PELHAM MEMORIAL HIGH SCHOOL



SYMPOSIUM

MAY 29, 2019

The Executioner Protein: Targeting BAX to Induce Apoptosis in ATC Cells

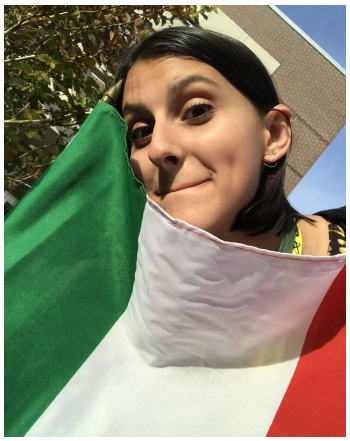
While chemotherapy and targeted therapy are common cancer treatments, both have limitations. Induced apoptosis is an attractive alternative. Mitochondrial apoptosis is controlled by the BCL-2 family of proteins. The BH3-only members of this family activate BAX, which irreversibly triggers apoptosis. At the same time, anti-apoptotic members (BCL-XL, BCL-2), sequester and inhibit both BH3-only proteins and BAX. Cancer cells are often addicted to anti-apoptotic proteins. BH3-mimetics such as ABT-263 have been developed to bind to and inhibit BCL-2/XL, allowing BH3-only proteins to activate BAX. While BH3-mimetics have had success in hematological tumors, solid tumors are more genetically complex, often overexpressing multiple anti-apoptotic proteins and rendering BH3-mimetics ineffective. Direct BAX activation with a small molecule would bypass these problems. EGAV1 is a novel BAX activator that has been only tested in hematological tumors. The response of solid tumors to this approach is a major gap in our field. We used anaplastic thyroid cancer (ATC) as a model to determine whether EGAV1 is effective in inducing apoptosis in solid tumors. We found that ATC cell lines have limited sensitivity to ABT-263 and EGAV1 as single agents. We hypothesized that high levels of BCL-2 and BCL-XL still sequester EGAV1-activated BAX, limiting its efficacy. In fact, addition of ABT-263 dramatically sensitizes ATC cell lines to EGAV1-mediated apoptosis. Our data provide support for a novel approach to the treatment of incurable solid tumors such as ATC, which, thanks to the low concentration of compounds required, is likely to be more effective and tolerable than current treatments.

WESEF 2017
2nd place - Cell & Mol. Biology
Westlake Science Fair 2017
1st place - Biology
JSHS 2018
1st place - Biology

WESEF 2018
3rd place - Cell & Mol. Biology
Genius Olympiad 2018
1st place - Innovation (bio?)
JSHS 2019
3rd place - Cell & Mol. Biology

WESEF 2019
1st place - Cell & Mol. Biology
NYSSEF 2019
Best in Fair - Cell & Mol. Bio
Intel ISEF 2019
Finalist

Superficially, the blue room of science research doesn't look like much. It's got a chipped floor, blue walls drawn over by its past inhabitants, and it oddly smells like a McDonald's bathroom. It's a place I've been discouraged. It's a place I've felt consumed by fear. It's a place where I've dealt with failure. But the community I've found makes it so much more than that. It's a place I've shared laughter. It's a place I've reveled in success. It's a place I've been inspired. This is what makes our program a family. This is what makes the blue room my home.



Francesca Di Cristofano
Lawful Evil

Albert Einstein College of Medicine

Dr. Antonio Di Cristofano

BROWN UNIVERSITY
Intended Major: Biology

Assessing the Plasticity of Pain Through the Lens of People with Limb Loss

Pain is essential in protecting the body, yet it can be dangerous and debilitating if persistent. Many currently hypothesize that pain is subjective and is affected by context and perception of the person in pain, ultimately affecting their experience of pain. Phantom limb pain (PLP) is chronic pain where people with limb loss experience pain where their limb was prior to amputation. 80% of people with limb loss experience PLP, yet despite the prevalence, there is a lack of evidence supporting the basis for non-pharmacological treatments, even though said treatments have been used in clinics. My study aimed to address this gap in research by assessing PLP as related to sensation and cognition. I found a unique connection between PLP and both sensation and cognition, as compared to residual limb pain (RLP). Through my study, I also created a new protocol for measuring sensation which may be validated and implemented in the future. Secondary analysis showed both that perception may impact the experience of PLP, and that left unaddressed, PLP will not decrease over 1-year, contrary to previous research. Overall, it is essential to further explore treatments for PLP, which is now feasible with my findings demonstrating the association between pain, sensation, and cognition.

Regeneron Science Talent Search 2019
Semifinalist
WESEF 2017
2nd place - Behavioral Science
WESEF 2018
3rd place - Behavioral Science

JSHS Regionals 2019
Finalist - Biomedical Sciences (PowerPoint)
JSHS States 2019
1st place - Behavior I (PowerPoint)
Special Abstract Recognition 2017
American Physical Therapy Association

I would not be the person I am today without science research. Research is my favorite part of high school, and through being in the program, I not only gained responsibility, independence, and knowledge, but I also found my voice and found a community. To any younger peers, I tend to give two general pieces of advice regarding high school: find your niche and don't waste your time doing things you don't like, both of which research helped me achieve. Research was my niche in high school; I love everyone I met through it, and I never regretted joining (even when finishing my STS paper at 5 am). Research has brought me life skills, a lot of laughter, lifelong friends, and a love for 11 pm Panera and Benny Troung.



Caitlin Wong
Neutral Evil

Columbia University Irving Medical Center

Dr. Christopher Kevin Wong

VASSAR COLLEGE
Intended Major: Neuroscience

"Comparison is the thief of joy." –Theodore Roosevelt

The Development of a Remote-Controlled Device for Power Factor Correction in a Commercial Setting

Decreasing power consumption has become increasingly important because of climate change, closures of power plants, overloaded grids, and weakening distribution lines. Power factor correction adds capacitance to inductive loads, and supplies reactive power locally, to increase the ratio of real power on the system, power that is usable by the motors, and therefore improve the efficiency of the entire distribution network. Power factor is the ratio of real power to apparent power, which is made of real power and reactive power. With less reactive power traveling through the distribution lines, currents are reduced, and therefore power losses are decreased. In this study, devices were created that can communicate with each other and the power meter by using radio chips that control relays connected to the capacitors. By creating remote controlled devices with capacitance that can plug into the wall, it eliminates the need for professional installation. Testing these devices in a building with a large inductive load, showed a decrease in the reactive load by approximately 3 KVAR and a power factor increase of approximately 0.04. More visible changes would have occurred if more devices were installed in the building with no more than two devices per circuit. The proof of concept of these devices allows for an expandable load correction system that saves the utility money by lessening the need for repairs on the distribution system and the operation of backup generators.

JSHS 2018 2nd Place - Physics	**Genius Olympiad** 2nd Place - Innovation

When I first joined the research program I had to rip myself out of my chair to go and present in front of my small freshman research class. While today that still may slightly be the case, I have seen huge growth from myself because of the encouragement from the community that the program creates. I have gained invaluable life skills all while being able to explore my passions at the same time, which is why the research program has been an extremely rewarding experience.



Sarah Ellenbogen
Lawful Good

Power Factor Correction LLC

Richard Ellenbogen

CORNELL UNIVERSITY
Intended Major:
Electrical and Computer Engineering

"No one can make you feel inferior without your consent." - Eleanor Roosevelt

Examining the role of a putative coinhibitory receptor in CD8-mediated cytotoxicity

To grow in vivo, tumor cells need to escape immune surveillance. To do so, cancer cells express inhibitory ligands which dampen T cells activation and immune response. Blocking these inhibitory molecules, such as by using antibody against the co-inhibitors PD-1 and CTLA-4, restores immune control and promotes tumor regression both in mice and in patients. However, while some tumor types have high response rates, some patients do not respond or relapse. In addition, some tumor types remain refractory to immunotherapy. This is thought to be due to the existence of multiple co-inhibitory molecules. In agreement, blockade of 2 coinhibitory molecules together, CTLA4 and PD1, enhanced their anti-tumor efficacy in melanoma patients. Yet, initial resistance and relapse are still observed. To understand how to enhance antitumor efficacy of these antibodies, recently discovered putative inhibitors must be further investigated. A recently discovered coinhibitory molecule, “conhibitor1”, promotes tumor growth when overexpressed in tumor cells, and its expression is associated with poor prognosis in patients. We hypothesize that the “coinhibitor1” inhibits the activation and activity of cytolytic CD8+ T cells. To test coinhibitor1 effect on priming, we generated an in vitro priming assay testing CD8+ OT-Is proliferation using carboxyfluorescein succidinimidyl ester (CFSE) in presence or absence of the coinhibitory ligand. To test its impact on cytotoxic activity, we generated an assay determining the cytolytic activity of CT26 tumor infiltrating lymphocytes using lactate dehydrogenase (LDH) release in presence or absence of the coinhibitory ligand. We show that the coninhibitor1 inhibits both priming and cytotoxic activity of CD8+ T cells, hinting that blocking coinhibitor1 may inhibit tumor progression *in vivo*.

Westchester Science and Engineering Fair 4th Place - Cellular and Molecular Biology	**2nd Place - Kahoot** WESEF, 2018

I knew that joining science research would be a monumental high school experience. Little did I know, however, that in joining this family I was moving into my home for the next four years. I sound like I’m joking, but some weeks I would genuinely spend more time in the research room than at home. Here, I’ve felt truly supported and encouraged to succeed and embrace the fears that manifest from the assigned presentations and critiques. Through the program, I strengthened relationships and found a community of strong, independent, intelligent young adults that acted as both role models and my strongest support system. I won’t openly admit that “winning isn’t everything” (though I probably should), but I will say that this program has given me much more than an amazing research experience. Through research, I made lifelong friends, essentially learned to speak, and felt the true rewards of independent work and collaboration.



Alyssa Wong
Lawful Neutral

Regeneron Pharmaceuticals

Dr. Nicolin Bloch
Dr. Sarah Ebstein

BOSTON UNIVERSITY

Intended Major:
Biology

“All you need in this life is ignorance and confidence, and then success is sure.” –Mark Twain

The Increase of Citi Bike Usage Among Young Adults by Targeting College Campus Locations

Citi Bikes have become a valuable commuting method for many New Yorkers on their day to day routine. While the bike-sharing program has been growing in both locations as well as use among people, the question of location accessibility for New Yorkers still remains. With bike docks available in the borough of Manhattan, and limited areas of Brooklyn and Queens, many people find the bikes are not in reasonable distance of their homes or workplaces to travel to. It is especially important that Citi Bikes are made available to all New Yorkers because of the environmental benefits they have on the city around them, as well as the health benefits for the commuters using them. With many young adults commuting to college everyday in New York, it is indispensable that this population has Citi Bikes easily available for use so they can commute to school, being that Citi Bikes have the previously stated benefits as well as the fact that they are extremely economical to use compared to other forms of public transportation in New York City. With Citi Bikes available for the younger population, overall Citi Bike usage can be increased a decent amount. By analyzing the Citi Bike data publicly available, it has been found that almost a fifth of young adults using Citi Bikes have travel routes that take them within a one block radius of colleges. Increasing the amount of Citi Bike stations near college campuses would allow for more Citi Bike use among young adults.

Most Resilient 2018	**Amazing Personality** 2019

The science research program has helped me develop a sense of resilience through my projects and the hardships associated with finding a mentor. I have enjoyed going through the research process all four years, and developing wonderful friendships. What I learned most from this program is that Citi Bikes are going to change the future. Not anything else.



Julia Plourde
Chaotic Good

Joseph DiBello

SKIDMORE COLLEGE
Intended Major:
Political Science

"What is reet reet? A passionate emotion." –you know who

Assisting the Dietary Restricted Community Through the Development of a Mobile Recipe Application

A dietary restriction is an outside intervention on the volume and type of food consumed as well as the ways in which these foods are consumed. Dietary restrictions are becoming increasingly prevalent in recent years as an increased combination in allergies, dietary restrictions to treat and prevent diseases, and an increased look to live a healthy lifestyle in terms of weight loss and clean eating. In the United States, there are an estimated 15 million people who have at least one food allergy (FARE, 2017). The purpose of this study was to create a survey that targeted the dietary restricted community as a means to provide insight as to the necessity and useful features of a mobile application. The survey was designed and created on Survey Monkey and distributed to Facebook groups, online forums, and websites targeted to the dietary restricted community. It asked a variety of questions, including the possible use of the application in each participant's life and the ways in which dietary restrictions impact their lives, emphasizing the need for a mobile database of recipes. This mobile application was then created using the analyzed results from the survey, including the platform on which it should be published, the dietary restrictions that are available for selection, and the features that would create the easiest user interface. One of the difficulties of allergies and other necessary dietary restrictions is finding recipes that align with said dietary restrictions and are of comparable taste and quality of normal ones. Our research identified these problems through the results of the survey and provided a means through which to solve them in our mobile application.

Genius Olympiad 2018 3rd Place - Science Category	**WESEF 2019** 3rd Place - Behavioral Studies

Science Research is so much more than a program or class. It is an unforgettable experience at PMHS. I will never forget the late nights "working", the trips to competitions and the friends I have made along the way. Thanks to research I have been able to flourish and truly break out of my shell.



Hailey Nelson
Neutral Good

Joseph Nelson, Software Engineer

CORNELL UNIVERSITY:
The Hotel School

Intended Major:
Food Service Management

"Haters are a sign of success. If you don't have a few haters, you're doing something wrong."
–Joseph Nelson, boxing, coding extraordinaire

Co-culturing Fetal Mouse Cardiomyocytes with Fibroblasts and Endothelial Cells For Use in Cell Transplantation

Millions of people worldwide suffer from heart attacks, and the effects from cell injury are often life threatening. Of the cells damaged due to a heart attack, cardiomyocytes are some of the most important. This study presents an effective method of culturing isolated cardiomyocytes with endothelial cells and fibroblasts to promote healthy growth of these rare, non-regenerative cells. With a sufficient supply of these cells, cell transplantations into the heart can be done to help replace cardiomyocytes where they are lacking. This study used cardiomyocytes for the co-cultures that were isolated from the hearts of fetal mice, making the study's purpose solely for observing the behavior of these cells when cultured with others. Although the method of isolation used in this study may not be possible in humans, other methods of derivation such as differentiation from human induced pluripotent stem cells (IPSCs) can be conducted and used for similar cultures, and the same clinical usage for cell transplantation.

WESEF 2018	Westlake Science Fair 2017
Innovations in Tissue Culture	3rd place - Plant Science

Science research has been the one class throughout high school that has taught me more than specific subject matter. Outside of all the science I was exposed to throughout my four years in the program, I learned life skills that otherwise would've been learned the hard way. My struggles and failures have better prepared me to succeed in the future, where it really counts. The research program here at Pelham is one that supports students and allows them to recognize their own potential.



Jon Girolamo

Neutral Neutral

Weill Cornell Medical College

Dr. Masataka Yokoyama

UNIVERSITY OF CALIFORNIA LOS ANGELES

Intended Major: Undecided

"Life ain't always beautiful, but it's a beautiful ride." –Gary Allan

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Diabetes is the seventh leading cause of death in the United States, annually approximately 1.4 million new cases of diabetes are diagnosed. 90-95% of the diabetes diagnosed are Type 2 Diabetes Mellitus (T2DM). Due to alarming rates of T2DM, preventing it is essential. Hemoglobin A1c (HbA1c) test is a powerful indicator that measures the beta-N-1-deoxy fructosyl component of hemoglobin. HbA1c has a strong correlation with glucose, as a person consumes more sugar, the HbA1c increase. Hemoglobin A1c level could also increase due to not maintaining a healthy lifestyle. Metformin is considered initial pharmacologic therapy due to glycemic efficacy, prevention of weight gain and hypoglycemia. Although metformin is an effective treatment, it must be taken for a long time for HbA1c to decrease. Due to tolerance levels of metformin, endocrinologists/ primary care doctors usually prescribe a low dosage of metformin to their patients. In our study, the aim was to determine how much can a high risk diabetic patient benefit, as in reduce BMI/HbA1c, with a rigorous exercise plan, diabetic plate planner, and the administration of extended release form of metformin in a high dosage (750-1000 mg) in a 12 week period. We gathered a total of sixty patients and broke them down into 4 groups. Group 1 had to take medication as well as exercise and use the plate planner. Group 2 had to take medication, but only exercise. Group 3 had to take medication, but only use the plate planner. Group 4 did none of the above, they were the control group. When the 12 weeks were over, we saw which group had the most significant improvement in HbA1c, BMI, and/ or life quality.

WESEF 2019	Westlake 2017
4th place - Medicine and Health	1st place - Medicine and Health

Science research is the best program anyone can be in it. In my junior year, I took a break from it and I didn't realize how much I missed it until I came back in senior year. It really taught me how to work hard, be dedicated, and how to be professional.I will never forget this program in the future.



Nahian Ehtesham

Dr. Shah Alam,
Internal Medical Doctor

DREXEL UNIVERSITY

Intended Major: Public Health Premed Track

"Success is walking from failure to failure with no loss of enthusiasm." –Winston Churchill

Junior Class

Assessing the Financial Literacy of University Students to aid in the Development of a Financial Education Application
Isabelle Anderson

The Effectiveness of Wellness Intervention Programs in Teaching Young Children to Cope with Anxiety
The "W" School In Eastchester
Lynn Dvorkin and Philip Dulock

Assessing the Feasibility and Effectiveness of Flood Reduction Methods in Pelham, NY
Pelham Village
Andy Radvany and Luke Diffley

Novel Approach to Inhibiting HIV-1 through Blocking Molecular Interaction between HIV Integrase and Tumor Suppressor INI1 for Drug Screening
Albert Einstein College of Medicine
Sophie Xu

The Role of Microglia on the Dendritic Development of Hippocampal Adult-Born Neurons
Albert Einstein College of Medicine
Vedika Basavatia

Determining the Beige Adipocyte Transcriptome Using Third Generation Sequencing Methods
Albert Einstein College of Medicine
Emily Nakayama

An Evaluation of Support Groups for Families of LGBT+ Youth Community
LGBT Family Community
Asher Lal

Examining the Role of G-quadruplexes in Human Embryonic Stem Cell Development
Weill Cornell Dept. Surgery at New York Presbyterian
Michael McInerney

Effects of Beaver Construction on Surface Water Quality: A Case Study of Beaver Ponds in Vernay Lake
Teatown Lake Reservation
Lukas Glist

Assisting the Dietary Restricted Community Through the Development of a Mobile Application
Julia O'Neil

Targeting the VIM of the Thalamus Using Diffusion Tensor Imaging and Probabilistic Fiber Tractography
Weill Cornell Imaging at New York Presbyterian
Olivia Min

Freshwater River Eutrophication: A Profile of Nutrient Loading Along the Upper Hutchinson River
Callahan U
Morgan McLean and Bernadette Russo

The Reliability and Consistencies in the King-Devick Concussion Baseline Test
Daly Walsh

Isolation and Characterization of Novel Mycobacteriophages
Albert Einstein College of Medicine
Piers Upton

Conformational Plasticity of Mitofusins Governs Mitochondrial Fusion
Albert Einstein College of Medicine
Peter Wei

The Effects of Microplastics and Other Plastics on the Marine Environment
University of Western Ontario Earth science and Geology
Justin Woodward

Analyzing the Use of Kinems Movement Based Games for Skill Development and Maintenance
Pace University
Luke Tarazi

Application of State-of-the-art Machine Learning Algorithms for the Detection of Diabetes Mellitus on Computed Tomography Imaging
Weill Cornell
Catherine Taubner

Finding Sustainable Use of Biofilm from the Catskill Aqueduct
Lance Brady

A Study of Procrastination: Outlining Needs for the Procrastination Management Methods of the Future
University of Calgary
Matyas Spunberg

Providing Rehabilitation for an Impaired Arm or Hand Through Designing a Functional Human Upper Limb Using Virtual Reality Software
Department of Biomedical Engineering, Stevens Institute of Technology
Helen Meyerson

Improving Soft Robot Applications Through New Laser Cutting Design Methods
Weill Cornell Medicine: Mosadegh Lab
Cole Mackool

Chassis Affect on RC Mobility
Tayib Khawaja and Samir Ellis

The Perceived Effectiveness of Skin Cancer Advertisements
Grace Liberatore

Parental Perception of Anxiety in Their High Schoolers
Anna Shampanier-Bowen and Quinlan Monaghan-Morris

iWitness: A Technological Solution to Faulty Eyewitness Testimonies
Grace Anderson

Sophomore Class

The Viability of Nuclear Power in Sub-Saharan Africa
Isaac Blackburn

Using Desensitization to Lessen Asthmatic/Allergic Reactions against Vitamin D
Nya Haseley

The Concentration of Lead Contamination in the New York City Area
Andrew Terraciano and Evan Sefchick

Predictive Factors for Non-Response to Intravitreal Ranibizumab in Diabetic Macular Edema
Emily Kalyvas

Using Minihepcidin to Reverse the Effects of Hemochromatosis
Elise McCarthy

Lead Concentration of Houses in Lower Westchester in Comparison to Proximity to New York City
Daniel Dusevic

Lead Concentration of Houses in Lower Westchester in Comparison to Proximity to New York City
Jack Dougherty

Mitigating Telephone Spoofing Through a Redesigned PSTN
Allison Feldman

Effects of Virtual Reality Therapy When Tested on Various Phobias
Julia Davis

Labeling of α5 Amigo1 and α5 Epyc Cell Populations
Gabrielle Chavez

Mapping PCB Levels of the Northeast United States via GCMS
Juan Carlos Matos

Animal Protein Contributing to the Metastasis of Stage Three Pancreatic Cancer
Hannah Doka

An Exploration of the Success of New York City Charter Schools
Thomas Roche

Design and Evaluation of an Authentic Language Learning Mobile Application
Stevie Gristina

The Stimulation of Delta and Kappa Receptors for Relief of Chronic Pain
Lucia Lavallee

The Combined Effects of Physical Activity and Air Pollution on Health
Brett Bober

Applications of Disputed AS-NMD Coupling in the Regulation of Gene Expression by Intronic ncRNAs
Vikram Jallepalli

Evaluating the Effectiveness of a Ban on Single Use Plastics in Smaller Communities
Honor Durham

E-cigarette Flavoring Chemicals and their Health Effects
Jamie Burke

Using a Game Engine to Simulate Nucleophilic Substitution Reactions in Carbonyls
Dylan Lee

Youth Opinion of Genetically Modified Products
Noah Breskin

Analysis and Comparison of EMA and FDA ADR Records
Jack D'Angelo

The Accuracy of Seasonal Weather Predictions in Common and Uncommon Sources
Grant Roll

Observing the Transition from Heavy Holes to Light Holes in Quantum Dots
Eliza Bratone

Reducing Skin Inflammation In Epidermolysis Bullosa Pruriginosa With Topical Calcineurin Inhibitors
Rebecca Jacobson

Determining the Conservation Status of a Wide Array of Native Insect Pollinators in Non-agricultural Habitats
Madeline Buehrer

Impact of M.tuberculosis Treatment on the Gut Microbiome
MJ Phillips

A Special Thank You!

Thank you to everyone from the Pelham School District and Community who have contributed to the continued success of our program.

We look forward to another exciting year of progress, bolstered by your dedication and support.

"It takes a Village / Manor"

Sincerely,
The Science Research Family