***The Research Dragon***

![dragon[1]]()



**Commack High School’s**

**Research Yearbook**

**2016 - 2017**

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

**Thursday May 25th, 2017**

**7:00 pm**

**Evening Events**

Poster Presentation of student projects

Slide Show Presentation… Olivia Dubi, Maeve Smart

Introduction…………....….Raphael Iskra

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

 Director of Science, K-12

Student Reflections..….….Marina Khan, Louis Viglietta

Alumni Comments……….David Li, Class of 2016

Guest Speaker………….. Mr. Zachary Kurtz

 Scientist

 Lodo Therapeutics

Special Recognition Presentation…....Abinya Anand

 Adam Dubi

 Aria Eghbali

 Amy Uthup

Honoring Our Seniors…...Alexis Davitashivili, Jake Nieto

Senior Picture Compilation….Tara McCaffrey, Jamey Meotti

Closing Remarks…..…….Raphael Iskra

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

Ms. 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.*

Susan Abbott, Eric Biagi, Anthony Capiral, Laura Cavalluzzo, Lisa DiCicco,

Chris DiGangi, Susan Fanwick, Carolyn Gallogly, Paul Giordano,

Dolores Godzieba, Camille Horak, Dr. John Kelly, Dr. Barbara Kruger,

Dr. Fred Kruger, Dr. Susan Lee, Brenda Lentsch, Chesley McColl,

Daniel Meeker, John Mruz, Frank Musto, Eileen Rogers, Richard Schramm,

Genny Sebesta, Gary Shaw, Victoria Stack, Lois Webster, and Frann Weinstein.

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

**Science Fair Participation**

**Regeneron Science Talent Search**

Jordan Cooper - National Semifinalist

Abbigayle Cuomo – National Semifinalist

**Siemens Competition in Math, Science, and Technology**

Daniel Lee – National Semifinalist

**Intel International Science and Engineering Fair**

**Abbigayle Cuomo**

**Raphael Iskra**

**Charity Russell**

***Awards to be Announced***

**Junior Science and Humanities Symposium**

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

Abbigayle Cuomo – 2nd Place, Earth and Environmental Science

Daniel Lee – 2nd Place, Engineering

Anoop Singh

Muzaffer Tasoglu

Ryan von Hof

**Toshiba/NSTA Exploravision Program**

Aria Eghbali – National Honorable Mention

Mia Goren

Theresa Haupt – National Honorable Mention

Emma Karadenes

Yeil Kim – National Honorable Mention

Christine Kong – Regional Winner, National Finalist

Kimberly Liao – Regional Winner, National Finalist

Maheen Naseem – National Honorable Mention

Sarah O’Conner – National Honorable Mention

Michael Parrinello – Regional Winner, National Finalist

Arianna Tringali

Louis Viglietta – Regional Winner, National Finalist

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

*National Finalists may compete in June in Washington, D.C.*

**Exploration of the Moon by Secondary Science Students**

Karen Abruzzo

Delina Levine

Pragati Muthukumar

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

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

Abbigayle Cuomo

Jordan Cooper

Raphael Iskra

Jared Habermehl

Daniel Lee

Paul Mokotoff

Jake Nieto

Charity Russell

Anoop Singh

Maeve Smart

Mazaffer Tasoglu

Elizabeth Van Loon

Ryan von Hof

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

Abbigayle Cuomo – 1st Place, Environmental and Earth Science

 American Meteorological Society Award

 Association for American Women Geoscientists Award

 National Oceanic and Atmospheric Administration Award

 Young Scholar Award

Jordan Cooper – Honorable Mention, Biochemistry

Raphael Iskra – 1st Place, Microbiology

 United States Air Force Award

 Young Scholar Award

Jared Habermehl – 3rd Place, Embedded Systems

 INTEL Excellence in Computer Science Award

Daniel Lee – Honorable Mention, Energy

 Yale Science and Engineering Award

Jake Nieto – 3rd Place, Biomedical and Health Science

Charity Russell – 1st Place, Animal Science

 United States Air Force Award

Anoop Singh – 3rd Place, Environmental and Earth Science

 American Meteorological Society Award

 National Oceanic and Atmospheric Administration Award

Mazaffer Tasoglu – 3rd Place, Environmental and Earth Science

 American Meteorological Society Award

 National Oceanic and Atmospheric Administration Award

Elizabeth Van Loon – Association for American Women Geoscientists Award

Ryan von Hof – Honorable Mention, Chemistry

 United States Metric Association Award

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

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

Karen Abruzzo

Paulina Buchta

Kathy Cao – Honorable Mention, Environmental Science

Aria Eghbali – 3rd Place, Engineering

Julia Greco

Maheen Khan – Honorable Mention, Environmental Science

Catherine Kim

Yeil Kim – 3rd Place, Engineering

Joshua Lee

Delina Levine

Amanda Loo

Emma Matz

Pragati Muthukumar

Yasemin Sahin – Honorable Mention, Environmental Science

Deniz Sinar

Carly Tamer

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

Abbigayle Cuomo – Stockholm Junior Water Prize

Jordan Cooper – 2nd Place, Life Science

Raphael Iskra - – 2nd Place, Life Science

Jared Habermehl – 2nd Place, Physical Science

Daniel Lee

Paul Mokotoff

Jake Nieto – 3rd Place, Life Science

Charity Russell - – 2nd Place, Life Science

Anoop Singh

Maeve Smart – Honorable Mention, Life Science

Mazaffer Tasoglu

Elizabeth Van Loon

Ryan von Hof

**WAC Lighting Foundation Invitational Science Fair**

Karen Abruzzo

Melike Akoglu – Merit Award, General Biology

Rebecca An

Abinya Anand

Aaron Angeles

Jacob Ashkenas

Brandon Axelrod – 3rd Place, General Biology

Kathy Cao

Kristen Chao

Nathan Cheung

Julia Cicalo

Gabrielle D’Agostino – Honorable Mention, Earth and Environmental Science

Alexis Davitashivili

Kyle Dituro

Aria Eghbali – 1st Place, Prototype Engineering

John Finnie-Maloney

Danielle Gabay

Nicholas Gembs – 3rd Place, General Biology

Honorable Mention, The Vladimir Brezina Award for Imagination, Initiative, and Independence in Science

Elias Gonzalez

Eliana Gruvman – Honorable Mention, Earth and Environmental Science

Jared Habermehl – 3rd Place, Computer Science and Modeling

Austin Heller

Alex Horowitz

Maheen Khan

Christine Kim – 3rd Place, General Biology

Yeil Kim – 1st Place, Prototype Engineering

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

Charlson Kim – 3rd Place, General Biology

Honorable Mention, The Vladimir Brezina Award for Imagination, Initiative, and Independence in Science

Nicole LaReddola – Honorable Mention, General Biology

Anthony LaSala – Honorable Mention, Prototype Engineering

Daniel Lee – 3rd Place, Computer Science and Modeling

Joshua Lee

Delina Levine

Jordyn Lieberman

Taylor Lipton

William Liu

Sophia Mastroianni

Tara McCaffrey

Pragati Muthukumar

Jake Nieto – Merit Award, General Biology

Megan Padgett

Kelly Page

Zachary Peare

Victoria Pensiero

Shamtej Rana

Trevor Rosenlicht

Yasemin Sahin

Sarah Samad – Honorable Mention, General Biology

Chase Schare

Mia Serritella

Manvi Sharma

Deniz Sinar

Anoop Singh – Merit Award, Earth and Environmental Science

Max Sugarman – Merit Award, Earth and Environmental Science

Dylan Talarek – 3rd Place, General Biology

Honorable Mention, The Vladimir Brezina Award for Imagination, Initiative, and Independence in Science

Amy Uthup

Alexa Varlamos – Honorable Mention, Earth and Environmental Science

Louis Viglietta

Jeremy Vlacancich – Merit Award, Earth and Environmental Science

Matthew Wu – Merit Award, Earth and Environmental Science

Tyler Young

Michael Zareif

Kevin Zhou

**Molloy College Science Fair**

Julio Alves

Kaitlyn Cestaro

Gabriel Chan – Gold Award

Tyler Chipetine

Anthony Citera

Elizabeth Demacopoulos

Santiago Depascale Carena

Emily DiPrima

Emma Downey

Ryan Duffy

Amy Held

Jason Hladki

Maria Hoover

Marina Khan

Joseph Kim

Christine Kong

Kimberly Liao

Kacey Lopez

Emma Matz – Bronze Award

Jake Novello

Sean Pak

Kristina Parkas

Victoria Pensiero

Funda Sahin

Vincent Santangelo

Ethan Sontarp

Carly Tamer – Bronze Award

Megan Thampy

DeVaughna Tulloch

**Technovation Challenge**

Aria Aghili

Candace Arneaud

Jillian Evers

Ruth Lee

Jordana Resnikoff

Cassidy Volatile

Jenny Won

**Long Island Science Congress**

Karen Abruzzo – To Be Announced

Emma Baker - Meritorious

Nicholas Bitonti - Meritorious

Gabriel Chan - Achievement

Matthew Damiata - Achievement

Isabella Daquita - Achievement

Cathleen Deutsch – Honorable Mention

Mikayla Elferis – To Be Announced

Matthew Feigenbaum - Meritorious

Dylan Feldman – Honorable Mention

Bridget Flynn – Honorable Mention

Samantha Gray - Achievement

Nicholas Greco - Meritorious

Christopher Ioannou - Meritorious

Joshua Kaplan - Meritorious

Delina Levine – To Be Announced

Kimberly Liao - Meritorious

Vishwanath Madhavan - Achievement

Izza Malik - Meritorious

Brian Merritt - Meritorious

Pragati Muthukumar – To Be Announced

Mustafa Naseem - Meritorious

Nicholas Nasis - Achievement

Zachary Peare – To Be Announced

Alexandra Ramotar - Meritorious

Paige Robinson - Meritorious

Funda Sahin - Meritorious

Emma Sass – To Be Announced

Mia Serritella - Achievement

Joseph Strickland - Meritorious

Ryan Tedesco – Honorable Mention

Sundar Teja – Honorable Mention

Caitlin Tolentino – To Be Announced

Shawn Uthup - Meritorious

**Medical Marvels Challenge**

Kathy Cao

Kristen Chao

Adam Dubi

Charlson Kim

Yasemin Sahin

Alexa Varlamos

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

*Awards to be announced*

Adam Abdabhai

Gianna Anderson

Riley Bode

Jacqueline Brandel

Ruslan Burns

Nathan Cheung

Daniel Czop

Gabrielle D’Agostino

Ethan Darvin

Ryan Dery

Jessica Fecht

Brian Flynn

Dimitri Gouvoussis

Eliana Gruvman

Jason Haber

Joshua Hardoon

Jessica Hastings

Mikayla Kelly

Hamza Khan

Amanda Lemza

Frank Mastroianni

Brendan McCaffrey

Nicolette McKeon

Paul Moon

Samuel Morris

Eric Nigro

Abigail Pace

Nicholas Pappas

Sydney Sirota

Simon Snowden

Kyle Spinelli

Justin Tollin

Lauren Tuffy

Alexa Varlamos

Louis Viglietta

Peter Yu

Michael Zareif

**SAAWA Fair**

*Awards to be announced*

Kaitlyn Cestaro

Jordan Cooper

Gabrielle Cooper

Brian Flynn

Maria Hoover

Marina Khan

Christine Kong

Paul Moon

Sean Pak

Alexandra Ramotar

Paige Robinson

Ethan Sontarp

Kyle Spinelli

DeVaughna Tulloch

Ryan von Hof

**American Society of Human Genetics Video Competition**

Pragati Muthukumar

Victoria Pensiero

Deniz Sinar

**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**

**SENIORS**

***Zack Abrams***

**Creation of a Vibratory Speaker for Deaf Users**

An estimated 37.5 million Americans have some difficulty hearing. (2) This disability impacts many aspects of their personal lives, including not being able to experience activities which others find engaging, like listening to music. However, research has shown that deaf people experience music through vibrations created by loudspeakers or other vibrating surfaces (3). I will show here that it is possible for a vibrating speaker and a visual display to transmit information about timing and pitch changes to deaf participants in the same way normal speakers do for hearing participants. We will show this using normal hearing participants who match a song playing through the vibrating device or through the visual display to an actual song played out loud, as well as using deaf participants who match a song playing through the device to one playing through the visual display. The results will hopefully show that a high percentage of correct matches can be achieved which has implications on whether or not deaf people can understand musical information using tactile methods, not just auditory ones.

***Jung Soo Ahn***

**Pitch Memorization in Gender**

The purpose of this study was to test for a correlation between the ability to memorize the pitch of a tune and the gender. The motivation for this study was to gain knowledge of the effect of gender in memorizing the pitch. An interval is the difference between pitches and can be described as melodic if it is related to sounding tones, such as two adjacent pitches in a melody. Pitch is the degree of how high or how low a note is and it is the quality that makes it possible to judge if a note is higher or lower. Studies have shown that According to a study by Williams (1994), females tended to sing sharper than the original tune and males tended to sing flat compared to the original tune. Some individuals were not able to compare separate pitches, which led to my research regarding the correlation between the ability to sing in the original pitch and the individual’s gender. To carry out this study, both female and male musicians who have had at least three years of experience in playing instruments, sang several short famous tunes without giving the starting pitch. The results show that males are better able to memorize pitch compared to the females.

***Brandon Axelrod, Christine Kim***

**Oral Health as Assessed by Xerostomia Status**

This aim of this study was to determine the symptoms and risk-factors associated with self-diagnosed xerostomia. Xerostomia is self-observed dryness of the mouth associated with low salivary flow or alterations in the composition of saliva. Saliva is important for protecting the oral mucosa; oral mucosa helps protect deeper tissues in the oral region from daily functions carried out in the oral region as well as has sensory functions and reflexes, allowing the body to be informed about what is happening inside the oral cavity. Therefore, when the quantity and quality of saliva are compromised in the xerostomia state, it is highly likely that the oral health of patient is also. A conservative estimate of xerostomia prevalence is about 20% in the general population, with increased prevalences in females (up to 30%) and the elderly (up to 50%). The most recent data from the 2003-2004 data sets of the National Health and Nutrition Examination Survey (NHANES) were analyzed. Oral health status of those with and without xerostomia were statistically analyzed using the STATA/SE 14.1 program. Multivariable logistic regression analysis were conducted with interaction terms or subgroup analyses for relevant variables. 45 existing Oral Health Questionnaire variables (including main reason for one’s last dental visit, last time taste was affected because of oral cavity status, reason for most recent tooth extraction, etc.) assess the prevalence of major oral health diseases and conditions as well as preventative and treatment measures the sample persons have taken. Participants’ responses show significant correlations with xerostomia: frequent aching mouth, poor quality of life, affected taste, need for dentures, household arrangements (marital status, family income, etc.), gender, etc. Increased familiarity with xerostomia stimuli is necessary for dentists to take an active role in diagnosis, management and treatment of oral complications through professional suggestion.

***Julia Cicalo, Kelly Page, Megan Padgett***

**Do Planaria (Dugesia antillana) Exhibit Place Preference and Addictive Withdrawal Response after exposure to Monosodium Glutamate (MSG)?**

The goal of this investigation was to determine if Planaria exhibit a place preference after being exposed to the sodium salt Monosodium Glutamate (MSG). Monosodium Glutamate is used in the food industry as a flavor enhancer and produced the umami taste which is one of the five tastes. MSG occurs in natural ingredients such as hydrolyzed vegetable protein, autolyzed yeast, hydrolyzed yeast, yeast extract, & soy extracts.  The FDA does not require food production companies specify that these ingredients naturally contain MSG. Many processed foods contain Monosodium Glutamate (MSG) and other sources of glutamate which is a powerful, taste-enhancing amino acid.  When foods taste this good, they activate the pleasure centers in the brain, which are also regulated by glutamate neurotransmission.  This can produce the same powerful addiction impulse as cocaine and other addictive drugs.  We have a dual force, a sense of hunger and addiction, driving our appetites.Planarian are the earliest animals with a centralized nervous system and are often used to test for possible additive properties.

Place preference will be determined through the methods of Condition Placement Preference, Line Crossing Assay-Motility, and Observation of Withdrawal- Behavioral Assay.

It was hypothesized that Planarian (Dugesia antillana) will exhibit place preference and addictive withdrawal response after exposure to monosodium glutamate. Many processed foods contain Monosodium Glutamate (MSG) and other sources of glutamate which is a powerful, taste-enhancing amino acid.  When foods taste this good, they activate the pleasure centers in the brain, which are also regulated by glutamate neurotransmission.  This can produce the same powerful addiction impulse as cocaine and other addictive drugs. Results have shown that after conducting place preference tests, Planaria who were not exposed to MSG prefered the dark half of a petri dish on average 222 (± 1 sec.) seconds out of 600 seconds. After conducting Line Crossing Assay-Motility tests, it was found that Planaria who were exposed to MSG on average crossed more lines in an 8 minute period than Planaria who were not exposed to MSG.

***Gabrielle Cooper***

**Targeting the Inhibition of Protein-Protein Interactions Using Photochemistry**

Protein-protein interactions (PPIs) are vital components of all living systems, as they control all biological functions. The ability to control these interactions, particularly their inhibition, has the potential to lead to the development of methods to diagnose and treat illness through molecular based drug therapies. The aim of this study was to control the inhibition of a PPI vital in cancer treatment, p53- MDM2. p53 is a protein that downregulates the production of tumor cells, but when it binds with MDM2 it is unable to do so, making this interaction a vital one to inhibit. In this study, a non-peptidic helix mimetic was used to inhibit the PPI, and incorporated a photoswitchable element into the inhibitor, with the aim of being able to turn on and off the inhibition of the MDM2-p53 interaction. The inhibitor with the photoswitchable element will change shape when exposed to a given wavelength and intensity of light, so it will stop inhibiting the interaction. A UV-Vis scan showed that the inhibitor exposed to the light did photoswitch and change shape, but the data from the fluorescence polarization competition binding assay did not show the anticipated results, that the inhibitor exposed to light would no longer be able to bind to MDM2. It was thought that the molecule exposed to light would not bind to MDM2 and the molecule left in the dark would, but instead the binding assay with both molecules exposed to light showed similar binding to the assay with the molecule that was not exposed to light.

***Jordan Cooper***

**The Efficacy and Effects of Combined BCL6-BTB and Survivin Inhibition in**

**Diffuse Large B-cell Lymphoma**

Diffuse Large B-cell Lymphomas (DLBCLs) are a heterogeneous group of lymphoid malignancies that make up approximately 40% of Non-Hodgkin's Lymphoma diagnoses. The disease is recognized in two distinct subtypes as Germinal Center B-cell (GCB) or Activated B-cell (ABC) DLBLC. ABC DLBLCs have a worse prognosis and show resistance to chemotherapy, necessitating further research of more effective therapies. Combination therapy has been identified as a viable avenue due to the heterogeneity of these tumors and the multiple pathways involved in their pathogenesis. In this study a combination of BCL6 and Survivin inhibition was investigated in ABC and GCB DLBCL. Both pathways are thought to be of importance, particularly given that BCL6 inhibitors derepress (activate) STAT3, hence activating Survivin in ABC DLBCL. BCL6-BTB inhibition significantly increased Survivin expression in ABC DLBCL but decreased it in GCB DLBCL, whereas Survivin inhibition decreased BCL6 expression in both subtypes. Survivin and BCL6 inhibitors were efficacious as single agents against both subtypes, and their combination was potently synergistic in ABC DLBCLs. Synergy was demonstrated through CompuSyn analysis, showing significant reduction in viability and in high dose reduction indices with combination indices <1 in ABC DLBCL. BCL6-BTB Inhibition upregulated Survivin in ABC DLBCLs. Taken together, these results suggest that the combination of BCL6 and Survivin inhibitors is highly potent and more effective than either drug alone, which may present a new avenue for clinical translation. Further, this work suggests that Survivin upregulation is a mechanism of resistance to BCL6 inhibitors and demonstrates new interactions between BCL6 and Survivin which might be important to lymphoma pathogenesis.

***Abbigayle Cuomo***

**A Study of Westward Recurving Topical Cyclone Tracks in the Atlantic**

Hurricane Sandy was unusual in that it recurved to the west as it travelled north, rather

than recurving to the east, resulting in over $62 billion worth of damage. Although these westward recurving storms account for <10% of all the western Atlantic storms, they occur more often than scientists originally believed. The purpose of this study was to analyze the tracks of cyclones that recurve in the westward direction and those that recurved to the east to determine if there were any features which might identify the direction of recurvature. Tropical cyclone data for 15 westward and 15 eastward storm tracks was obtained from Weather Underground and weather composites were created for surface pressure and vector winds using the National Centers for Environmental Predictions and the National Center for Atmospheric Research (6-hourly NCEP-NCAR reanalysis data). Ten additional westward recurving tracks were identified. Results indicated that westward tracks have high pressure systems to the northeast of the cyclone and winds traveled northwest at the location of the cyclone. Eastward tracks generally experienced no pressure systems around the cyclones and east/northeast wind travel. Historical jet stream maps were consistent with vector wind patterns. These results have the potential to improve cyclone forecasting.

***Isabella Daquita, Samantha Gray, Helen Koukoulas***

**The Effect of Cough Medicine on the Aggregation and Mobilization of Planarian**

The purpose of this investigation was to determine the effect of cough medicine on planarian aggregation and mobilization. Planaria are one of the best invertebrate model organisms in developmental biology research since they have a centralized brain and share many features to vertebrate nervous systems. An aggregation is a group of distinct or varied things. In previous studies, planaria have been known to aggregate as a natural behavioral response and as a means of protection. They react to a predation risk of a situation and secrete pheromones as a signal about possible danger. By exposing planaria to varying concentrations of cough syrup, we analyzed how this drug affects the nervous systems of planaria through observing changes in aggregation size and formation time. In this investigation, we exposed 10 planaria to 0%, .001%, .002%, and .003% concentrations of cough syrup, and then videotaped them for two hours under red light to observe the size and number of aggregations that formed every 5 minutes. We hypothesized that there will be smaller and fewer planarian aggregations with exposure to cough syrup due to planarian straying away from each other. Since cough medicine is known as a central nervous system depressant, it is used to suppress the symptoms of a cold, but can also result in various side effects such as nausea, dizziness, and restlessness that can cause an organism to stray from its natural behavior. Results show that as the concentration of the cough medicine increased, fewer aggregations formed, if any at all, and the formation time increased.

***Kyle Dituro***

**Cryptography Attack on an Elliptic Curve System**

Elliptic curve cryptography is one of the most widely used and most relevant forms of cryptography in use today, and is used to encrypt much of the most important data available in the world today. The signature verification process of elliptic curve encryption requires the knowledge of two very large and privately kept prime numbers (called $x $and $p$) which were multiplied together to form an extremely large, publicly known composite number (called $q$). The ability to 'forge' a signature on an encrypted message consistently would be catastrophic to the form of cryptography. I find that the continual evaluation of the function $f\left(x\right)= \frac{1}{q mod x} | x\in P $(where $P $is the set of all candidate prime numbers) until the function is undefined will eventually yield a value for $x$. Once that is obtained, the other prime might be obtained by evaluating $p= \frac{q}{x}$. The efficiency of such an attack was estimated by approximating the number of candidate primes and calculating how long it would take, on average, to obtain a value for $x$. The results show that such an algorithm would be inviable as a form of attack. This result does, however, prove the viability of a 'discount' system of elliptic curve encryption for public use. Such a system would, in theory protect against basic attacks and would require minimal resources to maintain, making it useful for things such as cellular phones and personal laptops or computers.

***Olivia Dubi***

**The Effect of Mental Skills Training on Gymnasts’ Abilities to Overcome Fears and Enhance their Performances**

The purpose of this investigation was to observe the relationship between mental skills training and fear in gymnastics, as well as performance enhancement. Often, gymnasts experience mental blocks in which they struggle to perform skills due to fears. Psychological blocking is often overcome with support from parents, teammates, and coaches, along with slow progression in overcoming the fears. Gymnasts can be taught mental skills that may help eliminate their mental blocks. This research is important because the benefits of being taught these mental skillsets can be applied to aspects other than gymnastics practices. Two groups of gymnasts were administered a “Survey of Athletic Experiences” and scored on a balance beam skill by three unbiased judges before and after a two week time period. The athletes trained for four days a week, three hours each time. One group received a mental skill-set intervention while the other group did not. It was hypothesized that if mental training was used, then the gymnast’s performance and abilities to overcome her fears would improve. The results showed improvement in both groups, as expected due to the time training their chosen skills. Positive feedback was received from gymnasts who reported that they achieved their goal and had been implementing the techniques into their lives and practices. Coaches confirmed improvements in the experimental group based on their frustration levels and abilities to cope with fears. A statistically significant increase was demonstrated in the experimental group when compared to the control group in both performance enhancement and mental control.

***Jessica Fecht, Jessica Hastings, Nicolette McKeon***

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

*Drosophila melanogaster,* or fruit flies, have become a valuable source for observing biological mechanisms, neurobiology and gene expression. Recent research has been conducted using the *Drosophila melanogaster* to study the diabetic phenotypes which are analogous to the diabetic states in mammals. The purpose of this investigation was to map out the genomic sequence of chromosome II and III. in order to observe and investigate the movement of a P-element called StanEx. Using transposase $Δ$2-3, the P-element will become mobile in all cells of the fruit fly. In the first cross every sperm made by the males may contain the P-element. The males that contain the P-element, otherwise known as Jumpstarter males, are taken to be crossed with double balanced females. This cross, $F\_{1}, $produces red eyed, non-Sb males that have eliminated transposase. These males have red eyes which ensures that the P-element has moved from the male X chromosome to chromosome II, II and in some cases IV. Thus far, we have found several red eyed, non-Sb males and have crossed them to generate females with the matching genotype. A stable stock is needed in order to make enough flies with the P-element to investigate their expression patterns. Investigating the chromosomes will show if the P-element has been inserted into chromosome II, III or in some rare cases IV. The stocks produced will be stored in the Bloomington Stock Center for other scientists to use in their future research.

***Samantha Gray – See Isabella Daquita***

***Julia Greco, Paulina Buchta, Amanda Loo***

**Exploring the Function and Development of Insulin-Producing Cells in *Drosophila melanogaster* with the Goal to Improve Diagnosis and Treatment of Diabetes**

This project was designed to explore the function and development of insulin-producing cells in *Drosophila melanogaster* with the goal to create unique strains of flies that can be used to improve diagnosis and treatment of diabetes. Diabetes is a metabolic disease in which the body’s inability to produce any or enough insulin causes elevated levels of glucose in the blood. *Drosophila melanogaster*, known as the common fruit fly, are model organisms of human diseases by providing unique features such as similar genetics and conserved disease pathways. In this study, a strain of flies called StanEx contain a transposable P-element. This “transposon” is a small piece of DNA that can be mobilized from the X chromosome and inserted onto either autosomal chromosome II or III of the fruit flies. Throughout the crosses, males with specific genotypes (identified by their phenotypes) were crossed with double balancer females to mobilize the p-element. The chromosome which acquired the insertion was determined by the offspring’s phenotype. Once the desired and stable cross is achieved, DNA mapping will be done to determine the physical location of the p-element on the chromosome. A stable stock will be maintained at the Bloomington Research Center.

***Joshua Hardoon, Jason Haber***

**Can Different Types of Music Improve Physical Performance Using a Handheld Strength Device?**

Athletic participation is growing rapidly around the world (Szabo, A, 1999) and there is a connection between psychology and performance. It has been shown that an individual may be able to overcome obstacles, such as muscle fatigue, with the addition of music while exercising. Listening to music during physical activity and physical exertion may even allow a person to perform at a higher level and exert more force than without music. To investigate the relationship between listening to music and its effect on physical performance, a group of human participants will squeeze a dynamometer which measures force, both with music and without music. The purpose of this investigation was to see if there is any correlation between listening to music and the amount of force exerted during an exercise, and to see if different genres of music have effect on physical performance. It was hypothesized that the amount of force exerted on a dynamometer handgrip will be higher while listening to music as compared to no music. Also, we hypothesized that the subject could exert more force while listening to rap music as compared to classical music. This was hypothesized because in another experiment by Attila Szabo (Szabo, A, 1999), there was an increase in force exerted with an increase in tempo of music. To carry out this study, participants squeezed the dynamometer while listening to rap music, classical music, and no music in random orders for 15 seconds with a one minute break in between the different genres of music or the no music category. They listened to each song for 30 seconds prior to squeezing the device. Data was input into Microsoft Excel and the sum, standard deviations and averages were found for each participant’s data.

***Jessica Hastings – See Jessica Fecht***

***Raymond Janis and Kyle Mitra***

**Identifying the Relationship Between California Almond Production and California Drought Conditions**

A drought is defined as a prolonged period of an abnormal shortage of water. In the recent years, the growing regions of California have experienced an increase in the number of annual extensive drought periods. As drought conditions in California have worsened, the demand for several California-grown crops has increased. Many of these crops including almonds, walnuts, pistachios, and pecans require high volumes of water to sufficiently grow. The increase in agricultural production due to the growth of these crops has raised the question, “To what extent is the increase of almond production responsible for the increase in California drought conditions?” Through this investigation we hypothesized that the increase in highly water-retentive crop production was correlated to the increase in drought conditions in California over the recent years. To identify any existing correlations, we evaluated changes within California’s agricultural growth patterns and determined the water requirements for each respective crops. The water levels of these surrounding regions were then compared along with the production levels of each crop with high water retention levels. Through this process, a correlation between the recent spike in water retentive crop production and the diminishment of water levels in California growing regions was been identified. The increase of agricultural production in these regions has increased the already high water demand in this water-stricken region. However, this recent escalation of almond production has utilized California’s remaining water resources to near extinction. In comparison to almonds, other crops such as pecans and walnuts have experienced smaller spikes in production levels. As a result, the correlation between their production growth and the water level drop in their surrounding regions is significantly lower. Conversely, there are other existing crops such as pistachios which exhibit similar correlations as almonds. Pistachios require a significant level of water for growth, requiring 0.75 gallons per almond compared to the 1.10 gallons of water required to grow one almond. This information validates a correlation between the increased demand of highly water-retentive crops and the downfall of water availability throughout the California growing region. Additionally, this investigation could potentially provide valuable information that could be vital to address this impending environmental problem. Given the information presented in this study, it may be essential to enforce production restrictions in order to maintain sufficient water levels throughout California.

***Alexa Karadenes, Tara McCaffrey, Jamey Meotti, Amy Uthup***

**JATA: A device that tracks stolen and lost devices**

Pickpocketing is a prevalent crime in today’s society. There are 3,000 reported incidents of pickpocketing a month in New York City, and many cases go unreported. About 400,000 pickpocket incidents occur around the world each day. The purpose of our project was to create a device to reduce the chance theft or misplacement of a variety of items. The purpose of this investigation was to create a device to discourage theft and prevent the loss of items. The device is useful for anyone who has a phone, and it could be used to keep track of other objects as well, such as wallets, iPads, and keys. The device consists of a bracelet and an alarm that can be attached to a phone, wallet, etc. The bracelet is worn by the owner of the object that the alarm is attached to. When the alarm, which is attached to the object of value, is 10 meters from the bracelet, the bracelet vibrates to notify the owner of his/her separation from the object. The person is now reminded to not leave it behind. However, if the object cannot be found, they have the option to set off the alarm to find it. The person will no longer leave the object behind because the bracelet will always serve as a reminder to not forget. To construct the device two major elements in the locator system were used. These transmitter is worn as a bracelet and a receiver is an alarm module attached to the item that is being protected. The device consists of an FM band transmitter. The receiver consists of a diode detector, and a DC transistor amplifier that drives a relay. The relay is connected to the load. When the receiver stops receiving the signal, the relay switch turns on, and the alarm circuit is triggered to sound.

***Christine Kim - See Brandon Axelrod***

***Helen Koukoulas – See Isabella Daquita***

***Anthony LaSala***

**Using Light to Detect Sound**

The purpose of this investigation was to determine what effect a changing sound has on the position of a reflected laser beam. The sound wave from a source can induce vibrations in surfaces that it comes in contact with. When a beam of light reflects off the vibrating surface, I hypothesized that a position sensitive device, which detects the position of the reflected beam, can be used to determine the frequency the surface is vibrating at. When the position of the reflected beam was recorded as a waveform on the position sensitive device, the frequency of the waveform matched the frequency of the sound wave causing the surface vibration. Analysis of the different waveforms resulting from each various initial soundwave demonstrated clearer waveforms at the resonant frequencies of the system. These results show that the position of the reflected laser beam can be used to determine the frequency of the initial sound causing the surface vibration. This has important implications for discrete listening of sounds or conversation, depending on the sensitivity of the technique, as some surfaces are more sensitive to vibrations induced by sound waves than others.

***Joshua Mann***

**Determining Risk of Lyme Disease in Suffolk County Using Geographic Information Systems**

In the Long Island, New York region, Lyme disease is the most prevalent vector-borne disease. Deer ticks are the primary vector, responsible for 95% of cases over the last ten years. Deer ticks are known thrive and cluster in moist environments, typically far from urbanized and industrialized regions. In order to determine risk of Lyme disease transmission, Geographic Information Systems computer software was used to study wetland coverage of a region and road concentration (miles of road coverage per 100 square miles of land area) as factors that could affect the risk of occurrence. It was hypothesized that increased wetland coverage would result in increased risk of Lyme disease because ticks have been shown to thrive in moist environments in previous research. It was also hypothesized that increased road coverage would yield higher risks of Lyme disease due to displacement and disturbance of the natural environment, leading to abnormally large clusters of ticks in affected regions. Consistent with previous findings, it was found that wetland coverage was significantly correlated with the risk of Lyme disease, supporting that ticks thrive in moist environments; however, there was no correlation found between road concentration and risk of transmission. A probabilistic risk model was developed as well to determine risk of Lyme disease transmission by zip code in Suffolk County. Based on previous data, the model was shown to be statistically significantly accurate in predicting the probability of Lyme disease occurrence. This research could potentially be applicable in studying the relationship between environmental factors and vector-borne disease as well as predicting risk of Lyme disease in other regions.

***Tara McCaffrey – See Alexa Karadenes***

***Nicolette McKeon – See Jessica Fecht***

***Jamey Meotti - See Alexa Karadenes***

***Kyle Mitra – See Raymond Janis***

***Elizabeth Van Loon and Paul Mokotoff***

**Urban Heat Islands and Their Effects on Local Environs**

It is well documented that, due to climate change, the earth's temperature has been increasing steadily throughout the latter half 20th century and into the 21st century. This effect is more pronounced in urban areas than suburban or rural areas. These warmer urban areas are often called urban heat islands., and the purpose of this project was to determine the temperature effect of an urban heat island on its surroundings. The urban heat island center chosen was New York City, and its effects on the surrounding temperatures were studied. These results were compared to a second control location (a nonurban heat area), Lehigh Valley, PA, and its effect on surrounding temperatures. This was then extended to Des Moines, IA, with the second control location being Harlan, IA. Average yearly temperature data was obtained from the two centers and four northerly stations within 110 miles of each center. The temperature differences from each center and its surrounding stations were calculated. The surrounding stations from each of the two centers were paired based on distances from their respective urban centers. Four out of six outputs from unpaired T-Tests were less than 0.05. Thus, there is a statistical difference between the temperature effects of an urban heat island on its surroundings than that of a more rural area on its surroundings.

***Kristin Orrach***

**Mg2 V(BO3)O2 : A New Synthetic, Semi-Opaque, Inorganic Gold Pigment**

Paint is vital to all aspects of human life, not just to add color with pigmented paint, but to protect what is underneath. The paint pigments are typically organic, but this can be a problem because organic paints fade over time since organic reactions have a lower activation energy and breakdown easily. To prevent the fading of pigments, inorganic pigments are needed. Inorganic pigments tend to be hard to make due to their toxicity and their high expense, but they fix the problem of fading. The goal of this project was to create a pigment using magnesium oxide, boric acid, and vanadium oxide. The materials were chosen because they are inorganic, inexpensive, and have been used in previous studies to make other successful pigments such as lidwigite and pinakiolite. In this study, the starting materials were powders, so they were measured out with a electronic scale, and mixed together with a mortar and pestle. The mixed materials were compressed into a pill with two tons of pressure. Next, the pill was put in a 900 degrees fahrenheit furnace to get the materials to react with each other, and create a pigment. When the sample was taken out of the furnace, a gold pigment was made. A part of the sample was taken, and was put through X-Ray diffraction, and analyzed with the photo spectrometer. The X-Ray diffraction showed that all of the sample was made of magnesium vanadate (Mg2V2O7). The photo spectrometer shows what wavelengths are reflected and absorbed by the pigment. The results showed that violet light was absorbed, and yellow light was reflected, which is why a gold pigment, a variation of yellow, was observed. The sample was crushed, and combined with linseed oil to make a successful paint that was semi-opaque and gold.

***Megan Padgett – See Julia Cicalo***

***Kelly Page – See Julia Cicalo***

***Charity Russell***

**Manipulating Odor Driven Behavior in Drosophila melanogaster: A Model to Investigate Gama Aminobutyric Acid Deficiency Disorders**

Olfactory receptor neurons (ORNs) are located in the antennal lobe of the fruit fly and are responsible for all olfactory processing. In this study, the effects of manipulating these ORNs were investigated. Through the use of a “controlled odor presenting mechanism”, fly behavior and response to non- aversive 10% apple cider vinegar was determined. The two fly lines NP3056-gal4, UAS-TNTe and NP3056-gal, UAS-Chrimson were used during experimentation. Although UAS-TNTe inhibited the vesicles moving across the synaptic clefts of the ORNs, the fly demonstrated a much weaker response to the administered odor. The flies exposed to UAS-Chrimson, an optogenetic light-activated channelrhodopsin ion channel, had activated neurons. Despite this fact, the flies ceased all movement when exposed to red LED light and red LED light combined with odor. These results demonstrated that the red light was aversive. Fruit flies stopped all movement when exposed to only red light and red light and odor (10% apple cider vinegar). The LED lights may have been too intense for the fruit fly and impacted other areas of the brain, for example, motor neurons, which may have caused the ceased movement. Various odors, both aversive and non-aversive may be used to determine the effects they have on fly odor response. Trials could also be conducted in blind flies, to determine if sight has an impact on odor recognition.

***Sidney Sirota***

**Judging the Accuracy of a Weather Reanalysis Model:**

**A Comparison with 19th Century Weather Observations**

Recently, climate modeling groups worldwide produced a number of simulations of climate change from the late 19th century through the end of the 21st century as part of the Fourth Assessment Report (AR4) by the Intergovernmental Panel on Climate Change (IPCC). Climate change has been a major concern, and understanding the history of weather patterns and their tendencies is crucial. Since the 1990s, major national and international efforts have led to the creation of climate data sets called retrospective analyses or ‘reanalyses’ using reanalysis systems, such as the National Oceanic and Atmospheric Association’s (NOAA) 20th Century Reanalysis. Reanalysis systems generate huge amounts of temperature, pressure, precipitation, and many other types of data that cannot be absorbed by the human mind without further refinement and interpretation. The different reanalysis models have different abilities, such as being able to recreate historical weather data. Using these long-term datasets and reanalysis systems, a more comprehensive understanding of our atmosphere can be determined. The purpose of this investigation was to determine how successfully the 20th Century Reanalysis System (20CR) can model weather patterns. The starting point for this analysis was the use of historical weather records from the Southern Ocean which was compared to recreated data from 20CR. The historical data used in this study came from the logbooks maintained by record keepers at the Cape Borda Station weather station, located off of the southern coast of Australia (1870-1899). The data in the logbooks was imaged by the Bureau of Meteorology of the Australian Government. The precipitation data was digitized from the logbooks using Excel. The generated precipitation data from the 20CR model was then compared to the historical precipitation data, and standard tests were done to compare the actual data to the data predicted by the 20CR model. After the analysis was completed, the results thus far show that there is no significant statistical difference between the actual historical recorded data and the data recreated by the 20th Century Reanalysis system. This indicates that for this example the 20CR model is a good predictor of past precipitation data.

***Maeve Smart***

**The Characterization of Ceramide Synthesis Pathway Responsible for Cisplatin and Doxorubicin Induced Cell Death in MCF-7 Cells.**

Ceramides are a family of [waxy](https://en.wikipedia.org/wiki/Wax) [lipid](https://en.wikipedia.org/wiki/Lipid) molecules that lie on MCF-7 cell membranes. Contrary to previous assumptions that the ceramides found on cell membranes are purely supporting structural elements, ceramide has been proven to participate in the [programmed cell death](https://en.wikipedia.org/wiki/Programmed_cell_death), or apoptosis, of [cells](https://en.wikipedia.org/wiki/Cell_%28biology%29). There are three major pathways of ceramide generation: the sphingomyelinase pathway, the *de novo* pathway, and the salvage pathway. The *de novo* and salvage pathways were the focus of this experiment in an effort to pinpoint which pathway of ceramide production is responsible for apoptosis. In this experiment, MCF-7 cells were treated with either doxorubicin or cisplatin, and then the inhibitor myriocin (Myr), which blocks the *de novo* pathway, or the inhibitor fumonisin-B1 (FB1), which blocks the salvage pathway, was used in combination with the chemotherapeutic agent. Following these treatments, changes in cell morphology were assessed, a cell viability assay was performed, caspase-7 activation was determined, and western blots were conducted. Results showed that Myr demonstrated no inhibitory effects on the cells, but FB1 did display promising results. In both cisplatin and doxorubicin treated cells, FB1 showed clear inhibitory effects when assessing changes in cell morphology, LDH release, and caspase-7 activation. These results demonstrate that the salvage pathway of ceramide production is responsible for apoptosis. Therefore, the future development of new chemotherapeutic agents that target the salvage pathway may result in more effective treatments that will cause a decrease in the cell viability of aggressive breast cells and a better prognosis for those suffering from the late staged or drug resistant forms of breast cancer.

***Maxwell Sugarman, Jeremy Vlacancich, Matt Wu***

**The Effect of ENSO (El Niño Southern Oscillation) on Reservoir Levels in California**

This project was designed to determine if there is a correlation between California’s drought history and El Niño Southern Oscillation (ENSO) events. To determine drought level we analyzed the historical storage levels in reservoirs located in California’s Central Valley. El Niño Southern Oscillation is a weather phenomenon that has broad effects on the worldwide environment, and is caused by a warming in Pacific easterly trade winds. Characteristically, ENSO has been shown to cause droughts, floods, and landslides throughout California (Dolce & Erdman, 2014) In 2015-2016, California faced one of the largest droughts in its history, with temperature anomalies peaking at +2.3°C (Null, 2016). Between 2012 and 2015, the state faced the driest four year period of precipitation on record. Reservoir data from the CDEC (California Data Exchange Center) database for New Hogan Lake, New Melones Lake, Don Pedro Reservoir, Lake McClure, and Eastman Lake were used. We looked at the reservoir storage levels and calculated the percent deviation from the historical average (1997-2016) for each reservoir. We then looked for a correlation between the El Niño years and percent capacity for our reservoirs. We hypothesized that during ENSO years, levels in our selected reservoirs will increase due to precipitation levels and flood frequency during a typical El Niño event (Monteverdi, 1997). If a correlation is seen, predictions for reservoir levels anticipated during an El Niño event could be made more accurate, and allocation of reservoir water during El Niño events in California could be improved.

***Justin Tollin***

**Do Asian Shore Crabs, *Hemigrapsus Sanguineus*, Exhibit Territoriality**

**In an Artificial Habitat?**

The Asian shore crab, *Hemigrapsus Sanguineus,* is an invasive species that has caused a decrease in biodiversity along the east coast of the United States. The origin of the Asian shore crab, also known as the Japanese shore crab or Pacific crab, dates back to 1988. The first Asian Shore Crabs are thought to have come to New Jersey in tanks from Asia. Today the crabs have spread from Maine to North Carolina. They have altered availability of resources and food webs because they aren’t native. The purpose of this study was to investigate the territoriality of this crab species. By obtaining a greater understanding of their territoriality, it may be possible to use that knowledge to control their population so they do not have such a negative effect on native species. To conduct this study, crabs that were collected from a local beach and were relocated into control tanks based on gender and size in the lab. Tiles were used to represent rocks that the crabs commonly live under. All trials done consisted of two or four tiles. In conclusion, the crabs have shown small hints of territoriality. The p value of greater the .05 in the two tile trials claim no territoriality at all. However, the four tile trials show there could be signs of territoriality after all. The results also show that the larger crabs take less time to reach the habitual area. Future research will be done to further investigate the invasive species.

***Amy Uthup – See Alexa Karadenes***

***Elizabeth Van Loon – See Paul Mokotoff***

***Jeremy Vlacancich – See Maxwell Sugarman***

***Ryan von Hof***

**Development and Analysis of Inorganic Pigments**

This project was to establish a method to predict the colors produced by inorganic oxide compounds. According to the results of this investigation the color of a compound can be predicted using periodic table trends. Data was collected from Pearson’s Crystal Database and the periodic table of elements datasheets. The data was then interpolated by merging datasets in order to perform statistical tests to find possible trends. These trends were then applied to solid-state reaction oxide synthesis to predict the color of compounds before they were synthesized, so that the trends could be tested. The trends were used in a comparative manner where a historical compound was taken and manipulated by changing the elements in the compound that have a significant impact on color. The data collected defines: 1) the most common color an element produces; 2) a relationship between color produced by an element and the melting point of that element; and 3) an element's general location on the periodic table relative to the elements around it. The results demonstrated that these previously stated trends could successfully be used to predict the colors of novel compounds.

***Matthew Wu – See Maxwell Sugarman***

***Johann Yang***

**Chronic Cadmium Contamination of Agricultural Crops in the Hunan and Gansu Provinces and their Potentials for Developing *itai-itai* Related Pathologies.**

Renal tubular dysfunction (RTD) and *itai-itai* disease, an extreme form of osteomalacia, have strong connections to Cadmium (Cd) poisoning, as evidenced in studies of the Toyama Prefecture in Japan in the early to mid-1900s. Two provinces in China potentially facing a similar Cd pollution problem, the Gansu and Hunan provinces, were investigated to determine the likelihood of either province’s population developing similar pathologies. Across China, large populations of poverty-stricken farmers have no other choice but to employ environmentally-debased and egregiously polluting agricultural methods to feed their families food poisoned by sewage and waste sludge from industry. Geostatistical data was obtained from previous studies on the two provinces in order to determine the extent of Cd pollution and its connection with industry, agriculture and, ultimately, public health.

***Tyler Young, Abinya Anand, Mia Serritella***

**MomDroid- a Productivity Device**

Organization and time management skills are key to successful careers, educational opportunities and achievements. Unfortunately, proactivity is hard to achieve without the proper capabilities of organizational skills. Convenient organizational methods is crucial when  the educational work load becomes increasingly difficult. While there are organization self-help books as well as basic organization applications available on the market, there is a need for newer technology that would be able to encompass both push notifications to keep track of time, as well as have a working calendar and weekly scheduling system to make sure users make their available time most effective. The best way to bring about this idea is through a mobile application system, so that users can have quick and easy access to their schedule through android devices. First, a basic flowchart of organization was created to identify the components of the product. Then, we used the Android Studio program to map the design of the product. Lastly, the codes from Android Studio will be used to program the application. This application follows each individual’s plan from their morning to end of the day. The plan calculates the length of time left after the fixed schedules (Time in school, work, appointments, lessons, etc.) and allocate the sections for work and break in accordance to what the user finds most tedious. This product will benefit anyone who requires organization of a complex daily schedule.

***Peter Yu***

**Effects of Climate Variability on Glacier Mass**

The purpose of this study was to determine the extent in which change in climate affects glacier mass. As Earth's climate warms, rapid loss of glacial ice is being documented around the world. The mass balance and temperature for five glaciers between the Tropic of Cancer and Tropic of Capricorn (Hintereis Ferner, Goldberg, Jamtal, Peyto, and Martial) were taken under years 1964-2014. A T-test analysis will demonstrate whether or not there is an association between the two groups. Formatted trendlines will be created in conjunction of the dataset comparison of both mass balance and temperature over time in order to determine the extent of how the variations of one affect the other. The melting of mid-latitude glaciers has been linked to increasing temperatures which influence mountain ecosystems world wide. Melting glaciers cause rise in sea level, threatening to submerge coastal cities.  As a result, it is imperative to determine how climate fluctuations cause glacier mass to decrease. This is critical in order to predict and model future changes and effects to the world climate.

**UNDERCLASSMEN**

***Ethan Abbe, Adam Dubi, Philip Kwiecinski***

**A Universal Surface Cleaning Tool**

The purpose of this project is to design and construct a universal device to help people with mental and physical disabilities clean furniture easier. This is needed because mental and physical disabilities (specifically autism) make completing everyday tasks such as cleaning a table harder for people. Our product can be used in a variety of different settings such as at a house, in a school, or our most intended setting, a restaurant. The design of our product consists of a multifunctional body that mechanically sprays, wipes, and dries the surface while riding it of any crumbs with the use of the vacuum. It also consists of a collapsable handle that extends to a maximum length of 3ft and contracts to a minimum length of 1 ft. With the combined use of all the features in addition to the polished design, the task of cleaning surfaces for any person becomes overwhelmingly easier.

***Adam Abdabhai, Dan Czop, Ryan Dery***

**Determining the Most Effective Method of Pool Sanitation**

In the modern era, swimming pools are a common fixture in many homes and communities. These widely used accessories must be kept properly sanitized and clean in order to create a safe and healthy environment. There are several different methods of sanitizing pools each having their own advantages and disadvantages. Some methods include chlorine and bromine. The purpose of this experiment was to determine which method of pool sanitization is the most effective in killing microorganisms, while considering expense and environmental impact. It is hypothesized that chlorine will be the most effective method of sanitation due to its low cost and ability to kill large amounts of microorganisms. A spectrophotometer was used to measure absorbance of the water before and after the designated chemical was added. The more clear the water, the less the absorbance. Time intervals of 0 and 8 hours were used to determine bacterial growth for estimating sanitizer effectiveness.

***Karen Abruzzo, Delina Levine, Pragati Muthukumar***

**Mapping Possible Locations for Lunar Ice Mining**

The purpose of this study was to determine the ideal location to mine lunar H2O ice using mineral abundance and lunar topography data. Earth’s moon contains deposits of hydrogen and oxygen, indicating the existence of H2O ice. The moon’s shadowed poles maintain a low enough temperature to sustain H2O ice, which, if mined, could be decomposed into liquid hydrogen and oxygen and used as rocket fuel. These ice deposits have the potential for the moon to be a future “fueling station,” where spacecraft could refuel before continuing onward. Due to its low gravity, using the moon as a launch point may facilitate deep-space missions by conserving fuel, energy, and costs. To carry out this study, we used Lunar Prospector (LP) and Lunar Reconnaissance Orbiter (LRO) data in the ArcGIS mapping program. We plotted multiple data sets in frames called layers using the ArcGIS program. These data layers highlighted areas of hydrogen and oxygen deposits, and displayed lunar topography data calculated within the program. Economic feasibility of a lunar mining mission was determined from the map and external calculations - amount and cost of fuel was calculated for multiple types of rockets, and the locations on the moon with the most H2O ice and smallest gradient were considered the best places to mine. Based on the distribution of hydrogen and oxygen as well as topography data, seven areas at the lunar poles would be the most ideal locations to mine. Based on our calculations and criteria, the Space Launch System would be the best rocket to use for a lunar mining mission.

***Ariana Aghili, Ruth Lee, Jordana Resnikoff, Cassidy Volatile***

**Building an App to Provide Support to Immigrant on Long Island**

More than 20 million men and women have immigrated to the U.S. today. Immigrant women from all around the world continue to face many problems whether it’s financial, social, or physical. The variety of issues they face makes it difficult to adapt to their unfamiliar environment. The purpose of this project was to create an application to provide support to women who recently immigrated to the United States and live on Long Island. This application was created using AppInventor2, a program from MIT that allows student’s to drag blocks and code a fully functional application for Android devices. By using the application, immigrants are able to access maps of nearby services (stores), public transportation schedules, post coupons, sales, and ask questions on a forum. There’s also a language setting in which the user can have the app translated into their language and also learn common phrases in English. Our goal is to not only allow immigrants to familiarize themself in the new, uncomfortable environment, but to also introduce them to others in their situation. We worked with a variety of organizations such as 2M Technologies, SEPA Mujer, and Long Island Women in Tech in order to ensure accurate information and help build the application as well as interviewing immigrants with their current or past struggles.

***Melike Akoglu***

**Do Planarians Exhibit a Decrease in Anxiety and a Response to Withdrawal**

**after Exposure to St. John's Wort?**

The medicinal use of St. John's Wort(*Hypericum perforatum*) dates back to Hippocrates in ancient Greece. St. John's Wort is known to treat wound healing, menopausal symptoms, as well as most recently used to treat mild to moderate depression and anxiety. Planaria are flatworms that have been studied by scientists to test Planaria reactions to addictive substances. The purpose of this experiment was to test the anxiety levels and withdrawal symptoms of Planaria exposed to St. John’s Wort. To carry out this study, Planaria were exposed to various concentrations of St. John's Wort or artificial pond water with no St. John's Wort (control). Anxiety levels were tested using standard Planaria anxiety tests and withdrawal symptoms were recognized using a line crossing assay, which have been used in other withdrawal studies. It was hypothesized that the anxiety levels of the Planaria in St. John's Wort would significantly decrease compared to anxiety levels of Planaria in artificial pond water and withdrawal symptoms would be exhibited among the Planaria in the St. John's Wort. Results of this investigation showed that the Planaria demonstrated an increase in anxiety, except in the higher concentrations of St. John’s Wort, and withdrawal symptoms, after 24 hours in all solutions except for the control. This implies that St. John's Wort can decrease anxiety, but also create withdrawal symptoms, which means that the Planaria exhibited addiction to St. John's Wort.

***Julio Alves, Vincent Santangelo***

**Effect of Various Concentrations of BPA on Pearl Onion Root Growth**

 Bisphenol A, also known as BPA, is an industrial chemical used to make plastic, and has been used since the 1960’s. The plastic is most commonly used in water bottles and other food containers like chip bags. Several studies have linked BPA to disrupting hormone signals in the human body. The purpose of this study was to look at the effect of BPA on onion root growth. Five graduate cylinders were set up in triplicate containing different concentrations of BPA in water (1% 0.1% 0.01% and 0.001% and 0% respectively). A toothpick was placed through the center of a pearl onion and the onion was placed atop each graduated cylinder. The growth of their roots was recorded every two days. The 1% BPA had the least root growth of almost nothing at all, and each lower concentration had more growth than the last with the control growing the most. During the experiment the lower concentration onions (0% and 0.001%) sported a stem, and the length of the stem matched the relative length of the roots. Also, the 1% solution had crystallized in the graduated cylinder, and the onion took on the color of the toothpick that held it in place. This shows that in high enough concentrations, BPA can be harmful to plants and hinder their growth, and therefore provides a valid argument to further ban its use in food packaging.

***Rebecca An, Kristen Chao, Jordyn Lieberman, Sophia Mastroianni***

**Correlation of The Matthew Effect Within Professional Sports**

The Matthew Effect describes how birth month influences success. In sports, a child born in January will be deemed more mature compared to a child born in December therefore, selected for further nurturing of a skill. The purpose of our project, was to analyze birth months of four different professional sports teams, (baseball, hockey, basketball, and soccer) to see if the birth months correlate with The Matthew Effect. We hypothesized there will be more players born in the first quarter of the calendar year (January-April) than the other quarters, (May-August and September-December) as it demonstrates their physical maturity to coaches for placement in a more advanced league. From different team rosters we collected the birth months of each player and tallied it into the respective birth month quarter, and a statistical analysis was performed, thus far we are still collecting data.

***Abinya Anand, Mia Serritella, Tyler Young***

**MomDroid- a Productivity Device**

Organization and time management skills are key to successful careers, educational opportunities and achievements. Unfortunately, proactivity is hard to achieve without the proper capabilities of organizational skills. Convenient organizational methods is crucial when  the educational work load becomes increasingly difficult. While there are organization self-help books as well as basic organization applications available on the market, there is a need for newer technology that would be able to encompass both push notifications to keep track of time, as well as have a working calendar and weekly scheduling system to make sure users make their available time most effective. The best way to bring about this idea is through a mobile application system, so that users can have quick and easy access to their schedule through android devices. First, a basic flowchart of organization was created to identify the components of the product. Then, we used the Android Studio program to map the design of the product. Lastly, the codes from Android Studio will be used to program the application. This application follows each individual’s plan from their morning to end of the day. The plan calculates the length of time left after the fixed schedules (Time in school, work, appointments, lessons, etc.) and allocate the sections for work and break in accordance to what the user finds most tedious. This product will benefit anyone who requires organization of a complex daily schedule.

***Gianna Anderson, Mikayla Kelly and Lauren Tuffy***

**The Effect of Probiotics and Antibiotics on the Brain Functions of *Girardia tigrina***

Probiotic and antibiotic product usage have increased greatly, and it is imperative to identify the effects of this increased usage. The purpose of this investigation was to determine if there is a relation between the use of probiotics and antibiotics on planarian response time. If the planarian’s reaction time is affected, then the probiotics and antibiotics have an effect on brain function. This may be due to the effects of the probiotics and antibiotics on gut microbiota (Ann, 2015). To obtain these results, we exposed planarian to different doses of antibiotics and probiotics, and also has a control group to compare them to. Their preference for a light or dark region was tested and reaction time was recorded. The planarians were given a time period of 10 minutes to react before data was recorded. (Brown, 2005). It was evident that the planarians in both the probiotic and antibiotic solutions were more lethargic than the control group. The probiotic groups with higher doses moved slightly slower compared to the control groups. The antibiotic groups moved significantly slower. Based on the data, it seems to shows that with the introduction of antibiotics and probiotics to planarians environment results in an increase of the time the planarian takes to reach the dark region. Then it can be believed that with the antibiotics and probiotics there is an effect on the planarians brain function by slowing their reaction time. However, with the introduction of error bars on the graph and them overlapping represents there is no significance between the data.

***Aaron Angeles, Elias Gonzalez, Alex Horowitz***

**Investigating the Effects of Electronic Cigarette Chemicals on Planaria Mobility**

Electronic cigarettes are devices used to simulate the experience of smoking by vaporizing certain liquids, which are inhaled by the user. There is a common misconception throughout today’s society that these electronic cigarettes are a safe alternative to regular cigarettes. In reality, chemicals such as acetone, propanol, and lead have been identified in e-cigs, so the notion that they are completely safe is untrue. Planaria were used in order to gain a better understanding of the effects of the e-liquid, the liquid that is vaporized in the e-cigarette. The purpose of this experiment was to determine if concentrations of e-cigarette liquid would inhibit planarian locomotion. We hypothesized that a greater concentration of e-liquid would result in less locomotion, and vice versa, due to the harmful chemicals present within the liquid (GASP of Colorado). Planaria were placed in a small petri dish filled with 5 mL of water, on top of a 0.5 cm by 0.5 cm box grid. A set amount of the selected e-liquid, named “Thai Bobo”, was placed into the petri dish at 0.5, 1.0, 2.5. 5.0, 10.0, and 20.0 ul. Locomotion for each concentration was observed, and was quantified by number of grid lines crossed. Thus far, results indicate that locomotion is the least when a greater amount of e-liquid concentration is present in the water. The cumulative number of gridlines crossed per minute are almost 10 lines lower at 0.05 ul than at 20 ul, meaning that locomotion activity is significantly less given a greater concentration of e-liquid. Future research could include comparing the results of the e-cigarettes to those of actual cigarettes.

***Jonathon Appel, Brian Mokotoff, Faizili Rahim***

**Folding over a New “Leaf” For Arthritis**

*In 1995, about 15% of Americans suffer from a form of a disease called arthritis. By the year 2020, around 18% of Americans will suffer from the disease. The kitchen is a place in the home where people who suffer from arthritis struggle, especially when folding a napkin. This new dispenser will allow for flat napkins to be folded inside the dispenser with the simple turn of a knob. The design will be very simple and compact. The entire dispenser is only 16x14x16 (cm). Although it is small, it will have enough capacity to hold 100 napkins at a time. The body and lid will be constructed entirely from plastic, with the exception of rubber feet at the bottom to hold it in place. The interior will contain two mechanisms that help to fold the napkin. One will be attached to the bottom of the body with springs, and will be a plate in which you load the napkins onto, so they are forced to the top of the dispenser. The other will consist of a spinning cylinder that is attached to an exterior-mounted knob. This knob will be turned in order for the napkin to be fully dispensed and folded.*

***Candace Arneaud, Gillian Evers, Jenny Won***

**Cyber Relief**

We have created a computer generated application made to facilitate the control of stress in adolescents. This application provides five sections that guide the user through the app. The sections provide diverse ways to handle stress for various levels and personalities. We have emergency services for those who have suicidal thoughts or actions or for those who would rather talk through screens there is a chatting section. There are also two other areas consisting of games and therapeutic music for those who have lower levels of stress and for more alternatives. There is even a section consisting of a "rate your stress" where the user can find natural remedies they can do every day as well as guiding those through the app. The goal of our application is to ease the users stress but at the same time not make it to intricate which could cause an influx in the user’s stress levels.

***Jacob Ashkenas, Danielle Gabay***

**Correlation Between Grapheme-Based Synesthesia and Text Font**

Synesthesia is a condition where a sense or part of the body evokes a response from a separate sense or part of the body. One of the most common types of synesthesia is grapheme-based synesthesia, where a grapheme evokes a visual or conceptual reaction, such as a color. A grapheme is a written symbol. The purpose of this experiment was to see if the font in which the grapheme is typed in has a change in the response in synesthetes. We hypothesized that in most cases the perceived color won’t change as long as the structure of the grapheme remains the same. The data was collected through an online survey. Participants were asked to select the colors that they perceived with each letter in the different fonts. Results were analyzed to see if there was a statistical difference between fonts and the color perceived.

***Jasmine Bajaj and Christopher Collado***

**The Effects of Personality on the Weapon and Assertive Behavior of a Fencer**

This investigation is derived from the sport of fencing, more specifically, the mental aspect of it. Typically in most sports, athletes have unique personalities that either conform to or deviate from the overall “stereotype” of their sport. For example, football players tend to be aggressive as well as male athletes, whereas ballet dancers are calm and composed. Fencers are unique athletes with varying personalities on and off the strip. The sport is composed of three different weapon groups: epee, sabre, and foil. The purpose of this study was to analyze the different the role of personality and aggression on the fencer’s dominant weapon when they are on the strip. The conclusions we reach will be very beneficial to the fencers. This study will help the participants accept their specific styles of fencing and making adjustments and conform to the style to improve their fencing. To carry put this study, we approached participants at Mission Fencing Center and had the participants complete a personality questionnaire that would determine a specific personality of the fencer. The fencers then fenced a 5 touch bout in front of three highly trained individuals and received a number, 1-4. That number was their level of aggression. We hypothesize that the sabre weapon will display the most aggressive traits and the epee weapon group will display the most passive traits while fencing on the strip.

***Emma Baker, Nicholas Bitonti, Josh Kaplan***

**The Effect of Various Drugs on the Learning Abilities of Planaria**

Planaria are freshwater flatworms with nervous systems that bare a resemblance to humans. The similarities drawn between the nervous systems of humans and planaria are important because exposure to different substances may yield similar results. The purpose of this investigation was to discover how the cognitive abilities of planaria are affected by different substances. Data was collected by exposing planaria to light and shocking them, once the correlation between the light and shock was made they were left to regenerate. Afterwards they were shocked again but the time between the shock increased by two days at a time. It was hypothesized that the cognitive abilities of planaria would be hampered when exposed to alcohol and benadryl and increased when exposed to nicotine. It took the control group an average of 9.6 days to be conditioned, the benadryl group an average of 20.3 days, the alcohol group an average of 8.3 days, and the nicotine group an average of 7. It then the took the control group an average of 12 days to regenerate and it took the benadryl group an average of 14.6 days, the alcohol group an average of 9.3 days, and the nicotine group an average of 6.6.Additionally it took an average break between shocks of 6.6 days for the control group to be unconditioned, the rest of the groups are still being tested at this time.

***Nicholas Bitonti – See Emma Baker***

***Riley Bode, Ethan Darvin, Nicholas Pappas***

**Indoor Air Quality in Our School**

Indoor air quality is a very important public health issue. It can cause respiratory illness in public buildings including schools. The purpose of our project was to test the level of air pollution, in terms of particulate matter, in different areas of our school. We studied air pollution in different areas in our building to test the Indoor Air Quality (IAQ). In order to carryout the experiment we used an Arduino and a breadboard circuit to create a particle sensor to see how much particulate matter was located in specific locations. We programed this device the LED lights would indicate the presence of particulate matter in a certain location. It was hypothesized that rooms utilizing chemicals like a science or art room and those that leave debris like a woodworking room would have more particulate matter and therefore worse IAQ than a standard classroom. (Don't currently have results).

***Jacqueline Brandel, Amanda Lemza, Abigail Pace***

***Effect of Temperature on Drosophila Models of Huntington's Disease***

Drosophila models are used often because it key shows many similarities to humans. Testing Drosophila infected with common diseases can help scientists understand how the diseases have an effect on organisms. Huntington's disease is a genetically inherited illness that can be tested on Drosophila for the benefits of humans. Temperature is a factor that affects Drosophila. Drosophila cannot regulate their own body temperature very well, therefore they depend on behavior to keep their body temperature stable. Motor skills is a factor of human life which could also be affected by Huntington's disease. The experiment tests whether the motor skills of drosophila with Huntington's Disease are affected by temperature. The importance of this study is to further research on relief for Huntington's Disease patients. The groups of Drosophila being tested are wildtype drosophila (control), type G6 crossed with type p908 (2nd control), and type G154 crossed with p804r drosophila(this gives us affected flies). The method used for testing was the rollover assay due to motor deficits exhibited by affected organisms. This assay will record the amount of time it takes for each group to rollover in different temperatures such as room temperature (23 degrees Celsius), 16 degrees Celsius and 29 degrees Celsius.

***Paulina Buchta, Julia Greco, Amanda Loo***

**Exploring the Function and Development of Insulin-Producing Cells in *Drosophila melanogaster* with the Goal to Improve Diagnosis and Treatment of Diabetes**

This project was designed to explore the function and development of insulin-producing cells in *Drosophila melanogaster* with the goal to create unique strains of flies that can be used to improve diagnosis and treatment of diabetes. Diabetes is a metabolic disease in which the body’s inability to produce any or enough insulin causes elevated levels of glucose in the blood. *Drosophila melanogaster*, known as the common fruit fly, are model organisms of human diseases by providing unique features such as similar genetics and conserved disease pathways. In this study, a strain of flies called StanEx contain a transposable P-element. This “transposon” is a small piece of DNA that can be mobilized from the X chromosome and inserted onto either autosomal chromosome II or III of the fruit flies. Throughout the crosses, males with specific genotypes (identified by their phenotypes) were crossed with double balancer females to mobilize the p-element. The chromosome which acquired the insertion was determined by the offspring’s phenotype. Once the desired and stable cross is achieved, DNA mapping will be done to determine the physical location of the p-element on the chromosome. A stable stock will be maintained at the Bloomington Research Center.

***Ruslan Burns, Dimitri Gouvoussis, Frank Mastroianni***

**The Effect of Natural Sugars Compared to the Effect of Sugar Substitute on the Behavior of Planarian**

Zero calorie sweeteners such as Splenda, Sweet N’ Low and Equal are often used as substitutes to more conventional sugars in food and drink products. This is due to the common belief that zero calorie sweeteners are a healthier low calorie alternative to natural sugars. The purpose of our experiment was to determine the effect of zero calorie sweeteners on the motility of planarian. We observed behaviors such as head bopping and corkscrew motions that indicate addiction. Planarian are flatworms of the Turbellaria class that are found in both fresh and saltwater. We used the planarian (*Dugesia dorotocephala*) due to their small size and motility. By placing the planarian into multiple sugar solutions and performing, a line-crossing assay we were able to determine which sugar substance resulted in the lowest planarian movement. In addition, we observed the planarian behavior before and after the exposure to the specific sugar. It was hypothesized that the planarian would exhibit behavior that closely mimics their behavior associated with addiction. This was based on a similar experiment involving planarian withdrawal to nicotine. Thus far, our data supports the idea of traditional sugars (sucrose) results in less negative effects on the motility of planarians.

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

**The Effects of Water Exposed to Artificial Turf on**

**California Blackworms *(Lumbriculus variegatus)***

Controversy surrounds the use of artificial turf due to previous research that has shown that the composition of turf contains harmful chemicals. These include carcinogens, irritants, and volatile organic compounds. The purpose of this experiment was to study the health effects of turf-soaked water on California Blackworms. Blackworms were used in this study because of their regenerative abilities. In order to carry out this experiment, sections of turf were soaked in water for three different time periods. Then, the blackworms were placed in petri dishes with the turf-soaked water and were observed regularly. Their regeneration was tracked by counting their body segments and were observed for abnormal growths. Any worms that showed abnormal growths were appropriately sent to a histology laboratory to be properly mounted on a slide for observation. Additionally, samples of the turf-soaked water were sent to a certified professional laboratory for chemical analysis. It was hypothesized that if the turf was submerged in water for a longer period of time, then there would be an increased amount of chemicals released into the water and higher rates of regenerative defects in the blackworms, such as reduction in growth rates and increase in physical abnormalities. Previously, when this experiment was conducted with a slightly different methodology, the blackworms showed the same development of bulb-like abnormalities. Results show that as the soak-time of the turf increased, the survival rates decreased. Additionally, 4-methyl-2-pentanone and toluene, not yet confirmed on their carcinogenicity, were found in the samples exposed to turf. Furthermore, the worms were biopsied. The worms showed abnormalities, asymmetry, and signs of hyperplasia and dysplasia. Hyperplasia may be a sign of cancer, however it does not always lead to cancer.

***Kaitlyn Cestaro and Christine Kong***

**Effects of Changes in Salinity in the Survival Rate of Brine Shrimp (Artemia)**

Brine shrimp are a genus of aquatic crustaceans that are found in inland saltwater lakes and salt marshes that thrive in a hypersaline environment, with conditions reaching as high as ten times saltier than the Pacific Ocean. Because of this brine shrimp are considered to be a model animal extremophile, as they can easily adapt to live in harsh conditions. The purpose of this experiment was to determine how exposure to different salinity levels at birth affects the survival rate and lifespan of the offspring of brine shrimp. If salinity levels are changed dramatically, the brine shrimp will have a shorter lifespan because they will not be exposed to the correct levels of salt that they’ve been used to. For the experiment brine shrimp cysts were placed in well plates with 2 mL of water and varying levels of salinities. The varying levels of salinities mimicked certain bodies of water or environments. Brine shrimp were fed with algae and placed under a 100 watt incandescent light bulb. The highest number of shrimp hatched in the 25 ppt level with about 2 shrimp per well, and the longest survival rates were recorded in the 45 ppt level with an average of 4 days of survival. T-Tests showed that there was a statistical difference between the averages of many survival rates, but only between 2 hatch rates. Researching the effects of salinity on brine shrimp can further expand knowledge on cysts and could apply to other invertebrate organisms that reproduce this way.

***Gabriel Chan***

**Systemic Targeting of Oncoproteins in Skin Melanomas utilizing VIPER Analysis: A Strategy for Precision Cancer Treatment**

Skin Cancer is the most common form of cancer in the US. It is known that cancer is caused by un-regulated cellular proliferation. The wide range of cancers, both in location and in their response to treatment, have contributed heavily to the high mortality rate. Current cancer drugs commonly cause severe side effects due to their off-target activities. For these reasons, it is imperative to study the internal machinery of cancer cells more thoroughly to discover novel treatment methods.

The purpose of this investigation was to conduct a cell-wide analysis of protein function to develop more effective and less harmful therapeutic approaches for targeting skin cancer. It has been shown that the UV signature genes (UVSGs, genes that are expressed differently in UV-irradiated cells as compared to the control cells) are significantly enriched in genes found misregulated in skin cancer cells, highlighting the potential clinical applications of the UVSGs in risk prediction and drug development. Using global gene expression (mRNA) data obtained from UV-irradiated skin cell lines and control cell lines, VIPER (Virtual Inference of Protein-Activity by Enriched Regulon) analysis was performed to determine protein activities that were either increased or decreased in UV-irradiated cells as compared to the control cells.

I hypothesized that transcriptional up-regulation in gene expression may not correlate with increased protein activity due to redundant cellular processes and possible post-translational modifications. I also hypothesized that down-regulation in gene expression would result in decreased protein activity. Consistent with my hypotheses, two transcriptionally up-regulated genes, ADAMTSL4 and CST6, are not among the candidates with increased protein activities while two down-regulated genes, UHRF1 and TRIP13, were found to also have decreased protein activities. The identification of proteins with increased and decreased activities in skin cancer cells lays the foundation for effective diagnosis of skin cancer and development of new drugs to correct these changes so as to treat skin cancer.

***Kristen Chao – See Rebecca An***

***Nathan Cheung, Louis Viglietta, Michael Zareif***

**A Comparison of Phospholipids and Proteins in the Creation of Foams**

Foams are complex structures that have various applications. They often appear in areas like food science and have many culinary applications. Outside of the kitchen, they are used in soaps and as fire extinguishing systems in large buildings. Foams require many elements, including emulsifiers, to become stabilized and last for a significant amount of time. Emulsifiers work by lining the boundary of an air cavity. The polar, "water-loving" ends of emulsifier molecules align with the water, yet the other ends, which are non-polar and "water-fearing," align themselves in the air cavity, creating a strengthening layer around the bubble. The purpose of this experiment was to look at two types of these emulsifiers – phospholipids and proteins – and compare the foams that they produce, looking at bubble size and foam duration. The goal was to use these results to determine which emulsifiers are most effective at stabilization for easier production of food foams. We hypothesized that proteins will perform better than phospholipids and because they undergo a process called crosslinking, which might add extra fortification to air cells. To test this, we started with two phospholipid solutions and two protein solutions, adding equal amounts of each emulsifier to each (by weight). Each solution was mixed lightly using a vortex mixer, and then shaken for 15 seconds. The amount of foam created and liquid used was recorded. So far, the data shows that there is no guaranteed advantage of using proteins over lecithins. The soy protein isolate appears to do the best, although the whey performs poorly. Lecithins appear to be about equal to each other, performing better than the whey and worse than the soy protein. However, data is still being collected and is subject to change.

***Tyler Chipetine and Anthony Citera***

**A Study ​of Different Wavelengths of the Visible Light Spectrum on the Growth and Development of *Raphanus sativus***

Plant growth is dependent on the wavelengths of light that are absorbed and reflected and the intensity of that light (Bordy, M. and Emerson, R., 1959). Normally, plants absorb both the red-orange and violet-blue parts of the spectrum and reflect green and yellow visible light in order to grow, but this investigation explores the growth of plants when only a certain portion of the spectrum is available. The experiment was done inside of a box containing 2 F8T5/WW light bulbs for growing radish (Raphanus sativus) seeds in a controlled environment. Inside the box was a styrofoam frame with a rectangular hole cut in the middle. This regulates where the light passed through and was used to set up a piece of cellophane in order to change the color (wavelength) of the light passing through. The radish seeds were germinated for two days. After this process one seed was placed into each of six pots. The pots were put onto a tray and put in the box to grow for 48 hours. As a result, the testing shows that red light, expected to grow the best of the experimental groups, on average grew smaller than the blue (p=0.015) and green light (p=0.006) group, the groups expected to grow the smallest. Also, violet (p=.042) and red (p=.001) compared to the colorless cellophane grew significantly less than the control. The t-test showed that many of the stem means were statistically the same due to variation in the results and the fact that some seeds did not grow at all. Therefore, this experiment concludes that changing the wavelengths between the colors of the visible light portion of the electromagnetic spectrum significantly decreases the growth and development of Raphanus sativus in red and violet light, but does not significantly affect the growth and development of the radish seeds in blue and green light.

***Anthony Citera – See Tyler Chipetine***

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

***Jonathan Collado***

**A Novel Device To Calculate Electrical Potential Energy Within An Electric Field of Non-Nuclear Electromagnetic Pulses**

This device demonstrates a method of accumulating and storing a large electrical charge of up to 2.2 Coulombs. It shows what an electron charge of this magnitude really is by observing the discharge (light and sound) that occurs when the the storage device (a 18,000 microFarad capacitor) is shorted by a screwdriver. As a part of our explanation of what this magnitude of charge really is, a calculation was made showing how many electrons are involved. To further bring to light a further appreciation of what this means, a comparison between a grain of refined sugar and an electron resulted in the realization that a stored 2.2 Coulomb charge would be equivalent to 19,350,000,000,000 pounds of sugar.Future additions to this device can demonstrate how capacitive discharge can be used to generate bright and short duration photon bursts that can be used in a spectrum of applications from photography to laser radars and weapons. it can also be used in metal welding and to generate strong electromagnetic pulses (EMP) similar to an exploding nuclear device. Such equipment is used to test electronic device for survival in military and space applications. An EMP device made with this piece of experimental equipment could damage cellphones, computers and other semiconductor-based devices within 15 feet of the discharge coil, and is therefore not recommended for the classroom. Also, the voltage levels with the enclosure are dangerous and should only be accessed by a science instructor who is familiar with this technology and with this device.

***Daniel Czop – See Adan Abdabhai***

***Gabrielle D’Agostino, Eliana Gruvman, Alexa Varlamos***

**Testing the Accuracy of the 20CR Weather Reanalysis Model System Using Data from Erasmus Hall High School in Brooklyn, New York (1826-1857)**

Climate change concerns the world.  To investigate, scientists use historical weather data to analyze and predict future climate change.  Past weather data is obtained from proxy data in tree rings or ice cores, and historical data recorded in journals or logs.  This data is used to build and test weather reanalysis prediction models such as the 20th Century Reanalysis Model System (20CR). The 20CR is known to accurately predict past weather conditions ranging from 1841 to present day through the assimilation of historical data, sea ice distribution, and barometric pressure readings into the computer model system.  Historical weather data is of great value especially data from 1841 or earlier as the 20CR has not been tested with the prior to 1841.  Adding the historical data from Erasmus Hall, obtained from the New-York Historical Society, to the system may help the 20CR increase it’s accuracy in predicting weather further in the past.  The purpose of this investigation was to test the accuracy of the 20CR compared to weather data obtained from logbooks at the weather station at Erasmus Hall High School in Brooklyn, New York (from  1826-1857).  Data from these logbooks was digitized and sent to scientists operating the 20CR at the National Oceanic and Atmospheric Administration (NOAA).  The scientists at NOAA sent back the 20CR’s weather predictions which were compared to the actual data from logbooks at Erasmus Hall.  The 20CR was found to have a negative bias in predicting past weather pressure using MSLP.  As well, the correlation between the 20CR’s pressure predictions and the actual data was never higher than .87.  The 20CR was not very accurate at predicting past weather data.  By exposing the system to the past data from Erasmus Hall the 20CR may be able to increase its accuracy in predicting past weather data in the future.

***Matthew Damiata, Nicholas Nasis, Mia Serritella***

**Exploring the Function and Development of Insulin-producing Cells in *Drosophila***

***melanogaster* with the Goal to Improve Diagnosis and Treatment of Diabetes**

As the danger of metabolic diseases increases in the world, it is apparent that there is a need for treatments and cures for diseases such as diabetes. In the United States, over 29 million people of all ages have a form of diabetes; this disease affects almost 10 percent of the population. People who have Type 1 Diabetes have little to no insulin production in their pancreas due to the malfunction of insulin-producing cells (IPCs). Those who have Type 2 Diabetes have functioning IPCs, however the body is not able to use the insulin they produce.

The purpose of this project was to use *Drosophila melanogaster* to cross flies with certain genotypes in order to identify gene function through mutations caused by a transposable element in the flies to identify which tissue expresses the insulin-producing cells (IPC) of the flies. Fruit flies have proven to be useful in this field of study, sharing 61% of the basic genomic structure as humans.  They reproduce fast, and are efficient for calculating genotype specific crosses. Through a cooperative endeavor with Stanford University, we used their transgenic fruit flies to produce lines to assist scientists in studying metabolic diseases. Our initial cross consisted of a genetically inserted transposable element, “StanEx,” This transposable element is mobile in the genome and moves to different loci from the donor site to the recipient site in the presence of a transposable element. Flies with specific traits and markers were observed to deduce which chromosome has the transposable element moved to, with the goal of obtaining the desired genotype. Next, we will map where the transposable element jumped in the flies’ genomes. This project creates unique lines that can assist in improving the diagnosis and treatment for Type 1 and Type 2 diabetes.

***Ethan Darvin – See Riley Bode***

***Alexis Davitashvili and Trevor Rosenlicht***

**Determining the Location of the South Atlantic Anomaly Using the TimePix Detector Data and “Google My Maps”**

Radiation exposure is prevalent in space due to the lack of atmosphere providing protection from the sun. There is a region with high radiant energy levels called the South Atlantic Anomaly (SAA).In this study we are determining the location of the SAA as a function of time. The European Organization for Nuclear Energy (CERN) works with the International Space Station (ISS), which has a radiant energy detector named TimePix. The TimePix detector has been developed by CERN to collect radiant energy data at regular time intervals on the ISS. By first isolating all of the high radiant energy points found in the TimePix data (radiant energy values above 35,000 keV are deemed “high”) using excel, we are able to plot those points onto “Google My Maps.” We created four separate “Google My Maps” files with these high radiant energy values which go from December 16, 2015 to June 18, 2016. By plotting these high radiant energy points onto “Google My Maps” it will pinpoint where the SAA is. The results of this study thus far indicate that the location of the SAA is between -31$∘$ and -24$∘$ Latitude, and -54$∘$and -51$∘$Longitude, a significantly smaller region than what scientists and had previously thought. Although the results are similar with the students participating in this research from England.

***Michael Delmonaco, William Liu, Kevin Zhou***

**A Comparison of Ocean Chlorophyll, Mixed Layer Depth and**

**Sea Surface Temperature Over Time**

Phytoplankton are photosynthetic microorganisms that are vital to marine ecosystems. However, a decrease in phytoplankton population has been observed over several years before 2010. The Intergovernmental Oceanographic Commission of UNESCO (IOC), the International Ocean Carbon Coordination Project (IOCCP), and the Ocean Carbon and Biogeochemistry Program (OCB) lead the International Group for Marine Ecological Time Series (IGMETS) project, a collective effort to prepare a comprehensive, integrated report concerning their collection of over 300 marine time series. Their collection includes time series data for sea surface temperature and ocean chlorophyll globally and includes data for the 2010-2015 period, which has previously not been studied. The purpose of this investigation was to study this new data and test for trends among sea surface temperature, mixed layer depth, and ocean chlorophyll time series. We hypothesized that if sea surface temperature increases over time, then ocean chlorophyll and mixed layer depth will both be negatively affected. This is important because it may provide new insight into trends that affect major ecosystems directly or indirectly. By studying changes in satellite-observed chlorophyll as an indicator of phytoplankton population and health in relation to sea surface temperature and mixed layer depth which both directly affect phytoplankton population, we can better observe trends between them. Data studied includes sea surface temperature, ocean chlorophyll, and ocean mixed layer depth time series. Datasets and trends will be compiled and plotted through a plotting software to determine whether there are trends between data sets.

***Elizabeth Demacopoulos, Amy Held***

**Interactions Among Hermit Crabs (*Pagurus longicarpus)* in the Presence of Food**

The goal of this study was to investigate the interactions between Hermit Crabs. In this project *Pargurus longicarpus,* which is a small (2.5-5 cm) crab found along the east Atlantic coast of the United States, was used. The Hermit Crabs, which are an important organism in the marine ecosystem, are omnivores and detritivores and are also prey for larger crabs. The objective of this study was to investigate the behaviors of the hermit crabsin the presence of food. There is a natural competition among hermit crabs to obtain their food. Hermit crabsneed to find a way to get enough food for survival. To carry out this study a hermit crab was "starved" for a week and another hermit crab was fed regularly. The hermit crabs were then individually tested to see how far away the food needed to be from the hermit crab before a reaction occurred. We hypothesized that if Hermit Crabs are placed in a setting in which one hermit crab has been isolated and not fed than that Hermit Crab will obtain the food faster than another hermit crab that has been fed. Thus far, results show that hermit crabs which were starved previously, will immediately recognize the food and move towards it. Hermit crabs that were fed previously, will back away from the food. These observations will be used to obtain more information about the feeding habits of *Pargurus longicarpus* in future research studies*.*

***Santiago Depascale Carena, Ryan Duffe***

 **The Behavior and Movement of Cellar Spiders (*Pholcus phalangioides*) in a Human Environment**

Cellar spiders, (Pholcus phalangioides) 8 long legged arachnids that are not dangerous to humans. Our hypothesis was that the spiders will create their web towards the corner of the terrarium as well as out of sight from humans, also that spiders would be aggressive in their own territoriality. Cellar spiders are venomous because of their very high concentration in their poison but they are not known to bite humans and much like their relatives of the Pholcidae genus have fangs that are too short to administer the poison into a human .These spiders have adapted to rely on human environments to create their webs (home). Cellar spiders can be seen in various human type-environments such as many manmade structures. This set up had been created to record data by keeping the spider in a controlled environment that we could produce observations and results. To record these habits observations were made of the spider in a terrarium. In order to do this a setup has been fitted with graph paper to record our results properly. The next step of this experiment would be the inclusion of another spider and comparing past results to the newly found results by the addition of this spider to test multiple scenarios in real life such as whirling. The result's applications in real life are limited but they can help us understand how us as humans can create artificial environments, and how cellar spiders adapt to these environments. The results provide proof to disprove or agree with our hypothesis, which is whether or not they prefer corners, windows, and undetectable places for webs in human-type environments to live. We believe our hypothesis is correct because the observations so far lead to it along with prior research on the topic. This topic will be continue to be researched by us and hopefully more people interested in it.

***Ryan Dery – See Adam Abdabhai***

***Cathleen Deutsch, Bridget Flynn, and Tejasri Sundararajan***

**The Effects of Permanent Hair Dye on Planaria (*Dugesia tigrina*)**

Studies have found that repeated hair coloring can remove the hair’s protective outer layer, and without this layer, the hair can lose its ability to repel water. Permanent hair dyes also contain harmful chemicals called aromatic amines, which has even been shown to cause cancer in animals. The purpose of the investigation was to determine the harmful effects of hair dye on the motility of Planarian. Research has shown that Planarian have similar physiological systems as humans, so they are ideal model organisms. Planarian were exposed to various colors of hair dye solutions. The control group was placed in artificial pond water. The reaction time of the Planarian in each solution was recorded by timing how long it took to travel across the petri dish when having a light shone from behind them. Due to their sensitive eyes, the light causes irritation, making the planarian move away from the light, and travel toward the end of the petri dish. It was hypothesized that the planarian exposed to the hair dye would have significantly slower reaction times, than the control group, taking longer to cross the petri dish. Also, the darker hair dyes color would have the slowest reaction time when compared to the other solutions as they contain a greater concentration of aromatic amines, para-phenylenediamine and lead acetate. We hypothesized that hair dyes have a negative impact on Planarian and darker shades of hair dyes are more dangerous, than lighter shades. According to our results, the darker shades of hair dye: Dark Pure Blonde, Medium Brown, and Special Blonde, all had a slower response time than the control.

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***Emily DiPrima and Kristina Parkas***

**How Much Metal Contamination Can Duckweed Remove From Pond Water?**

Metals that are soluble in pond water can harm the animals residing there. One such metal, chromium, can cause animals to become ill. *Lemna Gibba* is a common duckweed plant found in ponds, marshes, lakes, and quiet streams. Duckweed has the ability to remove metals, such as chromium, from bodies of water. Our hypothesis is that the amount of chromium in the pond water will decrease due to the duckweed. If the amount of chromium decreases, the pond water will become less harmful for animals to drink. Duckweed plants were cultivated in 0.05m K2CrO4 Samples were taken throughout a period of 24 days.  The concentration of chromium started at 155 mg/L.  After 4 days, the concentration went down to 145 mg/L.  After 10 days, the concentration was 149 mg/L.  After 14 days, it was 156 mg/L and after 24 days it was at 196 mg/L.   In conclusion, the duckweed started out removing chromium, but after 10 days the chromium concentration started to increase.  Duckweed can only remove metal contamination over a short period of time.

***Emma Downey and Kacey Lopez***

**Comparing The Effects of Various Herbal Medicines vs. Modern Medicines on the Regeneration Rate of Planaria**

The purpose of this investigation was to determine which medicines (herbal or modern) had the greater impact the rate of planaria regeneration. Planaria are a type of flatworms that can regenerate from severed body parts. They have extraordinary abilities and can be used to study the nervous tissue after injury. Herbal medicines were first written about in the second century BC in China. Traditional herbal remedies include ginseng root and willow bark while traditional treatments include cupping and acupuncture. Chinese medicines were used to reduce inflammation and chronic pain. By researching the effect of herbal medicines, compared to modern medicine on planaria’s ability to regrow their eyes, we may be able to better understand and naturally heal illnesses and injuries of humans without adverse side effects. Planaria were cut in half and placed into containers of Tylenol (modern medicine), Skull Cap (herbal medicine) and water (control), respectively. The planaria was observed daily until their eyes grew back. We hypothesized that Chinese Herbal Medicine will cause planaria to regenerate quicker than modern medicine because Chinese medicine is natural with no additives and human benefits include improved liver health and muscle strength. The results showed that, compared to the control, the herbal medicine helped the planarian regenerate at the same rate. However, compared to the modern medicine, the herbal medicine helped the planaria regenerate much quicker as the planaria in modern medicine showed no regrowth

***Adam Dubi – See Ethan Abbe***

***Ryan Duffe – See Santiago Depascale Carena***

***Aria Eghbali and Yeil Kim***

**A Radio Frequency Radiation Sensor Capable of Detecting RF Emitters**

**at Varying Frequencies**

Much effort is put into limiting the electromagnetic radiation exposure to humans, the number of Radio Frequency (RF) radiators, which are believed to have various harmful effects on humans. RF energy is another name for radio waves, it’s a form of electromagnetic energy that consists of waves of electric and magnetic energy radiating through space. A known effect of excessive RF radiation exposure is the overheating of body tissue. RF radiating devices with various frequencies are growing in numbers at an alarming rate. In this project, the goal was to detect a wide spectrum of RF. A log periodic dipole array antenna (LPDA) capable of detecting RF emitters in various frequencies was assembled. The LPDA, consisting of multiple half-wave dipole driven elements and gradually increasing lengths allowed the antenna to be more wideband and efficient for its’ small design. The antenna’s efficiency losses and gains - how well the antenna converted input radiation into volts - were calculated. Based on the findings, it was clear that the LPDA was more efficient than existing directional radiation detectors, most of which only detect the presence of an RF emitter without any indication of the source’s direction. Unlike other common radiation detectors with inefficient bandwidths operating in a small range of frequencies, the LPDA design is inexpensive and also capable of functioning with significantly wider bandwidth. A new generation of radiation detectors should be made to detect and locate RF emitters with ease.

***Erin Sass, Mikayla Elferis, Caitlin Tolentino***

**The Effect of Salt Of Sugar Play-Dough and Slime in Relation to Electrical  Resistance**

This project was done to test whether salt or sugar had an effect on electrical resistance and if so, if the concentration of salt or sugar affected the resistance level.  In previous studies, the addition of salt to play-dough allowed the flow of electrical current to pass through.  However, the addition of sugar caused a resistance to the flow of the electrical current.  To carry out this experiment, different concentrations of salt and sugar were added to slime and play-dough and their resistance in ohms was recorded.  Each substance was tightly packed into a PVC pipe with copper strips on each end in order to keep the slime or play-dough in place.  Ten trials for each slime and play-dough sample was performed to obtain more accurate results.  It was hypothesized that salt and sugar will have an impact on the level of resistance and that the materials containing salt will have a lower level of resistance than the materials containing sugar.  The results showed that overall, the playdough and slime containing salt had a lower resistance in megaohms than the playdough and slime containing sugar.  The data supported our hypothesis and when a t-test was performed, the alternative hypothesis was accepted and the null hypothesis was rejected, stating that there was a statistical difference between the salt and sugar.

***Gillian Evers – See Candace Arneaud***

***Matthew Feigenbaum, Nicholas Greco, Brian Merritt***

**Meteor Shower Correlation with Micrometeorite Findings**

Bits of rock that descend through the atmosphere and reach Earth’s surface are called micrometeorites. They are very small but relatively easy to find. The goal of this experiment is to test whether or not there is a correlation between the amount of meteorites found and the time of an upcoming, current, or past meteor shower. To collect these particles, a garbage can or bin, covered with plastic wrap was placed outside. After letting it sit out for a range of 1-2 days (depending on the length of the meteor shower), it was wrapped up and later sifted through with a magnet. To keep everything equal, the length of the before, during, and after time periods were all the same. The micrometeorites, most of them being partially composed of nickel, are magnetic and stuck to a neodymium magnet. Our hypothesis was that the most micrometeorites will be collected directly after a major meteor shower. This is because the particles are not very big or heavy, meaning they will probably fall slowly. After doing our collection, findings indicate that our hypothesis was incorrect, and most micrometeorites were found during the showers. After counting the particles on multiple occasions, the most particles were found during meteor showers (mean: 129.3) as oppose to before (mean: 25.3) or after (mean: 98.3). The *p* values of the data are all less than .05 which indicates that the alternative hypothesis is accepted, meaning that the means are statistically different. Our analysis has led us to the conclusion that the greatest amount of micrometeorites fall during meteor showers, and by a sizeable margin.

***Dylan Feldman and Ryan Tedesco***

**The Effects of Music Genre on Walking Speed**

Music has always been part of society, improving or worsening the daily lives of people. The purpose of our project was to see the effect of music on human actions. These affects were used to see if music could be used to lessen anxiety. A total of 10 participants, 5 male and 5 female, listened to rap, hard rock, classical, jazz, and techno. They also listened to no music, which was the control group. While listening to each genre, they had to complete a simple task of walking from our research room to the school library and back. We hypothesized that classical, jazz, and techno would increase the time to complete the task; while hard rock and rap would decrease the time to complete the task. The only music genre that promoted a faster walking speed for participants was rap with a mean of 66.1 seconds, this was confirmed by a t-test value of less than 5%, there was a statistical difference between music and no music. The music genres of classical, techno, hard rock and jazz slowed their walking speed. The results of this study could be used to enhance the time it takes for students time to complete their schoolwork.

***John Finnie-Maloney***

**Effect of Sorghum Plant Maturity on Sorgoleone and Its Ability to Suppress Weed Growth**

Amaranthus retroflexus, a weed common to North America, has significantly reduced the yield of crops and has depleted soil of water and nutrients. Current methods of weed control involve hand-weeding, mechanical weeding, and herbicides which have been proven costly, laborious, ineffective, and harmful to the environment. As a result, finding new ways in suppressing weed growth is becoming more and more important to farmers and consumers. The purpose of this experiment was to determine if a chemical, sorgoleone, produced by the sorghum plant could be a possible candidate for an environmentally safe and relatively inexpensive herbicide. To carry out this study, sorgoleone was extracted following Muhammad Ashraf’s procedure, then the sorgoleone water extract was sprayed on Amaranthus retroflexus. It was hypothesized that when testing the roots of sorghum from the first month to the second month, the sorgoleone tested will increase in its potential to inhibit photosynthesis since the sorghum plant is approaching maturity. The first month sorgoleone spray proved to be ineffective at suppressing weed growth since the Amaranthus retroflexus plants that were sprayed with the sorgoleone extract maintained an average 1.5% growth in inches per day. The second month sorgoleone spray showed to also be ineffective at inhibiting weed growth since the average growth of the sprayed plants stayed at a constant 1.38% growth in inches per day. Therefore, the earlier stages of sorghum growth produced sorgoleone that failed to inhibit weed growth.

***Brian Flynn, Paul Moon, Kyle Spinelli***

**The Comparison of GM2 Gangliosidoses**

Tay-Sachs Disease (TSD), Sandhoff Disease, GM2 Activator deficiency and Chronic Organic Mental Syndrome are all GM2 Gangliosidoses; a class of inherited disorders that are extremely rare in the general population. All are homozygous recessive mutations involving the β-Hexosaminidase A (HEXA) and β-Hexosaminidase B (HEXB) genes. All three diseases are caused by different mutations, although, they all possess similar symptoms. For instance, they all lead to the death of neurons; ultimately leading to mental regression and retardation; often patients die an early death. This is due to a failure of the enzyme that breaks down GM2 in the body’s cells. We hypothesized that it was possible to determine or predict protein influential sites (sites were a protein binds to a molecule to break it down) by modeling and analyzing gene and protein structure and sequence. A computer program was created to parse the National Center for Bioinformatics for gene and protein sequences in its “Nucleotide” database. Protein modeling software (PyMOL) and gene alignment software (clustalOMEGA) were used to compare coding sequences and map the affected protein sites and folds in the quaternary structure. Through our analysis, it could be discerned that Tay- Sachs affected proteins have several coding region properties in common. This information can be used in diagnosing patients who may have the TSD or other related Sphingolipidosis disorders. Future research could generate more information about the folding sites of the proteins, which can be used to develop targeted treatment sites for these diseases.

***Bridget Flynn – See Catherine Deutsch***

***Danielle Gabay – See Jacob Ashkenas***

***Nicolas Gembs, Charlson Kim, Dylan Talarek***

**The Antimicrobial Properties of Slug’s *Limax maximus* and *Deroceras reticulatum* Mucus**

Natural antibiotics have been used for thousands of years. Before the invention of penicillin, many alternatives were used to help treat and cure the sick. During the time of Ancient Greeks, documents from Hippocrates recommend the use of crushed snails to relieve inflamed skin. Honey is an example of a natural antibiotic, as it’s antimicrobial properties prevent it from spoiling. After nearly a century of mass produced antibiotics and antibiotic use, there has become a problem relating to antibiotic resistance. Antibacterial resistance is growing at an alarming rate, creating extremely resistant bacteria called “superbugs.” The purpose of this experiment was to determine if slug mucus has antimicrobial properties and could prevent bacteria from developing an antibacterial resistance to it. It was hypothesized that slug slime could be used as a natural antibiotic to create a new and safe way to eliminate bacterial infections. Using the Kirby Bauer method we measured zone of inhibition of the positive control (antibiotic free disk), the negative control (the antibiotic kanamycin), the slug mucus of both the Limax maximus and Deroceras reticulatum and honey which is a common natural antibiotic. The various antimicrobial remedies put into a bacterial culture and using a spectrophotometer, the concentration of bacteria was measured based on absorbance every 5 minutes for 30 minutes. Antimicrobial properties hinder bacterial growth, detected by lower light absorbance. The slug slime showed a noticeable zone of inhibition after being placed in a petri dish with both E. coli k12 gram negative therefore verifying the mucus’ antimicrobial properties in slug slime.

***Elias Gonzalez – See Aaron Angeles***

***Mia Goren, Emma Karadenes, Arianna Tringali***

**The Implementation of Hydroelectric Power Generation Into Household Pipes Using Turbines**

Our goal was to convert water flow into usable energy in an eco-friendly and cost-efficient way. There are many different hydropower turbines. We chose to use the Kaplan turbine because it is a reaction turbine which means it reacts to water and can convert it to energy as a result. These hydropower turbines can be implemented in household pipes to help perform daily household tasks such as using the sink, showering, and flushing the toilet. Energy can be very expensive and even environment-friendly forms of energy, such as solar panels, take a long time to pay off.These turbines inside of household pipes will be small and made of plastic which is a cheap and affordable way to get the results needed without costing too much. As water flows through the pipes, the turbine will spin which releases the converted energy into a generator. This keeps the energy until it is needed. Anyone who is a homeowner, tenant, renter, hotelier, ect would find this product appealing. It is a cheap and effective way to produce energy that is also environment friendly. Some challenges that we ran into while making this project were figuring out how to convert enough energy for household tasks, while using such a small scale turbine. Another challenge we faced was figuring out how to downscale the turbine enough to fit in a typical household pipe, while still being sufficient enough to work. Our product identifies the needs of many people in an affordable eco-friendly way.

***Dimitri Gouvoussis – See Ruslan Burns***

***Nicholas Greco – See Matthew Feigenbaum***

***Eliana Gruvman – See Gabrielle D’Agostino***

***Jason Haber and Joshua Hardoon***

**Can Different Types of Music Improve Physical Performance**

**Using a Handheld Strength Device?**

Athletic participation is growing rapidly around the world (Szabo, A, 1999) and there is a connection between psychology and performance. It has been shown that an individual may be able to overcome obstacles, such as muscle fatigue, with the addition of music while exercising. Listening to music during physical activity and physical exertion may even allow a person to perform at a higher level and exert more force than without music. To investigate the relationship between listening to music and its effect on physical performance, a group of human participants will squeeze a dynamometer which measures force, both with music and without music. The purpose of this investigation was to see if there is any correlation between listening to music and the amount of force exerted during an exercise, and to see if different genres of music have effect on physical performance. It was hypothesized that the amount of force exerted on a dynamometer handgrip will be higher while listening to music as compared to no music. Also, we hypothesized that the subject could exert more force while listening to rap music as compared to classical music. This was hypothesized because in another experiment by Attila Szabo (Szabo, A, 1999), there was an increase in force exerted with an increase in tempo of music. To carry out this study, participants squeezed the dynamometer while listening to rap music, classical music, and no music in random orders for 15 seconds with a one minute break in between the different genres of music or the no music category. They listened to each song for 30 seconds prior to squeezing the device. Data was input into Microsoft Excel and the sum, standard deviations and averages were found for each participant’s data.

***Jared Habermehl***

**Designing and Implementing A Secure Network System for the “Internet of Things”**

The Internet of Things (IoT) refers to the network connectivity of physical devices, enabling these devices to send and receive data. The availability of IoT devices has been growing at a rapid pace, with estimates of 6.4 billion devices currently in use worldwide. In the race to bring new IoT products to market, manufacturers have paid little consideration to security issues, leaving an estimated 70 percent of the most commonly used IoT devices vulnerable to hacking. The purpose of this project was to create a network system to secure transmission of data between IoT devices and the internet. Protocols such as RSA encryption, action IDs, and digital verification signatures were used for security. Raspberry Pis were used as the bridge between the WiFi router and IoT device to serve as a data firewall, exclusively transmitting approved data. The Raspberry Pi exclusively accepts connections sent in datagram packets. The Arduino, which serves as the IoT devices in the constructed prototype, connects with the Pi through Bluetooth exclusively as to avoid being able to be accessed by the router and obtaining an IP address. This new system was to create a standard between devices for a secure, communicating network.

***Theresa Haupt, Sarah O’Connor, Maheen Naseem***

**The Design and Construction of Devices to Improve Student Locker Storage**

The purpose of this invention was to design and construct an expandable locker shelf in addition to accessories to hold books, writing utensils, electronic devices, and more for use in a locker. These devices were made for students and employees, especially those who use wheelchairs, to help them organize and keep things in their lockers. Many lockers only have one shelf that is both too small to put things in and too high for many people to reach. Most students and workers give up using their lockers and carry their belongings instead. To encourage the use of lockers, multiple companies have developed locker shelves, but none similar to our design. There is a need for a locker shelf unlike the ones existing today that adjusts for all locker sizes according to the user’s preference. The first step was to build a prototype of the chosen design for testing in an experimental locker. The prototype consists of a locker shelf that can be moved to any position in a locker. The shelf is held in place by a spring and pulley system. Observations were made on how well the shelf fit and how much it could hold until it was working properly.

***Amy Held – See Elizabeth Demacoupoulos***

***Austin Heller and Chase Schare***

**Can Planaria (Dugesia antillana) Retain Memories of Trained-Responses to Light after Complete Regeneration?**

This project was designed to discover whether or not planaria retain memories of trained-responses to light after complete regeneration. Planaria, or Dugesia antillana, are flatworms which regenerate after being cut. The regeneration process takes from 1-2 weeks. Before the worms were cut, they were subjected to conditioning. Conditioning or associative learning is when a particular response becomes associated with a specific stimuli. The process by which the planaria were conditioned was a form of associative learning known as classical conditioning, which is a learning process by which a subject learns to respond in a specific way to a previously neutral stimulus. In order to train the planaria to respond to light, a light was turned on at certain times, two seconds after the light was turned on the worms were shocked. This took place over the course of two weeks. This is a form of classical conditioning because it may lead the worms to act as if a shock occurred when the light is turned on, even if there is no shock. After conditioning, the worms were cut in half, then placed in a different container of artificial pond water (APW). Next, the newly regenerated worms were subjected to the same conditioning process. If planarians showed signs of responding to the light without a shock would lead us to conclude that memories are passed down from parent worm to regenerated offspring. It was hypothesized that this would happen because planarians have shown memory retaining processes as evidence through past studies. If the newly regenerated planarians do not respond to the shock-absent light, it would be reasoned that memories are most likely not passed down from parent planaria to regenerated offspring.

***Jason Hladki, Joseph Kim***

**Effect of Over-the-Counter Pain Medication on the Regeneration Rate of California Blackworms**

California Blackworms (CBW's) are small (ranging from 2-5 centimeters in length) freshwater aquatic worms that have the ability to regenerate. They are easy to maintain in the lab and do not require much food or space. The purpose of this investigation was to test the effect of over-the-counter pain medication on the regeneration rate of CBW’s. The painkillers we used in this experiment were Excedrin and Aleve. They contain Acetaminophen and Naproxen sodium, which are the active ingredients in the drugs. Due to the painkillers blocking the neurotransmitters and potentially slowing the regeneration rate of CBW’s, this research could provide valuable information connecting the nervous system and regeneration. Our control consisted of a group of 10 worms that were exposed to artificial pond water. The experimental groups consisted of various concentrations of Excedrin and Aleve. Photomicrographs using a dissecting microscope were taken to record the added segments to each worm over time. We hypothesized that if over-the-counter pain medication is added to the environment of the CBW, then the CBW’s will regenerate at a slower rate, compared to the control group due to the pain medication blocking neurotransmitters. Thus far, we have found that concentrations of painkiller solutions above 3 mL drug solution/7 ml water are lethal to the worms. This shows that there must be an effect from the painkillers and we plan to reduce the concentration in. We also found that almost all of the CBW's grew normally after exposure to artificial pond water.

***Maria Hoover and Meghna Thampy***

**The Effect of ABA on the Growth of Radish Seeds**

Abscisic Acid (ABA) is used as a plant hormone and growth regulator. This research will show how ABA takes effect. Four pots of soil, each containing three radish seeds, were used. Three of the four pots had ABA, one didn't. A small amount of aqueous sodium bicarbonate was used to dissolve 50mg of ABA in 150 mL of distilled water. One pot was given 4 mL of ABA solution, another was given 8 mL of ABA solution, and the third pot was given 12 mL of ABA solution. The fourth pot was only given water and was used to compare the growth of a normal radish plant to the ones that were treated with ABA. The plants were watered with 6 mL of water 2 to 3 times a week. It was predicted that the plant with the 12 mL of ABA would grow the fastest and would be the largest out of all of the plants. It was given the most ABA solution. In the results, the plant that grew the tallest was the one that had 8 mL of ABA solution. Both plants with the 4 mL and 12mL ABA solution died. The plant with only water and no ABA solution was the second tallest plant. The hypothesis was disproved when the 12 mL and 4 mL solution plants died. The medium range of ABA was most beneficial to the radish seed plants.

***Alex Horowitz – See Aaron Angeles***

***Jonathan Iacovelli, Bart Wisniewski***

**The Design and Construction of an Ice Mold For Injuries**

A popular way of treating minor injuries is to apply cold to the injured area because it numbs the pain and decreases the swelling that often occurs. Usually an ice pack or a plastic bag with ice cubes is wrapped with a paper towel then applied to the injured area. The purpose of this project was to design and construct an ice mold that can make ice in a shape that conforms to the area of an injury. The ice mold is a reusable product that can be easily applied to make ice that can be used for example around an injured finger to reduce the inflammation due to the injury. To make the ice mold ⅛” inch plexiglass was cut to make a box like structure. To form the curvature in the ice to fit the injury a pvc pipe was cut down the center and placed upside down in the plexiglass box. Water was poured on top of the inverted pvc pipe in the box and placed in a freezer to make the ice. We aimed to create an efficient and effective way to minimize the pain as well as to decrease joint and ligaments swelling.

***Christopher Ioannou, Mustafa Naseem, and Shawn Uthup***

**Hyper Planarian:**

**The Effect of Sugar on Planarian Movement**

Over the last three decades sugar consumption has increased more than 30%, and this is unhealthy because sugar consumption can affect the nervous system in a negative way. Planarians are useful test subjects because they have a similar nervous system to humans. Planarians have traditionally been a favored animal model in developmental biology. In this experiment, it will be tested if sugar concentration affects the movement of planarians over lines on a piece of graph paper, in a given amount of time. Planarians have seizure-like movements, and planarian mobility can be tested after a very short exposure period. The amounts of sugar concentration that were used for the experimental groups were .5% and 1%, with one control group containing only artificial pond water. The planarians were tested to see how many graph paper lines they would cross over an eight minute time span. It was believed that if planarians were placed in artificial pond water with high sugar concentration they would cross more lines than the planarians in the lower sugar concentration due to increased activity. However, the planarians in the control group had the most movement as they had the higher average of cumulative crosses (mean (0%)= 98; mean (.50%)= 64, p= 1.97x10-9; mean (1%)= 35 p= 2.58x10-17). The results have an indirect relationship because as the sugar concentration increased, the number of cumulative crosses decreased. With higher sugar concentrations the planarians had seizures, causing them to cross fewer lines. Sugar affects planarian movement by making the planarian move less and slower.

***Raphael Iskra***

**The Effects of Nitazoxanide on Chaperone/Usher Pathway Assembled Virulence Factors in Gram-negative Bacteria**

Societal trends of antibiotic misuse have caused bacteria to evolve resistance, raising the potential for devastating, widespread health crises. To combat antibiotic resistance, novel therapeutic alternatives seek to target virulence factors, which facilitate bacterial pathogenesis and are secreted by outer membrane complexes. The chaperone/usher (CU) pathway is an assembly and secretion system that is responsible for the biogenesis of many virulence factors in Gram-negative bacteria. The anti-parasitic drug, Nitazoxanide (NTZ), has been shown to decrease surface expression of several CU pathway assembled pili in E. coli. The purpose of this study was to determine if NTZ inhibited the formation of the Fraction 1 (F1) capsule, a virulence factor utilized for host immunoevasion in Yersinia pestis. To analyze capsule formation in the presence of NTZ, mutated E. coli plasmids containing the Caf1A usher were administered varying concentrations of NTZ and tested against plasmids lacking the usher. Cultures of these plasmids were grown at 37°C to induce capsule expression, and the capsule protein surface-assembled was extracted and analyzed by gel electrophoresis. When the surface protein levels were analyzed, experimental groups containing the Caf1A usher plasmid exhibited a decrease in capsule levels in a dose-dependent manner, while those without the usher lacked the F1 capsule. These results suggest that the CU complex is a viable target for novel therapeutics, and that NTZ inhibits the functionality of a vast array of CU systems. Further research into NTZ’s interaction with CU systems may identify a common biogenesis requirement which the drug effects, thereby identifying a novel class of therapeutics to circumvent antibiotic resistance in Gram-negative bacterial pathogens.

***Joshua Kaplan – See Emma Baker***

***Emma Karadenes – See Mia Goren***

***Mikayla Kelly – See Gianna Anderson***

***Hamza Khan, Samuel Morris, Simon Snowden***

**A Practical Approach to Securing Paper Documents**

The growing issue of document theft has served as a reminder to the public that an inexpensive and universal method of instantly alerting owners to physical document larceny has yet to be implemented. The risk of losing medical and legal documents, correlated with rising rates of identity theft, have only increased the urgency of the issue. The invention of an inconspicuous gadget, which forces a thief to both move the device and trigger an alarm simultaneously provides an efficient solution to the problem. The purpose of this project was to design a cost friendly device, in the form of a paperweight, that would emit an audible notification when lifted or otherwise moved from above the papers. Due to the paper-weight form, the device must be moved from its current position in order for the protected documents to be stolen. The device was constructed using an electrical circuit consisting of a “ring switch” mechanism, closing the circuit (therefore triggering the alarm) when the device was moved. A latch and relay circuit was also implemented into the device in order to prevent the circuit from opening once the device was returned to its original position. To provide access to the owner, an array of switches were added to the circuit, breaking the path of electricity when the correct combination was pressed, closing the circuit if any other switches were used. The combination of document security and user convenience in a low-cost electrical device will be of value to anyone who requires paper document security.

***Maheen Khan – See Kathy Cao***

***Marina Khan and Ethan Sontarp***

***E. Coli* Resistance to Ionic Silver After Multiple Uses**

Ionic forms of silver are used as effective antibacterials in wound healing to prevent infection. However, ionic silver-resistant bacteria have been discovered specifically where the ionic silver is used often. The research question that was answered was how does silver nitrate dosage affect and encourage the growth of silver-resistant E. coli? E. coli was used in this experiment because the strain was non-pathogenic, yet represented other infectious bacteria such as Staphylococcus aureus. 1000 microliters of a bacteria and Luria Broth mixture were placed into different tubes to which different dosages of 0.1 molar silver nitrate were added: 0, 1, 2, 5, and 10 microliters, respectively. The bacteria were allowed to grow for 2 days in an incubator at 37℃, and the concentrations of bacteria were determined using a spectrophotometer. A killing curve graph was then created comparing the dosages of silver nitrate to the concentrations of bacteria.The bacteria was then plated and cultured for 2 days in the incubator at 37℃. The bacteria colonies were then taken and put into fresh tubes of Luria Broth. The process was repeated another time. In the second generation, the E. coli exhibited increased resistance to ionic silver.

***Catherine Kim, Joshua Lee, Deniz Sinar***

**Computational Analysis of Gene Proteins Relating to Huntington’s Disease**

Huntington’s Disease is a genetic disease that severely affects the brain. Thoroughly studying life threatening diseases is essential to improving the methods of treatment available. Huntington’s Disease is especially important to study, as the huntingtin protein correlated to the disease does not have a specific known function. The purpose of this research was to analyze the huntingtin (HTT) protein in order to offer a possible explanation of the protein’s function. It was hypothesized that commonalities in sequence across orthologs of the human HTT protein are most important to the function of the protein because it is not expected that vital sections of sequence would differ despite the organisms being different. To analyze the huntingtin protein, a series of computational resources were utilized. OMIM was used to obtain basic protein information. The amino acid sequence of the human protein was found using NCBI and was saved in FASTA format. Similar proteins to the human protein were found using BLAST software from NCBI. A sequence alignment using MUSCLE from DNA Subway was performed between the proteins in *Homo sapiens*(Human)*, Callithrix jacchus*(Marmoset)*, Mus musculus*(Mouse)*,*and *Rattus norvegicus* (Rat)so sequence commonalities could be identified. InterPro and ExPasy were then used to offer possible protein functions based on the common sections of the proteins. Finally, PyMol was used to create a visual model of the human protein. The proposed functions of the protein based on the results from these computational resources include cell signaling, cell structure, and memory in neurons.

***Charlson Kim – See Nicholas Gembs***

***Joseph Kim – See Jason Hladki***

***Yeil Kim – See Aria Eghbali***

***Christine Kong – See Kaitlyn Cestaro***

***Philip Kwiecinski – See Ethan Abbe***

***Nicole La Reddola and Sarah Samad***

**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 this 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 BSC 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.

***Daniel Lee***

**A Robust Sensor-Network-Based Estimation Model for Wind Fields**

Short-term solar irradiance predictions can be significantly improved by utilizing the wind field information that commonly includes wind direction and speed. However, it is difficult to estimate the wind field using irradiance sensors mainly due to 1) difficulties in validating the estimated wind fields, and 2) complexity of factors affecting prediction accuracies. To overcome these technical difficulties, a robust sensor network-based prediction model was developed in this study with implication of a realistic cloud simulator. This robust estimation model takes into account various factors including the number of irradiance sensors deployed, topology of sensor placement, wind speeds, and cloud cover moving rates. The qualitative study shows that the estimated wind field agrees surprisingly well with the simulated wind field data, indicating potential for practical deployment as an estimation model.

***Joshua Lee – See Catherine Kim***

***Ruth Lee – See Ariana Aghili***

***Amanda Lemza – See Jacqueline Brandel***

***Delina Levine – See Karen Abruzzo***

***Kimberly Liao, Izza Malik, Funda Sahin***

**Comparison of Historical and Modern Weather Data From Brooklyn, NY**

With extensive scientific data for fortification, scientists have concluded that the earth is undergoing changes in climate. This is an urgent issue because it could have drastic social and economic impacts. In this study, we aim to use historical weather data to analyze the trends of the climate in Brooklyn, NY over a 180 year time period. This will be achieved by comparing temperature and precipitation readings taken from 1826-1856 to readings from 1976-2006 by statistical measures. To obtain the historical data, pages from the Erasmus Hall High School (EHHS) Journal were photographed and manually digitized. The modern data, from a Brooklyn weather station in close proximity to EHHS, was retrieved from an online database and then transferred onto Microsoft Excel. The mean and standard deviation were calculated for each season of each individual year. An unpaired t-test was performed between the modern and historical data sets. The correlation coefficient was calculated for precipitation and temperature. We hypothesized that average air temperature and annual amount of precipitation will show an increase as time progressed.  The results show that air temperature has shown a statistically significant increase over the 180 year period, especially fluctuating through the fall and winter months, while average precipitation has decreased. This study is important because analyzing weather data specific to a single environment over the span of several decades allows us to see a gradual or significant change in precipitation and temperature, further supporting the effects of global warming. Analysis of differences and similarities in past and present weather data is essential for understanding the impacts of climate change.

***Jordyn Lieberman – See Rebecca An***

***Taylor Lipton and Manvi Sharma***

**Redesigning the Sprinkler Head and Increasing Domestic Irrigation Systems**

Many regions in the United States, especially in the Southwest, are currently experiencing a drought. A significant portion of the United States water supply contributes to residential irrigation. Existing Sprinkler Companies consistently fail to place individual sprinkler heads in locations that could ever allow a system to run at peak efficiency, since the majority of sprinkler head placement is arbitrary. The purpose of this investigation was to develop software that, given the shape and dimensions of a residential property, can dictate the most efficient and cost effective locations for sprinkler heads and provide a graphical representation back to the user. A website was created to allow a homeowner to input an aerial view (with the use of Google Maps) of their property and trace out their lawn. A program was designed to identify the minimal sprinkler head usage by optimizing the sprinkler head locations while providing a visual map containing accurate dimensions.  We aim to allow residential homeowners, irrigation companies, and agricultural workers to use our system to determine a more logical placement of sprinkler heads for maximum water conservation. This system is recommended for places like California, where a tremendous drought and population calls for it’s residents to use water sparingly. While our program is not yet completed, we’ve made much progress on the application and hope to soon implement it the website we’re building.

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

***Amanda Loo – See Paulina Buchta***

***Casimira Lopez – See Emma Downey***

***Vishwanath Madhavan and Joseph Strickland***

**The Effects of Solar Heat on Absorption Rates**

**Using Copper and Aluminum**

Loss of heat is a significant issue. Power loss can cause many repercussions. Finding new ways to create energy can help solve this issue. The rig which we created is meant to generate heat at a higher temperature than what the temperature is outside. Using the Sun’s solar heat rays, generating heat can be useful in solving this issue. The rig which we had created, the solar box, should be able to absorb solar heat and generate a higher temperature on the inside of the box. The copper, since it is used more commonly for conducting electric currents, should be the more absorbent metal material. The aluminum is not used as commonly for conductivity, but for cooking utensils, transportation, packaging, etc, and is not expected to greatly impact the absorption of solar heat. Metals are being used because their electrons are loose, allowing them to move around carrying kinetic energy with them. Electricity is able to stick to the electrons due to being kinetic energy. Copper’s low specific heat (.385 J/(g-℃) enables it to absorb larger amounts of solar heat, due to it being able to heat up faster. Aluminum does not allow this due to its high specific heat of .921 J/(g-℃). It is unable to absorb the heat as fast as copper because it heats up slowly. The amount of heat needed to raise aluminum’s temperature is greater than that of copper.

Testing of the solar box took only an hour. During this hour (3-4pm), every fives minutes the temperature inside the box as well as the temperature of the air surrounding us was measured and recorded onto a sheet of paper.
The copper had the largest effect on the absorption of solar heat, as expected. The copper has absorbed more solar heat and had generated a high interior temperature which had reached a max of 85.3°. The aluminum had not generated an interior temperature as high as that of the copper, reaching a maximum of 74.7°. The metals had an impact on the rate of absorption of the solar heat. The information that we had recorded from the trials show that the metals affected the rate of absorption and that copper had the greatest impact due to its low specific heat.

***Izza Malik – See Kimberly Liao***

***Frank Mastroianni – See Ruslan Burns***

***Sophia Mastroianni – See Rebecca An***

***Emma Matz and Carly Tamer***

**A Study of the Relationship Between Folate Deficiency and Behavior in *Dugesia dorotocephala* (Brown Planaria)**

Recent studies have proposed an association between insufficient levels of folate and the development of Autism Spectrum Disorder (ASD). Further investigation is necessary in to determine if a correlation does exist. The objective of this study was to draw connections between a reduced production of folate and ASD, modeled by Dugesia dorotocephala (brown planaria) exposed to succinylsulfathiazole (SST). SST is an antibiotic that limits the formation of folate by interfering with the production of an enzyme necessary for the synthesis of folate. Folic acid supplements are commonly taken among expectant mothers to decrease the probability of miscarriage and various birth defects in their children due to folate's major contribution to the development of the nervous system. However, recent studies have proposed that folate deficiency may also increase the likelihood of ASD developing in the offspring. ASD is a mental condition characterized by abnormal brain development which reduces social competence and can trigger repetitive behavior. Data was collected by observing planaria under exposure to various concentrations of SST and performing an acute motility test. It was hypothesized that if planaria were exposed to SST, they would exhibit a decrease in motility reflecting a correspondence to autistic behavior. Planaria exposed to greater concentrations of SST exhibited decreased motility, indicating that folate deficiency may be a factor in causing a disruption of movement in planaria. This may offer some evidence that folate deficiency may impact human neurological disorders due to the human like physiology of planaria’s nervous system.

***Brendan McCaffrey and Eric Nigro***

**Can an Efficient Microbial Fuel Cell be Made Using Inexpensive Materials?**

According to a projection done at the University of Queensland in Australia, by the year 2112 coal, natural gas, and petroleum reserves will be completely depleted. To compensate for the diminishing fossil fuels new, renewable sources of energy need to be developed. A possible alternative could be microbial fuel cells. Microbial fuel cells use bacteria that oxidize an organic substrate on a cathode, electrons from the oxidation are transferred to the anode generating a voltage. A microbial fuel cell requires a bacterial mixture, water, two electrodes, and a proton exchange membrane or a salt bridge. The construction of a MFC started with a plastic container. It was divided with a piece of Rubbermaid with a PEM insert attached with superglue. We then filled one part of the container with distilled water, and the other part with a mixture of water, sucrose (household sugar), and Escherichia coli. We then installed electrodes to hang in each section and connected them with a copper wire. A voltmeter was connected to the two electrodes as well. We read the circuit with a voltmeter for a period of 40 minutes, taking measures every 10 minutes once every weekday for a full week. The daily average was 66 mV and the voltages ranged from 50 mV-100 mV.

***Brian Merritt – See Matthew Feigenbaum***

***Brian Mokotoff – See Ethan Abbe***

***Jiwon Moon – See Brian Flynn***

***Samuel Morris – See Hamza Khan***

***Pragati Muthukumar – See Karen Abruzzo***

***Maheen Naseem – See Theresa Haupt***

***Mustafa Naseem – See Christopher Ioannou***

***Nicholas Nasis – See Matthew Damiata***

***Jake Nieto***

**An Empirical Biomarker-based Calculator for Autosomal Recessive Polycystic Kidney Disease (ARPKD)**

Autosomal recessive polycystic kidney disease (ARPKD) is associated with the progressive enlargement of the kidneys due to the formation and expansion of fluid-filled cysts. The disease is congenital and often fatal in neonatal period. Children born with ARPKD often require dialysis and nephrectomy by age 10, and or kidney transplantation for management of both pain and renal insufficiency. Increasing cystic index (CI; percent of kidney occupied by cysts) drives both renal expansion and organ dysfunction. Management of these patients including options could clearly benefit from serial determination of CI, as could clinical trials evaluating the efficacy of novel ARPKD drug candidates. Although ultrasound is currently the imaging modality of choice for diagnosis of ARPKD, its utilization for assessing disease progression is highly limited. Magnetic resonance or computed tomography imaging is expensive, time consuming and difficult in the pediatric population. Using a well-established mammalian model of ARPKD, I derived a formula that estimates CI using minimally-or non-invasive blood and urine biomarkers. This determination of CI may be helpful in identifying, monitoring and evaluating treatment options for patients with ARPKD.

***Eric Nigro – See Brendan McCaffrey***

***Jake Novello and Sean Pak***

**The Influence of Distance on Reaction Time Against Epée Attacks in Fencing**

The purpose of this project was to determine the influence of distance on the reaction time of a fencer when the opponent performs an attack using the epée weapon. Fencing is a very physically demanding sport which requires not only quickness, but a mind capacity like a chess player to make appropriate moves and countermoves. If the distance between the two fencers increases, then a fencer will have more time to reaction to an attack, such as, a lunge and advance lunge, that is devised by the opponent. We hypothesize that the reaction time will diminish as the opponent gets closer until the fencer is not able to avoid the attack. By studying the reaction time of fencers, it will highlight the areas in which fencers need to focus: movement speed and quick response. Ten trials were performed for the short, medium, and long lunges. The distance that the hand traveled during the lunges and the duration of the lunges were recorded; the averages of the trials were calculated. The times of countermoves such as a retreat, advance, bind 4, bind 6, and bind 8 were also recorded. Thus far, results show that it takes an average of 0.54 seconds to complete a long lunge- which was the fastest lunge performed. More force is required to propel an object or person further and faster. The fastest counterattack was the bind 6 which took 0.10 seconds to perform. The bind 6 counterattack can prevent the opponent from scoring a touch if performed at an appropriate time. The distance between two fencers influences the size and type of attack of the attacker. The advance lunge and long lunge are most appropriate for a bigger distance. The allotted reaction time was smaller for the advance lunge and long lunge than that of a smaller lunge over a smaller distance.

***Sarah O’Connor – See Theresa Haupt***

***Abigail Pace – See Jacqueline Brandel***

***Sean Pak – See Jake Novello***

***Nicholas Pappas – See Riley Bode***

***Kristina Parkas – See Emily DiPrima***

***Zachary Peare***

**The Effect of Honey on Kidney Bean Wound Healing**

The purpose of this study was to determine if different dilutions of honey promoted wound healing in Kidney Beans stem after an incision made in the stem of the plant. When a plant is damaged, energy from the plant diverted is control infection and to heal the wound, thus causing the plant to not perform at peak efficiency. Honey has been used for centuries in the healing of wounds and is effective due to its anti-inflammatory and anti-pathogenic properties. This project was conducted by growing a control group(no honey) and experimental group(with honey) of Kidney beans, injuring them and then observing the scar over 10 days using microscopy. For the experimental group after the incision was made dilutions of honey ranging from 0-75% were applied to the wound after approximately 4 hours, then observed over 10 days. It was hypothesized that with the lower dilution of honey the healing rate of the scars will increase in terms of speed and overall health of the plant. Lower dilutions of were thought to be more effective due to lower pH but still with the key effects of honey.

***Victoria Pensiero***

**The Effects of Dietary Consumption Levels on Cancer Gene Expression**

Let-7 and daf-18 are genes present in C. elegans, which are homologs to two cancer related genes found in the human genome. Daf-18is a homolog to the human gene PTEN, which is a tumor repressor most commonly expressed in lung cancer. Let-7 is a homolog to the human gene “LEThal” which is associated with skin cancers, and when mutated, results in the onset of tumorigenesis and other cancer symptoms. Previous studies with different cancer genes have shown that on dietary terms, a low sugar consumption, and average salt and protein consumptions, produced the lowest rates of harmful cancer gene expression, which could also be compared to the standard American diet. Since daf-18 is a tumor repressor, less tumor cells should be produced if the gene was expressed more, so a brighter band would be optimal for this specific gene. However, since let-7 insights tumorigenesis and other cancer symptoms, lower expression of this gene would be optimal, which would be indicated by a lighter band. C. elegans were placed in various concentrations of salt, sugar, and protein solutions to mimic different human diets. An RNA extraction was performed on the C. elegans, and using an RT-PCR the RNA was converted into cDNA, which was then amplified. The amplified cDNA was used to quantify gene expression in the various solutions by the different band intensities produced from a gel electrophoresis test. The more RNA produced, the more the cancerous gene was expressed. After observing the results, the band intensity from the RNA collected from the C. elegans of each salt, sugar, and protein solution was evaluated to determine which concentration of each produced the brightest band intensity for daf-18, and the lowest band intensity for let-7. The results indicated that the lowest concentrations of salt and sugar combined with the highest concentration of salt yielded the optimal gene expression levels. By understanding how the human diet can be used to manipulate gene expression and decrease tumorigenesis and other cancer symptoms, scientists can develop a medication or treatment option to mimic optimal dietary concentration effects in cells, in order to regulate cancer gene expression naturally.

***Samuel Petruzzi***

**An Analysis of the Function of Picky Local Neuron 3 in Olfactory and Gustatory Prompted Chemotaxis of Drosophila melanogaster**

Picky local neuron 3 is a type of neuron associated with modulation of olfactory and gustatory signals found in fruit flies (Drosophila melanogaster). It is of special interest due to the unusual proportion of synapses from gustatory receptor neurons in comparison to other local neurons of its class. This suggests that it is more associated with gustation than other picky local neurons and may be more involved in integration of olfaction and gustation relative to the other neurons. In this study I analyzed preferences for tastants and odorants and how those preferences are modulated by the silencing of picky local neuron 3. Larvae exhibited attraction to the odorant acetal and no change in the quantified preference when the neuron was active or silenced. This supported the idea that neurons other than picky local neuron 3 are integral to the analysis of olfactory signals. The larvae found the previously attractive tastant fructose to be aversive when the neuron was silenced. This suggests that picky local neuron 3 is vital to gustatory decision making which may be due to innervation of the subesophageal zone by picky local neuron 3. A combination of both fructose and acetal resulted in a slight change in preference when the neuron was silenced, suggesting that there is some redundancy in function regarding integration of olfaction and gustation. However, further analysis of picky local neurons is required to formulate a complete model of their function as a class.

***Faizili Rahim – See Jonathon Appel***

***Alexandra Ramotar and Paige Robinson***

**How Stereotypes, Racial Bias, and Representation of People of Color Have Changed in the Major Media Throughout Time**

The purpose of this study was to explore whether or not there is a correlation between ethnicity and a character’s screen time. In ancient times, people of color would not be able to perform in plays and dramas. When the television was invented, people of color typically were not given lead roles or would not be present. People of color include any minority; this can include African Americans, Native Americans, Middle Easterners, Asians, Latinos, and any person who is neither white nor possess European features. The use of blackface in early television history was used to make a character a certain race without hiring and paying an actor of that ethnicity.  It was hypothesized  that modern pieces of media will have more diversity within motion pictures and more minorities as lead and supporting characters than media produced prior. To test this hypothesis, this study was executed by determining the length of time that lead actors in popular media (television and movies) are on screen and correlating screen time to ethnicity. Analysis consisted of television shows with the highest ratings and movies with the most Academy Awards for its respective category. Thus far, the results do not support the hypothesis. The data shows no correlation between time of production and diversity in motion pictures. There was a sawtooth wave with a single spike in the data for both movies and television. It is probable that if media produced in a specific time frame was analyzed, it would follow a similar pattern.

***Rana, Shamtej***

***Effect Of Time Limit On Reaction Time In An Internet Survey***

On average, about three billion surveys are completed every day, meaning that in two days, enough surveys are completed for each person in the world to have taken one survey. The nature of many surveys in their impact on the economy, politics, and social behaviors makes it imperative to study the way in which people think and are affected by different parts of these surveys, assisting them in answering some survey questions with increased efficiency. The purpose of this study was to determine if the change in time given to answer a survey question would affect the time the survey taker takes to answer a question and whether or not their answer was more or less accurate. By creating a private survey of knowledge questions, students in a computer accessible classroom were tested to see if the varying time limits to answer questions had an effect on the time to complete the survey. It was hypothesized that a lower time limit would result in a decreased reaction time, and an incorrect response. A longer time to answer a given question would result in a decreased reaction time and a more correct response. Based on results, for most categories, as the overall time given to answer the question in one comparison group decreased, so did the amount of time for the tester to answer the question, For the most part, the times were in correspondence and had similar results across all tests.

***Jordana Resnikoff – See Ariana Aghili***

***Paige Robinson – See Alexandra Ramotar***

***Trevor Rosenlicht – See Alexis Davitashivili***

***Funda Sahin – See Kimberly Liao***

***Yasemin Sahin – See Kathy Cao***

***Sarah Samad – See Nicole LaReddola***

***Vincent Santangelo – See Julio Alves***

***Erin Sass – See Mikayla Elferis***

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

***Mia Serritella – See Abinya Anand, Nicholas Nasis***

***Manvi Sharma – See Taylor Lipton***

***Deniz Sinar – See Catherine Kim***

***Anoop Singh and Muzaffer Tasoglu***

**The Relationship between the North Atlantic Oscillation (NAO) and the Atlantic Meridional Overturning Circulation (AMOC)**

*The North Atlantic Oscillation (NAO) is a pattern of atmospheric variability above the North Atlantic Ocean, characterized by fluctuations in sea level pressure. Both the NAO and the Atlantic Meridional Overturning Circulation (AMOC), a thermohaline ocean circulation system that plays a critical role in transporting heat to the North Atlantic Ocean, influence the North Atlantic climate. This study aimed to determine the relationship between the NAO and AMOC (represented by their indices) as it can help model climate in the North Atlantic region. Since data is only available from 2004-2015 the conventionally defined AMOC index lacks data. To study a longer time period we implemented a redefined AMOC index [Rahmstorf et al. (2015)], defined by fluctuations in the sea surface temperature. A strong correlation between the conventional and redefined AMOC indices indicated that the latter represents the AMOC. This redefined index allowed a construction of a historical time series from 1950-2015, for the two indices. Student’s T-Tests and correlations were then employed to determine the relationship between the AMOC and the NAO. The results show a statistically significant, negative relationship between the NAO and AMOC. Both, factors that influence the strength of this relationship, and trends, were identified. This can help predict future climate and assess validity of climate models.*

***Simon Snowden – See Hamza Khan***

***Ethan Sontarp – See Marina Khan***

***Kyle Spinelli – See Brian Flynn***

***Joseph Strickland – See Vishwanath Madhavan***

***Tejasri Sundararajan – See Cathleen Deutsch***

***Dylan Talarek – See Nicholas Gembs***

***Carly Tamer – See Emma Matz***

***Muzaffer Tasoglu – See Anoop Singh***

***Ryan Tedesco – See Dylan Feldman***

***Meghna Thampy – See Maria Hoover***

***Caitlin Tolentino – See Mikayla Elferis***

***Arianna Tringali – See Mia Goren***

***Lauren Tuffy – See Gianna Anderson***

***DeVaughna Tulloch***

# **The Effects of Noise Pollution on the Behavior of Hermit Crabs (*Pagurus longicarpus*)**

Humans negatively impacted the hermit crab population mostly due to noise pollution from marine recreational vehicle use. Noise pollution is caused by loud sounds coming from boat engines or signaling boat horns that create distracting vibrations in the hermit crab environment. These loud noises distract hermit crabs, making them unaware of predators in their environment. By studying the effects harmful noise pollutants have on hermit crab behavior, we can better understand how other organisms in the ecosystem are being affected by their ability to protect themselves. Hermit crabs were placed in a tank that mocked their natural environment. A speaker was placed in the environment to portray a distracting noise pollutant, while a small rubber shark was used as a mock predator. The behavior of shell retraction/retreating of the hermit crab with and without noise pollution was observed and recorded. Results indicate that noise pollution changes the behavior of hermit crabs as it increases their retreating into their shells at an advanced rate while around the mock predator on the vibrations of the noise pollution.

***Shawn Uthup – See Christopher Ioannou***

***Alexa Varlamos – See Gabrielle D’Agostino***

***Louis Viglietta – See Nathan Cheung***

***Cassidy Volatile – See Arianna Aghili***

***Bartosz Wisniewski – See Jonathan Iacovelli***

***Benjamin Wolgang***

**The Positioning of a Fresnel Lens to Optimize Solar Cell Output**

Solar energy is a clean, reusable energy source and has potential to solve the fossil fuel crisis. Currently the energy that solar cells produce is not enough to completely replace the use of fossil fuels. Today, fossil fuels account for 67% of the energy used on Earth. Solar Energy only accounts for roughly 15% of Earth’s energy usage. There are various ways to improve a solar cell's efficiency such as lowering the temperature surrounding the solar cell. An alternative method would be to position a Fresnel lens, a thin lens that is able to converge rays of light perpendicular to its surface onto a single point, above the solar cell. The Fresnel lens is stationed above the cell to focus the incoming light. In the studies that have utilized a Fresnel lens above the solar cell the lens has been stationary. In this investigation, instead of being stationary, a Fresnel lens was moved continuously above a solar cell from 0 cm to 60 cm, or 0 to 2 focal length as the energy output of the solar cell was recorded. The Fresnel lens was moved continuously until a trend was observed. This trend was the optimal height of the Fresnel lens that was able to produce the most power from the solar cell. After a clear optimal focal length was determined, it was then compared to the time of day in order to pinpoint the optimal height of the Fresnel lens as a function of the time of day. From the data collected, there seems to be a trend. At a 0.8 focal length and at 1030 UT (Universal Time), there was a clear 15% increase in efficiency in energy production compared to when the Fresnel Lens was not used.

***Jenny Won – See Candace Arneaud***

***Michael Zareif – See Nathan Cheung***

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

**Alumni Updates**

**Class of 2015**

***Jason Bak – St. John’s University***

BS Candidate, Chemistry, Computer Science

***Ryan Chan - Hunter Macauly***

BS Candidate, Biology, Pre-med track

Volunteer, Bellevue Hospital

***Matthew O’Connell - Stanford University***

BS Candidate, Computer Science and Management Science and Engineering

Software Developer, Zynga

***Laxshika Raveendran - Fordham University***

BS Candidate, Biological Science

International Samaritan Treasurer

**Class of 2014**

***Zan Asif - SUNY New Paltz***

BS Candidate, Biology

***Anthony Bisulco - Northeastern University***

BS Candidate, Electrical and Computer Engineering

Undergraduate Researcher, Department of Homeland Security Laboratory

Research Intern, MIT Lincoln Laboratories

Design and Development work, CERN, Geneva, Switzerland.

***Christina Cabana - Carnegie Mellon University***

BS Candidate, Chemistry, Biochemistry

Science and Humanities Scholar

Undergraduate Researcher, Bruchez Lab

Summer 2015, Undergraduate Researcher, Rout Lab, Rockefeller University

Summer 2016, Amgen Scholar’s Program, Columbia University

Barry Goldwater Scholarship Recipient

***Justin Cheung - Stony Brook University***

Chemical and Molecular Engineering

8 year BE/MD Medical Program

Intramural Research Training Fellowship at Vaccine Research Center, National Institute for Allergy and Infectious Disease, Bethesda, MD

***Sarah Lamorte - University of St. Andrew’s***

5-year Master of Chemistry Degree Program

Organic Chemistry concentration

***Hugh Han - Johns Hopkins University***

Summer intern at the Johns Hopkins University Applied Physics Laboratory

Late summer Software Engineering Intern in China

***Tracey Rosenlicht - Stony Brook University***

Volunteer, Oncology department, Stony Brook Hospital

***Rakia Syed - Stony Brook University***

Biology and Linguistics student

***Noah Tollin - University of Georgia***

Biology Program, PreMed track

***James Whittaker - Lehigh University***

Pennsylvania Governor's School for Engineering and Technology

***Joshua Zweig - Columbia University***

BS Candidate, Computer Science, Environmental and Sustainability Engineering

DARPA RADICS Project

Carbon Sequestration Research with Dr. Klaus Lackner

Privacy and Civil Liberties work at Palantir

**Class of 2013**

***Megan Kurten - Scared Heart University***

BS Candidate, Nursing, Honors Program

***Trinity Russell - Wesleyan University***

BS Honors Candidate, Neuroscience, Behavior and Psychology

Optogenetics and Electrophysiology Research, National Institutes of Health.

**Class of 2012**

***Rebecca Alford - BS, Carnegie Mellon University; Ph.D. Candidate - Chemical and Biomolecular Engineering, Johns Hopkins***

Hertz Foundation Fellow, NSF Graduate Fellow

***Rachel Gross - Northeastern University***

BS, Behavioral Science, PreMed

Clinical Research Coordinator, New England Baptist Hospital, Research Department

***Michael Iadevaia - Cornell University***

BA, Industrial and Labor Relations, Highest Honors

Cornell University School of Law

***Steve Jang - Carnegie Mellon University***

PhD Candidate, Columbia University

***Abdullah Khan - Stony Brook University***

BS, Biology

***Savina Kim - Yale University***

BS, Cognitive Science and Economics

Healthcare Coverage Group, Barclays

***Zachary Kramer - Stony Brook University***

Education, History

***Philip Mauser - Stony Brook University***

BE, Electrical Engineering

RF Engineer, Zebra Technologies

***Anthony Musto - Hunter College***

Law Enforcement, Education

***Rajkumar Pammal - Harvard University***

Work with Qur, healthcare start-up in Boston

***Neela Qadir - Drexel Uniersity***

MS Candidate, Chemistry

***Cortney Tiberia - University of Buffalo***

Intern, Ernst and Young

**Class of 2011**

***Jesse Badash - Vanderbilt University***

BS, Computer Science and Math

Software Engineer, Google

***Amanda Cramer - Cornell University***

Syracuse Law School

***Matthew Katz - Washington University***

BS, Chemical Engineering

Deloitte Consulting

***Matthew Kim - Columbia University***

Computer Science Engineer, Dropbox

***Ian Marquit - Farmingdale State College***

BS, Nursing

***Sonal Nanda - Carnegie Mellon University***

RPI's Nuclear Engineering PhD Program

***Erica Portnoy - Princeton University***

Berkley University for Graduate School in computer science

***Savitha Racha - Boston University***

BS, Philosophy and Medical Science

Medical student, Boston University School of Medicine

***Arpon Raksit - Harvard University***

Master’s program in Math at Cambridge University

PhD program in Math at Stanford University

***Karen Schaub - Cornell University***

BS, Biometry and Statistics, Applied Economics minor

Retirement Actuarial Analyst at Towers Watson in Stamford, CT

***Asli Sinar, NYU***

***Marni Wasserman - Johns Hopkins University***

Insurance Services Offices, Actuarist

***Aaron Wilson - Bucknell University***

BS, Pre Med

Medical Student, St. George’s University, Grenada

**Class of 2010**

***Alexis Tchaconas, Columbia University***

Hofstra-Northwell School of Medicine

***Rachel Lordahl - Stony Brook University***

BS, Biology

Doctor of Veterinary Medicine 2019 Candidate, Atlantic Veterinary College

**Class of 2009**

***Jeremy Forman - Queens College***

BA, Film Studies

MS, Library Science

***Jason Gross - MIT***

MIT Graduate school

***Robert Schumann – Duke University***

BS, Mechanical Engineering

MS, Aerospace Engineering

Materials and Process Engineer, Boeing

**Class of 2004**

***Michael Bisogno - Johns Hopkins University, SUNY at Buffalo School of Medicine***

Orthopaedic Surgery Resident at Stony Brook University Hospital

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

Investment banking, Morgan Stanley

***Sarah Fink - Williams College, Cambridge University***

BioDuro Senior Scientist

**Class of 2003**

***Brandon Imber - Harvard University***

Attending medical school

**Class of 2001**

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

Associate Director of Investments at Bucknell University

**Class of 2000**

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

Anesthesiologist

**Class of 1999**

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

Private Optometry Practice, Northport

***John Egan - SUNY Geneseo, Emory University***

Attorney at Seyfarth Shaw, New York

***Sandra Nudelma - Harvard University***

McKinsey & Company, Management Consulting Firm

**Class of 1996**

***Dominick Rosa - Yale University***

Anesthesiologist

**Class of 1992**

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

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**Class of 1991**

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Associate Professor of Plastic Surgery, UT MD Anderson Cancer Center

**Class of 1989**

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

Associate Professor of Medicine, University of Chicago

**Class of 1977**

***Dan Hertzon - Bachelors of Mechanical Engineering, MIT; MFS Rochester Institute of Technology***

NYS Professional Engineer

HVAC Department Manager, Turner Engineering

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