truly provide relief for those with celiac disease and gluten sensitivity. Gluten sensitivity (a non-celiac auto-immune reaction to gluten) has recently been a rising problem in the United States. Prolamins are the components of gluten that cause negative reactions in patients with celiac disease. Currently, several enzyme supplements on the market exist, such as Gluten Digest and GlutenEase, that claim to provide relief for those with celiac disease by aiding in the digestion of gluten. However, there is reservation about their efficacy. We tested these supplements in an *in vitro* digestive system using hydrochloric acid and pepsin to stimulate a stomach. A small ball of dough was formed using wheat flour; it was weighed and added to the system, along with the supplement being tested. It was left to stir in the system for 6 hours at body temperature (37 ºC). After the dough completely dried, it was re-weighed to determine how much gluten had broken down. The percent change of the digested gluten using commercial enzymes was compared to the percent change of gluten from the control trials (no enzymes). We hypothesized that the gluten would be digested most effectively by the supplement GlutenEase because it contains more enzymatic proteases than other brands, which can digest many different proteins.Thus far, results show there appears to be the same amount of gluten after digestion than the control trials, contradicting our hypothesis. Further investigation is needed.

***Erika Kraft, Michelle Mojsa, Jayden Prestiano***

**The Effects of Caffeine and Alcohol on the Regeneration in Planarian.**

Caffeine is a stimulant to the central nervous system, which can improve mental alertness. Alcohol is a depressant that interferes with the brain communication system, disrupting behavior and making coordination difficult. The purpose of this experiment was to determine the effects of caffeine and alcohol on planarian regeneration. Planaria were used because they had similar stem cells to humans making them a model organism for regeneration studies. Three planaria were placed into 0.0001% ethanol and caffeine solutions respectively based on an LC50 assay. After 48 hours the planarian was cut in half and the time for the lower half to regrow eyes was recorded. We hypothesized that the planarian in caffeine and alcohol will both increase in time taken to regenerate because they are both depressants and suppress the central nervous system. Our hypothesis was supported, the rate of growth of the planarian did increase or take longer in the various experimental solutions compared to the control group. However, we are not very confident in our results as our error bars are large and overlap. According to the T-test, the p-value for all the experimental groups against the control group were all greater than 0.05, supporting there is no difference between the various experimental conditions and the rate of planarian regeneration as determined by eye regrowth.

***Dylan Krukowski, Cole Margarites***

**Is Convenience a More Impactful Factor than Fruit Preference for Food Selection in *Drosophila melanogaster*?**

*Drosophila melanogaster* is a small insect with a tannish body and large red eyes that protrude out of the sides of their heads. They tend to feed on fruits and other fermenting foods, and they have a preference towards citrus. For this experiment, we had eight flies and two fly traps in each petri dish, and each trap with either grape or grapefruit in them. We ran a control group with both fruits where the traps were of equal length, a preference test with different fruits in each trap with equal length traps, a convenience test with both fruits with one trap longer than the other, and two final experiments with different fruits in each trap with one trap longer than the other. After running these experiments, our results showed that most of the fruit flies would choose to go for the grapefruit and ignored the lengths of the traps. Even when grapefruit was placed in the longer trap and grape was placed in the shorter trap, many of the flies went towards the grapefruit. This supports the idea that fruit flies will not consider convenience when selecting food in a contained environment. Their choice will only be swayed by the type of fruit that is available to them.

***Philip Kwiecinski – See Jonathan Appel***

***Joshua Lang – See Michael Chacon***

***Nicholas Leahy - See Gavin Cressy***

***Joshua Lee***

**A Bioinformatics Approach to Probe the Genetic Links Between Schizophrenia and 22q11.2 Deletion Syndrome**

22q11.2 deletion syndrome is a genetic syndrome and a copy number variation, caused by a microdeletion in the arm of chromosome 22. It is a strong risk factor for developing schizophrenia. There are variable phenotypes of 22q11.2 deletion syndrome, including cognitive impairment, low IQ, and intellectual disability which can be diagnostic predictors for later onset of psychotic disorders. Cognitive defects are especially involved in the pathways leading to psychosis. Individuals with 22q11.2 deletion syndrome have up to twenty-five times higher chance of developing schizophrenia over the general population. Schizophrenia is a mental disorder that is primarily identified in childhood and adolescence. To determine a link between the two disorders, a computer software has been programmed to visually analyze gene protein models and vital genetic loci. Using the newly developed program, it was revealed that TBOX1 and COMT were two gene proteins that displayed the most similar gene expression in both disorders. That leads to the conclusion that these gene proteins are vital to the expression of the two disorders, making them targets for novel therapeutic treatment.

***Matthew Lee, Michael Scaccianoce***

**Oleics Acids: The Stink of Death**

Most insect repellents utilize substances harmful to the environment, resulting in a demand for natural substitutes. An ancient warning signal among various insects caused by the release of oleic acids inspired the use of oleic acid as a natural repellent. Oleic acids were tested for their effectiveness to repel ants in different temperatures.  The ants were placed in the incubator for 10 minutes. Afterwards, the oleic acids were placed in one end of container on a paper towel with the ants for 5 minutes. Using an incubator to change the temperature of the environment, oleic acids were found to be most effective 22° Celsius. In 17° Celsius, the oleic acids were successful in repelling the ants, but to a smaller extent. In 37 Celsius the oleic acids repelled the ants but produced inconsistent results. The oleic acids performed the best at 22° Celsius. The data disproved that oleic acids most effectively functioned in a warm environment. Unfortunately we were not able to perform a proper control trial where the ants were tested with no oleic acids. In addition, the effect of the geometry of the container on the ants was not tested. Also, the short lifespan of the ants proved to be an obstacle as more trials could not be performed. In the future oleic acids will be tested for environmental effects and methods to strengthen the effects of the oleic acids will be explored. The data supports the versatility of the oleic acids in all temperatures, proving oleic acids as a promising natural repellent.

***Ruth Lee***

**Efficiency of *Theobroma cacao*, *Thymus vulgaris*, And *Vaccinium angustifolium*extracts against k-12 *Escherichia coli***

As antibiotic resistance has increased, new emerging infectious diseases presses for the need of new sources of treatment. Many plants contain useful antimicrobial compounds consisting of phytochemicals including alkaloids, flavonoids, terpenoids, and phenols that targets and disrupts the cell membrane and prevents growth. Certain antibiotic resistant bacteria strains can be detrimental to human health. To combat these harmful strains, new non-toxic, plant-derived solutions have potential as an alternative treatment. The purpose of this study was to find a new compound by combining various concentrations of cocoa, thymol and blueberry extracts to determine which ratio is the most effective at diminishing and preventing bacterial growth in *E. coli*. Various concentrations of these plant extract mixtures (blueberry, thyme, and cocoa) were combined and the zone of inhibition was measured after 24 hours at 37°C. It was hypothesized that a mixture of higher concentrations would have larger zones. Results deduced that Thymol was the most efficient individual extract because of its small variation of data and largest zone of inhibition. Although Thymol was the most efficient extract, it is toxic by itself. Therefore, the mixture of 25% Thymol and 25% *Vaccinium angustifolium* is the most effective mixture of extracts for this study. It had a similar zone of inhibition as the antibiotic Ampicillin.

***Soobin Lee – See Michael Cancro***

***Ciara Lehnhaeuser, Jane Maloney, Valerie Slackman***

**The Effect of Noise Pollution on Hermit Crab Behavior**

Over the past century the amount of underwater sound has increased significantly. The main source being the propulsion of ships. Marine animals rely on sound for communication, orientation, and locating prey, therefore there is a concern that elevated sound levels from anthropogenic sources may interfere with their behavior and physiology. Some studies have shown there is a decline in reproductive rates in noisy environments. The purpose of this study was to determine the effects of noise pollution on hermit crab behavior. Three different types of music (rap, hip hop, and jazz) were played against hermit crab tank to create vibrations. These different music types have different frequencies and pitches that cause different vibrations within the tank, most likely causing discomfort towards the crabs. The music was played in thirty second intervals, and the crabs' startle response and movements were recorded. We hypothesized that music affects hermit crab behavior negatively, with hip hop music having the greatest effect due to more infrequent changes in pitch and tempo. Our hypothesis was not supported and there was no difference in the crab’s movement or the number of boxes it moved into and the type of music played. Although crabs exposed to hip-hop overall appeared to move the most and crabs exposed to no music and jazz appeared to travel into the most boxes, we are not confident in our results due to the large and over-lapping error bars.

***Corey Levy – See Wonjeong Choi***

***Delina Levine***

**Applying a Quadrature Representation to Model Aerosol-Cloud Interactions**

Aerosol-cloud interactions are a large source of uncertainty in predicting human-induced climate change. Many models have been developed to study these interactions, but the detail needed for accurate modeling is computationally expensive. If it were possible to use a model that could represent detailed processes accurately while tracking a small amount of information, it would allow for cloud simulation in a time/data efficient manner. This research focused on applying a quadrature scheme to an existing cloud parcel model to determine if the quadrature scheme accurately represents aerosol activation and growth by the resulting cloud droplets. Using the quadrature model, the effect of varied vs. uniform mixing state was also tested. It was shown that the quadrature model accurately reproduces the cloud properties simulated by a detailed benchmark model. Trends of overestimation in the benchmark model were shown and corrected by the quadrature scheme. Variation in mixing state was also shown to be overestimated in the benchmark model as compared to the quadrature scheme. Tests of variation in updraft speed further confirm these correlations and help to determine effect of aerosols on cloud formation. This research shows that a quadrature model is an accurate and efficient alternative to traditional cloud models. With a changing climate, improved modeling will enable better prediction of future atmospheric patterns and the global impacts of these aerosols

***George Li – See Joseph Cramer***

***Kimberly Liao***

**Using GIS to Investigate the Prevalence of Diabetes in New York State Based on Specific Attributes**

Diabetes is a disease in which the body’s ability to produce or respond to the hormone insulin is impaired, resulting in abnormal metabolism of carbohydrates and elevated levels of glucose in the blood and urine. It affects 1.6 million New York State (NYS) residents yearly. The aim of this study was to use Geographic Information System (GIS) to determine how certain attributes (county residence, gender, age, education) influence the prevalence of diabetes. Mapping diabetics in NYS allows specific populations to be more easily identified increasing the potential for diabetics to obtain proper medical care by assuring more medical resources in that geographic area. It was hypothesized that older individuals (≥ 45 years old) and individuals with a high school education or lower will have the highest prevalence of diabetics due to decreasing health and poor access to healthcare, respectively. The Behavioral Risk Factor Surveillance System (BRFSS) dataset for years 2005-2012 was retrieved from the Centers of Disease Control website. The data set was formatted into Microsoft Excel, and study maps on the county level were created using ArcGIS 10.3 and SAS (Statistical Analysis System). The age-adjusted rate, Anselin Local Moran’s I, and Getis-Ord Gi\* statistic were calculated. The results show the prevalence of diabetics in NYS increased during the seven years analyzed. Western NYS was shown to be a diabetic hotspot with high clustering of all attributes. Allegany County had the highest prevalence of older, female diabetics.

***Amy Liu – See Elena Gnilitskaya***

***Casamira Lopez***

**The Effect of Artificial Sweeteners on Planarian (*Dugesia tigrina*) Behavior?**

Many artificial sweeteners have been approved by the Food and Drug Administration (FDA), but new recent studies contradict this approval. When they approved these sweeteners science at the time lacked the scope and technology as seen today, as they did not test the carcinogenic potential or consider long term effects. Planaria (*Dugesia tigrina),* are a flatworm that has the ability to regenerate from severed body parts. Planaria have very similar nervous systems to vertebrates including humans, so they are often used in behavioral studies. The purpose of this experiment was to show the effect of artificial sweeteners on the behavior of planaria. Four groups were created. Aspartame and Splenda were the experimental groups, while sucrose was the positive control and Artificial Pond Water (APW) was the negative control. The LCSD was determined to be a 0.25% solution. After 24hrs of planaria in their respective solution a line crossing assay was performed for 5 minutes. It was hypothesized if planaria are exposed to Aspartame and Splenda then they will cross less lines. Other studies with planaria and artificial sweeteners like Splenda conducted using light/dark assays, showed the planaria responded with a reduced mobility rate and curling into a c-shape.

***Luke Maciejewski – See Aryaram Anand***

***Vishwanath Madhavan – See Riley Bode***

***Alexis Maikowski – See Wonjeong Choi***

***Izza Malik - See Candace Arneaud***

***Jane Maloney - See Ciara Lehnaeuser***

***Cole Margarites – See Dylan Krukowski***

***Sophia Mastroianni***

**Olfaction Discrimination Between Alzheimer's Mutated Fruit Flies**

Alzheimer's is a neurodegenerative disease that slows and damages the nerve cells in the brain. It has been shown to affect the scent and decision making in humans. This project was designed to determine olfactory discrimination of Wild Type (WT) fruit flies and flies with the activated Alzheimer's gene utilizing Sweet Almond Oil. It was hypothesized if the fly express’s the Alzheimer's gene, then it would take longer to decide and wouldn’t respond to the almond scent like the WT flies.  For the control group females were extracted from a WT population and put into an olfactory sensor chamber. The chamber required the flies to choose between the sweet almond essential oil and water pathway.  The time it took the fly to decide and the type of scent was recorded. For the experimental group female virgins were extracted from one stock and males were extracted from another in order to cross for a production of offspring expressing the Alzheimer’s gene. Then the offspring with the straight wings were separated from the curled winged ones and both were tested in the same manner as the WT. The straight winged flies expressed the activated gene and the curly winged flies were used as a control group. The results show that overall there was no difference between the WT flies and the flies with the activated Alzheimer’s gene, however there was a difference between the offspring of the crossed flies (Stock 33774 and 8765) and the Wild Type flies. This shows that when comparing the WT to the mutated flies the choice made was independent on the type of fly, but when looking at the crossed offspring overall in comparison to the Wild Type the choice was dependent on the type of fly.

***Emma Matz, Carly Tamer***

**Characterizing Mutants of the *Acinetobacter baylyi* Tat Pathway**

Due to bacteria’s ability to evolve rapidly, antibiotics are deemed ineffective after a strain of the pathogenic species develops resistance. Studying bacteria's transportation mechanisms may uncover new targets for antibiotics, allowing for longer periods of functionality. The twin-arginine translocation (Tat) Pathway is responsible for transporting folded proteins across the inner membrane to the periplasm in certain gram-negative bacteria, including *Acinetobacter baylyi*. This organism is unique in that it possesses two Tat pathways: one essential (TatA1B1C1) and one non-essential (TatA2B2C2). By mutating the non-essential Tat pathway, we can decode its function and role in the bacterium. The growth TatA2, B2, and C2 mutant strains with a biofilm assay under varying dilutions. By comparing the growth of the wild type strain to the Tat mutants, we can determine the function of Tat substrates and their role in maintaining homeostasis under stressful conditions.

***Michelle Mojsa – See Erika Kraft***

***Brian Mokotoff – See Adam Dubi***

***Jiwon Paul Moon – See Melike Akoglu***

***Nikhita Mudium, Jessica Murrell, Caroline von Hof***

**The Effects of Heavy Metal Pollutants on Fruit Flies for**

**Potential Application to Humans**

The world relies heavily on many industrial agricultural, medical, and technological applications to advance. These processes could have negative effects on human health and the environment by distributing heavy metal pollutants into the environment. These harmful compounds leak into food and water supplies and can be ingested by humans. Since fruit flies are physiologically similar to the human, they are often used in neurobiological studies. The purpose of this experiment was to observe the effects of heavy metal pollutants on behavioral assays of fruit flies. It was hypothesized as fruit flies are exposed to increased levels heavy metal pollutants, their cognitive ability would become increasingly stagnant. To carry out this study, three experimental food groups of lead nitrate, silver nitrate, and cupric nitrate were created along with a control group which had no heavy metals added. Each heavy metal was used at a concentration of 0.002% based on previous LD-50 assays. Flies in both the control and experimental group were allowed time to mate, respectively. The resulting larvae were first tested using a Crawl Assay to evaluate how far they could travel in one minute. Additionally, the mature flies were tested using a Ring Assay to see how far they could fly vertically in three seconds. The results show that the surviving flies within the lead grouping either flew all the way to the top or barely flew at all, rarely did the flies meet in the middle like the flies in the control group. Results regarding the Crawl Assay show that effected larvae are unresponsive and unable to sense food right in front of them.

***Jessica Murrell – See Nikhita Mudium***

***Pragati Muthukumar***

**Phylogenetic Analysis to Provide Insight on the Trihelix Gene Function in *Arabidopsis thaliana***

Plant growth and productivity is greatly affected by climate change, especially in hot and dry climates. Scientists use various methods to study gene families and find genes that respond to various abiotic stresses. The Trihelix gene family is a plant-specific transcription factor family that has known roles in heat and drought stress. However, this gene family has not been fully characterized in most plants. The purpose of this study was to use a new genome-wide method to identify, classify and determine gene function in the Trihelix gene family. This was done by incorporating a phylogenetic study, looking at gene expression and protein-protein interaction. Thirty members of the Trihelix gene family were identified using Pfam ID(PF13837) and their respective MYB-like/SANT binding domain was verified using InterProScan. From the phylogenetic tree, the gene family was divided into two sub-classes and four sub-groups. A second phylogenetic tree including Trihelix members of other plant species including Zea mays, Sorghum bicolor and Orzya Sativa helped to identify dicot and monocot specific members. The Trihelix gene family was further grouped by the expression at different developmental stages and with different abiotic stresses (salt, light and heat) using publicly available data.The data shows that 5 gene pairs were determined to share similar gene function and their similarity was further tested with a percent dot matrix. One particular gene pair, AT2G38250-AT5G01380 is induced by high temperatures and codes for heat stress proteins. Further experimentation can be done with these gene pairs in order to increase crop yields in hot and dry climates.

***Narumuchi Nakamura – See Jun Ko***

***Maheen Naseem, Meghna Thampy***

**The Effect of Ammonium Hydroxide on the Hatching Rate of *Artemia salina***

Ammonium Hydroxide(NH4OH) is a chemical used in many fertilizers and can infiltrate many water systems due to runoff. Excess runoff of ammonium hydroxide can negatively impact marine organisms due to toxic buildup in tissues and blood, and possible death of the organisms. The purpose of this experiment was to study the effects of Ammonium Hydroxide on brine shrimp hatching rate. Brine shrimp were used because they are the model organism for ecotoxicity studies. We hypothesized that Ammonium Hydroxide will decrease the hatching rate because it has already been shown to shorten the lifespan of aquatic organisms like brine shrimp. Experimental groups were tested by adding 10 brine shrimp eggs into 2 petri dishes per amount: 2 mL of Ammonium Hydroxide + 8 mL of the salt solution, 4 mL of Ammonium Hydroxide + 6 mL of the salt solution, and 6 mL of Ammonium Hydroxide + 4 mL of salt solution were used respectively.The dishes with eggs in Ammonium Hydroxide + salt solution were placed under a light as well for one to two days. Control groups were tested by putting the 10 brine shrimp eggs solely in salt water. The eggs were left under a light for one to two days. After words the amount of hatched shrimp were counted. Afterwards, a statistical analysis of the data to determine if there is any statistical differences in the number of eggs that hatch and the concentration of ammonium hydroxide was done.

***Mustafa Naseem – See Hamza Khan***

***Evan Ni – See Liam Cummings***

***Jake Novello***

**The Design and Construction of a Novel Traction Splint**

In a highly mobilized world today, many people spend large portions of their time in vehicles where they can potentially get into an accident. Injury due to motor vehicle accidents (MVA) has increased in recent years. The most common type of injury is the "dashboard injury" where the femur is forced forward but the tibia remains in place. A fractured femur causes excruciating pain and a penetrating trauma like a severed femoral artery, can cause a large amount of blood to be lost that can pool in the leg causing edema (swelling). The way to treat a patient with these injuries is to hold manual traction on the injury by pulling on the ankle of the fractured leg to realign the two fracture points and reduce pressure. This is done because the hamstrings and the quadriceps continue to contract causing the fractured bone to push further into the leg causing more damage. A device currently used to hold manual traction is a traction splint. The device is made out of metal and is adjusted to wrap around the ankle and extend past the foot. The traction splint is very difficult to fit into an ambulance or into a helicopter if the patient is of tall stature. In addition, the traction splint is confusing to deploy since all the parts are capable of being taken off. The purpose this project is to make a traction splint that will be less expensive, easily assembled and dissembled, and can be applied to all situations compared to other traction splints on the market today. The device was made out of aluminum due to its lightweight and durable characteristics, elastic material lined with silicon was used to attach the device to the person, this also allowed for the device to be easily cleaned after the call is over.

***Sarah O'Connor***

**Do Planaria That Show Signs of Addiction Pass on Their Addictive Traits to**

**Their Regenerated Offspring?**

The goal of this experiment was to discover whether addiction is passed onto the regenerated offspring of a bisected Planaria. Planaria are a species of flatworms that have a relatively simple nervous system. The nervous system is made of a small brain beneath the ocelli (the cerebral ganglia) that is connected to two long parallel nerve cords running along the body to the tail. The ocelli can detect the intensity of light so the Planaria move away from the light source. The two chords are connected by transversal nerves. Their nervous systems are similar to a human's which is why Planaria are a good choice for this experiment. Planaria are excellent model organisms because they are easy to work with; they can be kept in a simple environment and are easy to feed and to take care of. Planaria also can regenerate. Planaria regenerate when the head grows a new tail, and the tail grows a new head. To carry out this study I did a pre-test which found out if the Planaria prefers light or a dark environment more. This information is important because it indicated which environment was used as the drug-paired environment for the conditioning phase. The conditioning phase prepared the organism for the post-test by testing it in and out of the ethanol as well as in light and dark. Finally, the post-test tested to see how long the Planaria spends on each side and calculate the preference scores. After these tests, I cut the Planaria into two halves, the head and the body. Then, the head and body would regenerate. Next, I re-did all the tests and attempted to find out if the regenerated Planaria showed addiction to ethanol similar to it's parent. I hypothesized that the regenerated Planaria will have the same addiction response as the original Planaria. Thus far results show that the original Planaria's offspring are addicted to alcohol.

***Abigail Pace – See Theresa Haupt***

***Sean Pak, Kyle Spinelli***

**Deep Learning for Classification of Non-small Cell Lung Tumors in CT Scans**

Lung Cancer is one of the leading causes of death worldwide, rendering its patients to a lifestyle of constant medical supervision. To combat this disease and improve prognosis, it is imperative that a patient receives a correct diagnosis as early as possible. However, patients are misdiagnosed 19% of the time with a false positive or negative. Thus, an improved method of diagnosis is needed. Current imaging tests include Low-Dose Computed Tomography (LDCT) scans and biopsies. LDCT scans are part of the initial stages of cancer detection because they are non-intrusive. The goal of this study was to test the ability of a neural network to analyze and interpret CT scans of patients with non-small cell lung cancers. Using Google’s Tensorflow Python library, a neural network was developed to analyze scans and yield a diagnosis based on the presence of any abnormalities. The neural network was trained on a large set of test cases to create a robust model which was then tested against a smaller validation set of CT scans to tune the network further. The images were obtained from the SPIE-AAPM Lung CT Challenge project within the The Cancer Imaging Archive (TCIA). The neural network was able to operate at levels sufficient enough to assist professionals in improving manual analysis of patients’ CT lung scans. This signifies the validity of the implementation of artificial intelligence as a developing tool in modern society.

***Samuel Panes – See Andrew Kassnove***

***Thomas Parangelo – See Daniel Graf***

***Isac Park***

**Green Tea Extract on Planaria regeneration**

As scientists across the globe searched for methods to delay, halt, or reverse cancer cell reproduction rates in victims of cancer, the main catechin in green tea, Epigallocatechin-gallate, was found to have significant antiproliferal effects on human cancer cells. Specifically, EGCG was found to target the telomeres of cancer cells, limiting reproduction rates. Although pure EGCG and human cancer cells weren't available for my study, examining the effects of green tea extract on planarian cells could lead to insights on the effects of green tea polyphenols on the regeneration in other organisms. Specifically, the purpose of this project is to determine if EGCG, a chemopreventive agent and the main catechin in green tea, will decrease regeneration rates in Planaria. Hypothetically, the green tea extract containing EGCG and other tea polyphenols should increase the regeneration period of an amputated Planaria, given the apoptotic and inhibitive effects the polyphenols have on human cancer cells and their proliferation processes.

To test the effects of green tea extract (50% EGCG) on Planaria (*Dugesia dorotocephala*), Planaria in different concentrations of green tea powdered extract were cut and observed until full regeneration was observed. To record data, amputated Planaria were periodically observed and recorded with a microscope and camera. A Planaria is fully regenerated when both eyes and head are fully developed. Unfortunately, none of the five concentrations of the green tea extract solution groups survived; excessive apoptotic responses caused by the tea polyphenols in Planaria scattered the Planaria into unrecognizable clusters of post-apoptotic cell fragments. Planaria in 0.07 to 0.10 mg of EGCG in a 10 mL solution of green tea extract and artificial pond water died in less than 72 hours while Planaria in 0.04 to 0.007 mg of EGCG in a 10 mL solution died under 120 hours. Although low concentrations of green tea extract elongated regeneration period relative to the control group, all Planaria did not survive. The sustained exposure to large polyphenolic molecules caused the Planaria to undergo apoptotic death in response to excessive consumption of indigestible and possibly harmful substances. In other words, Planaria cannot fully regenerate in very small concentrations of green tea extract.

***Paul Park – See Kevin Chen***

***Victoria Pensiero***

**Multiple Gene Deletion in *Candida albican* Cells for the Treatment of Candidiasis**

SC5314 is a wild type strain of *Candida albicans*. Once it invades the bloodstream, it can produce strong protein filaments, allowing it to bind to kidney tissue (Caldarone & Fonzi, 2001). This will ultimately cause an infection known as Candidiasis (Wilson & et al., 1999). Candidiasis is the parasitic relationship between *C. albican* cells and kidney tissue, where the kidneys do not have enough nutrients to filter toxins from the blood (Park, 2005). REV1, REP1, and NDT80 are the three genes responsible for the production of filaments in *C. albicans* (Noble & Johnson, 2005). In order to terminate filament production, all three genes must be deleted simultaneously (Sanglard & et al., 1997). The purpose of this experiment was to perform the simultaneous deletion of the three genes in *C. albicans*, using a CRISPR CAS9 plasmid system in combination with the NAT\_FLIPPASE enzyme. This enzyme allows for the deletion of genetic material from genomes without having to replace the old DNA with unnecessary material. Heat shock transformation was used to transfer the CRISPR gene editing tools into the cells, and the resultant DNA was amplified using PCR, in order to be plated and observed. The cells with the deleted genes are marked with an ampicillin resistant gene, penicillin resistant gene, and red pigment gene. After one week of growth on ampicillin and penicillin agar plates, the control contained no colonies. However, on the plate with the transformed cells, 84 red colonies were counted, showing the three gene deletion was successful. On a control plate containing regular *C. albican* cells on plain agar, 112 colonies were counted, indicating that the gene deletion efficiency was 75%. The results of this investigation support that the CRISPR CAS9 plasmid system could be used to delete multiple genes in a wild type yeast strain, which was not possible with older transformation methods. Future use of this system could be in organisms that contain multiple genes that pose the possibility of serious disease transmission upon infection.

***Jack Pettit – See Jayson Bromberg***

***Craig Pihlkar – See Jayson Bromberg***

***Jayden Prestiano – See Erika Kraft***

***Faizali Rahim – See Riley Bode***

***Alexandra Ramotar – See Nathan Cheung***

***Shamtej Rana – See Ariana Aghili***

***Marlee Reiter – See Jayson Bromberg***

***Jordana Resnikoff***

**Temperature Change and Vitamin C**

Different from many animals, humans cannot produce Vitamin C. In order to obtain this extremely necessary factor of their diets, humans must consume foods that contain Vitamin C. Vitamin C is also known as Ascorbic Acid, has the chemical formula of C₆H₈O₆ and prevents a disease known as Scurvy. Without Vitamin C, humans would not be able to form collagen. Vitamin C also helps to reduce stress, resist infections, heal wounds quicker by producing skin and keeps bones and tissue strong. The purpose of this experiment was to test if changing the temperature of stored orange juice, a citrus juice known for its large amounts of Vitamin C, will change the quantity of the Vitamin C present. It was hypothesized that the quantity of Vitamin C in orange juice stored at 21°C (room temperature) over 48 hours will lose the least amount of Vitamin C, compared to orange juice stored in the refrigerator at 4°C and orange juice stored in an incubator at 38°C over the same period of time. Thus far, results indicate that the orange juice stored at 21°C, rather than 4° C or 38°C, took less amounts of iodine to change color when titrated. This result indicates that, in fact, orange juice will retain the most amount of Vitamin C while kept at 21°C (room temperature) rather than in the refrigerator.

***Paige Robinson – See Adam Dubi***

***Caitlyn Rothar, Kiera Spahn***

**Analyzing the Relationship Between Color and Emotion**

Studies have shown that colors can relate to our emotions and feelings, where certain colors are perceived to have positive and/or negative connotations. For example, most people associate green with feeling relaxed and soothed, as they make a connection to nature; whereas, red is perceived as angry and aggressive, as it is associated with fire. It was also found that a color-related emotion is dependent on one’s preference and past experience with that particular color. The purpose of our study was to investigate the color emotion associations with different color skin tones. This information could expand our knowledge on the psychological value of color and emotion. Five random aesthetically appealing people’s headshots were chosen. We equally darkened the skin tone of the headshots, using Photoshop, each headshot had three different shadings including the original. Pictures were randomly distributed, one shade from each person. The participants had 10 seconds to select an adjective from the list that they felt when looking at the picture. The adjectives represented positive and negative connotations. Between each picture, participants were shown a gray background. We hypothesized that paler people would be associated with words describing cool color tones (negative) and tanner people would be associated with words more associated with warmer colors (positive). Our hypothesis was not supported, there was an association between people and selection because the p-value < 0.05, so perception of beauty was a factor that influenced results. There was no association found between skin shades and selection, probably due to the shades not being drastic enough.

***Funda Sahin, Mariam Zahran***

**The Effect of pH on the Efficiency of EDTA to Chelate Lead Nitrate**

EDTA (Ethylenediaminetetraacetic acid) is a chelating agent, meaning it reacts with metal ions to form stable soluble complexes. It is commonly used for chelation therapy to treat lead and mercury poisoning in humans by binding with the heavy metals and transporting them to the kidneys for excretion. This study consisted of two separate tests. Test A investigated which pH of water allowed EDTA to sequester the largest amount of lead. Two beakers consisting of lead nitrate at pHs of 4 and 5 were prepared. In Test B, different concentrations of EDTA were set up in the optimal pH found in Test A to study what concentration sequestered the highest amount of lead nitrate. To carry out Test B, ten beakers were set up with different concentrations of EDTA. In both studies, possible discoloration of lemna plants were studied to conclude the optimal pH and EDTA concentration. It was concluded from the results that EDTA was optimal in a pH of 5 with a 25% concentration. The lead nitrate solution with a pH of 4 had 400 ppm of lead remaining, while the lead nitrate solution with a pH of 5 had 200 ppm of lead remaining. It was also found that the lead in the solution crystallized when the EDTA concentration was between 10-20%. It was hypothesized that EDTA would sequester more lead in a higher pH and a larger EDTA concentration. This is due to the fact that lead dissolves better in lower pH’s and a higher concentration of EDTA would cause a larger ratio of EDTA molecules to lead ions. This study offers a potential method to detoxifying waters that are contaminated by lead, which continues to pose a risk to aquatic life around the globe.

***Yasemin Sahin – See Kathy Cao***

***Michael Scaccianoce – See Matthew Lee***

***Cole Schwartz – See Liam Cummings***

***Jason Sicoli – See Jun Ko***

***Deniz Sinar***

**Understanding the Role of Bacteroidetes Species Isolated from the Beachgrass Rhizosphere in Plant Health**

Beachgrass (*Ammophila breviligulata*) grows in a nutrient depleted environment, which makes it a useful model to analyze how it can thrive in such a location. One possible factor that aids in the health of these plants is microbe presence in their surrounding soil (rhizosphere) and roots (endosphere). This is because certain microbes are capable of producing compounds that promote plant growth by providing essential nutrients like iron (through siderophores), or protecting the plant from pathogens by producing substances like antibiotics. Previous data from a university lab indicated a significant abundance of Bacteroidetes species of the genera *Mucilaginibacter* and *Pedobacter* in soil samples taken from healthy beachgrass plants in comparison to those from unhealthy plants. Thus, it is possible to hypothesize that these species of microbes play a role in aiding beachgrass plant health. To test this, colonies of Bacteroidetes were isolated from a rhizosphere soil sample of a healthy beachgrass plant. They were grown on Mueller-Hinton Agar and tested against *E. coli* and *S. aureus* to identify possible antibiotic production by assessing any inhibition ofgrowth. The isolates were grown on CAS-Azurol media to test for production of siderophores by observing color changes in the media. Lastly, indole-3-acetic acid (IAA) production was assessed using Salkowski reagent and measuring absorbance using a spectrophotometer. The results thus far show three isolates that potentially contribute to plant growth: two species of *Pedobacter* that produce both high levels of IAA and siderophores, and a species of *Mucilaginibacter* that produces high levels of siderophores. Antibiotic production was not found to be a method of plant protection among the tested isolates.

***Valerie Slackman – See Ciara Lehnaeuser***

***Ethan Sontarp – See Christine Kong***

***Joseph Strickland – See Jonathan Appel***

***Aidan Spahn – See Joseph Cramer***

***Keira Spahn – See Caitlin Rothar***

***Kyle Spinelli – See Sean Pak***

***Rohan Surana – See Also Liam Cummings***

***Rohan Surana, Jordan Walsh, Chapin Zerner***

**Can We Develop an Accurate Sample Size of the Milky Way Galaxy to Learn What Mass Function Can Teach us About Stellar Distance Function?** ​

We provide an analysis of data which after close consideration, has proved small clusters of stars to be unrepresentative of the entire Milky Way Galaxy. We collected the mass and distance values of 476 stars and 46 black holes from sources such as Hygdata 3.0. We then created histograms and scatter plots to determine if the mass distribution of large stars and parent stars of black holes provided a strong representation of the Milky Way Galaxy as a whole. We found a strong linear representation of the relationship between distance from the solar system and stellar black hole mass. This inconsistency of strong mass and distance correlations demonstrated the limitations of current celestial observations. It provides a general understanding that the functionality of the Milky Way Galaxy cannot rely on the analysis of a small cluster of data consisting of present day stars and parent stars of the past, derived from mass conversions of stellar black holes. There is a need for advancement in the technology used for astronomical observation for us to broaden our understanding of how galaxies such as the Milky Way Galaxy have evolved. Due to the currently obtained clusters revealing strong linear relationships for subsets of our collected data, there is a chance that future collection of information could help us better define the growth and function of our galaxy. Overall, our results show that to represent a cosmological area as large as the 100,000-light-year galaxy, large portions of data must be obtained.

***Carly Tamer – See Emma Matz***

***Catherine Tawadros – See Grace Cutrone***

***Ryan Tedesco***

**Sprouting in the Dark: Differentiating Effect of Light and Darkness on Seed Germination of Red Kidney Beans?**

When plants are set in a dark setting, most of the plants would have stunted leaf growth. This is because with less light, there is less photosynthesis, resulting in smaller leaves since leaves absorb the sunlight and less CO2 intake. When most plants are placed into a dark setting, the leaves tend to be smaller, having a smaller starch reserve than light. Leaves would need to be bigger in order to absorb more of the light energy for photosynthesis and with less light, the leaves would be smaller. The purpose of this experiment was to better understand growth requirements of kidney bean plants. Several kidney beans were placed into a beaker of water overnight. Cardboard boxes were used for dark chambers, one hap no holes the other 2 had small holes, opposite the opening. The control was left tableside exposed to natural light condition, then placed into a damp paper towel for 2-3 days. They were placed into freshly moistened soil and 4 were placed into the boxes, the other 2 were placed into the direct light. Afterwards, they were potted into moistened soil, 4 were placed into the dark box conditions and were placed into direct light. The beans were watched for 6 weeks, with plant height recorded every other day. It has been hypothesized that with more light, the more the kidney beans' leaves and stem will grow larger and fuller. Thus, for results show that the light beans had experienced the greatest growth as the semi beans had the lowest growth. The light beans were the only beans with a positive slope showing that they are the only ones who had the best overall growth. The data may have been inaccurate due to days of dehydration from days off.

***Meghna Thampy – See Maheen Naseem***

***Caitlin Tolentino – See Marina Khan***

***DeVaughna Tulloch***

**The Effect of Hand Gestures on the Comprehension of the German Language**

Hand gestures are used to enhance the comprehension of everyday speech. These motions allow us to gather information from others and express emotions. Hand gestures are a way of communication used in multiple different cultures to help better understand language. If students are tested on learning from somebody in a video using hand gestures, they are expected to score higher on the matching quiz than those learning from a video without hand gestures. This is because the video containing hand gestures provides the students with an additional form of understanding. In this experiment, I tested the effect of hand gestures on the comprehension of the German language to discover the impact body language has on one’s ability to learn and understand. Students were randomly approached at Commack High School and randomly assigned into a group. The Control group (Group B) was a video containing a teacher verbalizing a set of 10 German words. The experimental group (Group A) was a video consisting of a teacher verbalizing a set of 10 German words with the addition of hand gestures to describe those words. After each student watched their assigned video, they were given a matching quiz to evaluate how well they’ve retained the information given within the videos. A survey was then given out to evaluate the student’s learning style preference. Results for this experiment show that those who watch the video with hand gestures scored higher than those who watched the video without hand gestures.

***Kevin Tuzinowski – See Juvin Johnson***

***Shawn Uthup – See Matthew Feigenbaum***

***Olivia Vasselman – See Faith Chi***

***Louis Viglietta – See Christine Kong***

***Caroline von Hof – See Nikhita Mudium***

***Jordan Walsh – See Rohan Surana***

***Jenny Won***

**Stalking Antibiotic-Resistant Bacteria in Organic and Inorganic Vegetables**

Bacteria are the single most common life form on the planet and one of our current crises due to an increase in the number of antibiotic resistant strains. Our over-prescription and misuse of antibiotics to treat disease has led to a natural selection 'war' in which antibiotics kill the weaker bacteria, leaving the stronger ones to thrive. These surviving bacteria have a mutation that either allows them to decrease their uptake of the antibiotic, destroy the antibiotic metabolically, or alter the antibiotic's ability to enter the cell. These characteristics make the bacteria far more dangerous than the original population as the antibiotic used in the treatment of the disease induced can no longer kill the resistant survivors. Worse, they pass this genetic trait on to future generations. The purpose of this project was to test antibiotic-resistant bacteria in organic and inorganic vegetables. I hypothesized that the more diluted the vegetables are, the less likely the bacteria will be antibiotic resistant because they had less chances of interactions. Vegetables were soaked into sterile water for over two days, then these sampled were serially diluted (10% to 0.001%) and pipetted onto agar plates containing Luna Broth or Ampicillin antibiotic. Plates were incubated overnight, and the number of colonies were counted. This far results show that the more concentrated vegetables grew more colonies.

***William Yuk – See Juvin Johnson***

***Mariam Zahran – See Funda Sahin***

***Tasneem Zahran – See Nathan Cheung***

***Michael Zareif – See Ethan Darvin***

***Tryphena Zareif – See Jeremiah Jerome***

***Chapin Zerner – See Rohan Surana***

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