24TH ANNUAL SCIENCE RESEARCH SYMPOSIUM



MAY 20TH, 2024

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Poster Layout in Back Gym

Seniors

Ruhi Khanna	Salena Kha	Austin Wang	Victor Zhou						
Advait Huggahalli	Daniel Dolch	Charlotte Shih	Erin Song						
Ashley Dang	Ryan Coppola	David Neel	Schwartz Roy						
Ava Choi	Diana Rosu	Olivia Chen	Alyssa Rose						
Anwen Cao	Vansh Bhatt	Jonathan Lexi	Notis Marshall						
Nikita Basok	Julia Aram	RamyaShree Kotagiri	Rithi Kumar						

Juniors

Xiaochuan Liang	Daniel Ye	Meadow Zhang							
Shrey Kumar	Sara Jankovic	Morgan Tsai	Elizabeth Xiu						
Audrey Ho	Justin Goldberg	Noah Shapiro	Zirui Song						
Amy Feng	Zara Dhand	Andrew Pang	Roshan Shahid						
Rachel Chen	Benjamin Chang	Nora Morton	Chaitra Mynampati						
Natalie Carousso	Samantha Bunjaj	Christopher Marlatt	Arjun Menon						

Sophomores

Uma Sharma	Ryan Zhang								
Benjamin Schifrin	Hadrian Sandt	Nevin Syeda	Wildstrom Wania						
Eve Rutman	Brady Kyle	Rudolf Rigger	Tseng Wang						
Shawn Qui	Sydney Maddie	Emma Peters	Tong Tsao						
Kathleen Paskowitz	Lorelai Jaxson	Naveen Nocca	Talla Thomas						
Stella Myers	Samuel Samuel	Jason Mullen	Stryker Staudenmaier						
Eva Millerman	Andrea Mazgravis	Jake Miani	Tess Sheehy	Sonne					

Cindy Chen	Adam Wendy	Kamal Chen	Lily Hubschman						
Julianna Chin	Dayuan Cheng	Rishi Lindsay	Kumar Kim						
Alexandra Juliette	Eve Day	Leinberger TingRay	Lansford Chung						
Meredith Evangelinos	Gianna Katherine	Limongello Fu	Warren						
Bailey Card	Albert Claire	Huang Jonah	Bowers Herman						
Mukul Battu	Benjamin Jonas	Kevin Balcetis	Harris Guo						
Natalie Isabella	Zoe Garcia	Golub Baccay	Jude Al-Mufti						

We would like to express our thanks to the following people (in no particular order):

To the Parents and Friends of the HGHS Research students
For their support for the program whether it be helping us put together our posters, serving as practice judges, listening to countless practice sessions, donating time, food, or anything that has helped the progress of our program here at Greeley

Dr. Sandra Sepe, Principal
For keeping Science Research students' needs in mind when making decisions at the high school

Mrs. Jill Rossing, Pam Tole, Joy Guido, Therese Dell'olio, Gabrielle Giordano, Lora Radovanovich, and the rest of secretarial staff
For getting all of our forms and competition fees organized so we can compete all year

Our Students' Mentors
For volunteering their time, expertise, facilities, and guidance for all our numerous research projects

Chappaqua School Foundation
For providing a grant to allow our students to compete with wooden boards and support

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For their tremendous help and support with statistical analysis and presenting

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For their constant support and daily assistance with our literature searches, books, and articles

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For supporting us and allowing our students to present their research at BOE meetings, and getting community support for this program

Zachary Arnold and the rest of the STEAM department *for all their support on boards and poster construction*

Superintendent Dr. Christine Ackerman
For making sure that Science Research is offered to the students of Horace Greeley and her support

Dr. Adam Pease, Andrew Cordelia, Josh Culwell-Block, Jamie Edelman, Andrew Taylor, and Adam Schoenbart
For supporting our program and ensuring that all students have the opportunity for research

Our Assistant Principals: Mr. Ron Gamma, Mrs. Karime Flores, Dr. Joseph Sullivan, & Mrs. Lauren Olmo
For your support for your students and this program

Our school counselors: Rebecca Mullen (chair), John Brenna, Daniel Cohen, Annalise Curtin, Carolyn D'Agostino, John Dunphy, Matt Friedler, Bernadette Kenny, Conor Lander, Sara Lewis, Stephanie Lia, & Patrick McAuliffe *for their support, counseling, and guidance of all of our research students*

Our Investigative Review Board
For reviewing all projects and & offering assistance in preparing research plans.

HGHS Science Department: Kevin Kuczma (Chair), Jenifer McCarthy (Co-chair), Haroula Argiros, Jennifer Berardi, Paul Bianchi, Mike DeBellis, Ernest DeMarie, Kate Hannon, Alex Lichorat, Lauren Loprinzo, Priya Ma, Randi McDonnell, John McManus, Susan Moore, Stephen Mulick, John Prignano, & Angela Russo.
For helping in increasing our understanding of our science topics and listening to presentations

Transportation Department and all of the Chappaqua bus drivers
For taking us to our numerous competitions

Justin Olive and the other K12 coordinators
For their support in supporting our students in the green house and the research program

The Custodial Staff *For allowing us to stay late in the classroom to continue our research*

STEM PTA *for their support on all practice nights, findings mentors, and donating their time*

Schedule of Events

May 20, 2024 5:30pm - 8:30pm

Poster Presentations

Senior Presentations and Montages in HS PAC

Opening Remarks . . . . . Mr. Jerry Zupan
Emcees: Roshan Dhand, Shawn Liang, & Nora Morton

Senior Presentations #1 . . . . . Victor Zhou, Vansh Bhatt, Salena Kha, Ryan Schwartz, Ruhi Khanna, & Rithi Kumar

Day in the Life Photo Montage. . . . . .Roshan, Shawn, & Nora

Senior Presentations #2. . . . . RamyaShree Kotagiri, Olivia Chen, Nikita Basok, Neel Roy, Lexi Marshall, & Julia Aram

Competition Photo Montage. . . . . .Roshan, Shawn, & Nora

Senior Presentations #3. . . . . Jonathan Notis, Erin Song, Diana Rosu, David Coppola, Daniel Dolch, & Charlotte Shih

Smartest Person in the Room . . . . . .Mr. Jerry Zupan

Senior Presentations #4. . . . . Ava Choi, Austin Wang, Ashley Dang, Anwen Cao, Alyssa Rose, & Advait Huggahalli

Senior Sendoffs and Gifts . . . . . Roshan, Shawn, & Nora & Mr. Jerry Zupan

Acknowledgement of Freshmen . . . . . Roshan, Shawn, & Nora

Closing Remarks . . . . . .Mr. Jerry Zupan

Overview of Horace Greeley Science Research Program

What is Science Research?

Science Research is a three-year course. This course is designed to provide students an opportunity to participate in authentic, original scientific research. Students choose a topic to research and then learn the correct way to search several databases, read articles, and eventually become an expert in their field. Students learn and complete all parts of the scientific method (review of literature, hypothesis writing, methodology, analysis of results, discussion, conclusions, and bibliographic information).

Once they have a strong understanding of their topic, they contact research scientists until one can serve as their mentor by the end of their sophomore year. Together the student and mentor design and carry out an original experiment. They learn how to analyze their data and write a 12-20 page research paper. The students write a scientific research paper for each of the last two years of the program. They also present their research in their class, at local and regional symposia, and various competitions. They have the opportunity to win trophies, scholarships and possible advancement to state, national, and even international competitions.



Science Research Teachers: Mr. Bianchi, Dr. Arginos, & Mr. Zupan

Throughout the entire three-year span they meet individually with their teacher every two weeks, in addition to class time, to ensure that each step of the scientific process is completed. Students learn time management, public speaking, communication with professionals in the field, and long-term goal setting.

SENIORS CLASS OF 2024









Julia Aram

Protective Effects of Arginine Against Glucocorticoid-Induced Atrophy in C2C12 Myotubes

RESEARCH LOCATION:
Burke Neurological Institute

CAREER PATH:
Pre-med track

INTENDED MAJOR:
Neuroscience

COLLEGE/UNIV/TRADE:
Amherst

AWARDS 2023-24
Regeneron STS applicant
JSHS participant
WESEF participant
Valedictorian

AWARDS 2021-22
3rd place in Behavioral Science category at Somers Science Fair

FAVORITE SCI RES MEMORY:
Building our posters as a class before WESEF

WORDS OF WISDOM:
Start your research and writing processes early!
Research is a difficult but rewarding experience, and it's very exciting to explore different topics.



Abstract: Ischemic stroke leads to an extensive immune response in the brain, and this injury causes body weight loss and muscle atrophy. Atrophy is induced by the release of glucocorticoid. The purpose of this study is to evaluate the metabolic pathways (catabolism vs. anabolism) associated with various treatments (control, dexamethasone, arginine, dex+arg, glutamate, and dex+glu) in C2C12 myotubes. After the growth and differentiation of C2C12 cells, proteins for each treatment group were extracted and measured using Bradford Assay. Western Blot analysis was then run utilizing these proteins, and data was collected using the expression levels of MuRF1 (degradation pathway) and S6K (synthetic pathway). Dexamethasone-induced atrophy occurred based on myotube diameter measurement, and the catabolic pathway was activated in this process. Changes in the expression levels of MuRF1 for dexamethasone, arginine, and dex+arg treated cells suggest the involvement of the protein degradation pathway in these processes. These conclusions provide key information about the mechanisms of arginine treatment. Further investigation is needed to confirm specific changes in metabolic pathway involvement. This research can be used to learn more about the immune response following ischemic stroke, specifically relating to how atrophy can be treated to improve the recovery process of patients.

Select Extracurriculars: Captain of Varsity Tennis, Varsity Track and Field, Volunteer at Mt. Kisco Child Care Center, Photography Passion Project, Student Leadership Executive Council

Nikita Basok

The Effect of Movement Tempo on Accentuated Eccentric Loading

RESEARCH LOCATION:
Sacred Heart University

CAREER PATH:
Biomaterial Development

INTENDED MAJOR:
Biological Engineering

COLLEGE/UNIV/TRADE:
Cornell University



AWARDS 2023-24
JSHS Local - 1st Place (Biology and Medicine)

FAVORITE SCI RES MEMORY:
My friend Vansh and I having an extensive conversations and getting separated in Junior Year Sci Res.

WORDS OF WISDOM:
Be ready for a lot of late nights. Research is dope but analyzing all the data takes a long long time.

Select Extracurriculars
Fencing (outside of school), Pharmacy Clerk, Cello(Area-All-State and GWYOA), Technology Teaching Assistant (Neighbors Link), Co-Founder of HGHS Physics Club

Abstract: In enhancing strength and performance, the adoption of innovative training methodologies is paramount. One methodology, Accentuated Eccentric Loading (AEL), stands out as a viable technique by emphasizing the eccentric phase of resistance exercises. This study explores the relationship between tempo and AEL during the back squat, examining how variations in tempo may affect performance outcomes. Three resistance-trained men (age: 34.7 ± 3.0 years, height: 182.0 ± 1.5cm, body mass: 101.6 ± 7.5kg, back squat 1RM: 123 ± 14.7kg; relative strength ratio: 2.2 ± 0.2kg) participated in a randomized counterbalanced within-subject design, examining eccentric tempos of 1, 3, and 5 seconds in both traditional and AEL back squats. The results showed that the use of a slower tempo leads to lower concentric mean velocity, power, and force outputs. Additionally, AEL showed to increase power, force, and velocity at all loading percentages except 80%, suggesting that it may be less effective at very heavy loads. AEL may serve as an effective loading strategy for enhancing strength and power development. However, there is a need for further research to refine the precise prescription of AEL and performance outcomes through precise tempo manipulation and tailored training approaches.

Vansh Bhatt

Comparing FB Prophet's Forecast Accuracy to Neural Networks for Australian Electricity Demand to Evaluate its Potential

RESEARCH LOCATION:
Online

CAREER PATH:
Electrical Engineering

INTENDED MAJOR:
Electrical Engineering

COLLEGE/UNIV/TRADE:
University of Illinois Urbana-Champaign

AWARDS 2023-24
WESEF BASF award

AWARDS 2021-22
Somers Science Fair

FAVORITE SCI RES MEMORY:
Talking with my peers

WORDS OF WISDOM:
Dont Procrastinate.

SELECT EXTRACURRICULARS:
Debate Club
MKVAC
Taek-won-do



Abstract:

This paper, titled "Comparing FB Prophet's Forecast Accuracy to Neural Networks for Australian Electricity Demand to Evaluate its Potential," explores the challenges of energy demand forecasting and the importance of reducing carbon footprints in combating climate change. The study highlights the potential of machine learning, with a particular focus on Facebook Prophet (Fb Prophet), as an accessible and user-friendly tool for energy demand forecasting. It sets out to compare Fb Prophet with other forecasting models, emphasizing the need for beginner-friendly solutions. The paper presents data collection and processing methods, including the consideration of holidays, and builds upon prior research while acknowledging limitations. The results showcase Fb Prophet's accuracy for battery consumption forecasting, while acknowledging its limitations for black coal consumption forecasting. In conclusion, this paper underscores the potential of Fb Prophet as a valuable tool for beginners and those seeking accessible forecasting solutions in the energy domain, contributing to the reduction of carbon footprints. Future research directions are also discussed, including improving Fb Prophet's resilience to outliers and supporting carbon footprint reduction efforts.

Anwen Cao

An Exploration of mTOR in Epstein-Barr Virus: Evaluating the Effect of EBV Deubiquitinating Enzyme BPLF1 on mTOR Complex 1 and 2

RESEARCH LOCATION:
New York Medical College

CAREER PATH:
PhD in Cell Biology

INTENDED MAJOR:
Molecular and Cellular Biology

COLLEGE/UNIV/TRADE:
Harvard University

AWARDS 2023-24
Regeneron STS Scholar, JSHS 1st Place Award in the Biochemistry and Cell Molecular Category, WESEF 3rd Place Award in Cell Biology

AWARDS 2021-22
1st Place (Somers)

FAVORITE SCI RES MEMORY:
STS work day! Making friends during competition downtime comes second and making holiday pens in class is a close third.

WORDS OF WISDOM:
Be very open; look for topics around your area of interest but be flexible too! You might find a project idea that wasn't what you originally intended, but becomes something you eventually love. Also write things down all the time! Especially if you're doing in-lab work; keep your journal very specific and make sure you know where to find all your procedures. Finally, meeting people people at competitions was more than worth it!! I'm in contact with a lot of people I met and competitions are both an amazing source for networking and for meeting a lot of people with similar interests!



Abstract: Epstein-Barr Virus encodes for the deubiquitinating enzyme (DUB) BPLF1, a protein critical for efficient viral infectivity. BPLF1 was recently discovered to interact with mTOR, the regulator of cell growth and survival. This study further examines this relationship through exploring mTOR's two distinct complexes, mTORC1 and mTORC2, specifically through the proteins Raptor (mTORC1) and Rictor (mTORC2). It was hypothesized that active BPLF1 would lead to increased Raptor protein levels, due to BPLF1 deubiquitination rescuing proteins from degradation. To evaluate this, we overexpressed BPLF1 1-246, the active DUB, and BPLF1 C61S, a mutant form where deubiquitinating activity is blocked. Data was collected using Western Blots, which probed for the presence of BPLF1, Raptor, Rictor, and various other mTOR components. Contrary to the hypothesis, Raptor protein levels decreased with BPLF1 1-246 and an interaction between them was not detected. Rictor protein levels were unaffected by BPLF1 1-246. However, when Rictor's association with mTORC2 was inhibited in EBV positive cells, the viral infectivity levels decreased, indicating that Rictor may be an important protein in preserving EBV infectivity. Examining Raptor and Rictor revealed the specific relationships between mTOR complexes and BPLF1, raising implications for the roles these proteins have in EBV infectivity. Future research may evaluate mTORC2 inhibitors as potential treatments for EBV, as well as investigate the downstream targets of mTOR. Intensive exploration of EBV's interactions with this crucial cellular pathway may help in the development of detailed therapeutic targets.

Select Extracurriculars: Fun and Arts Club (Co-President), Letters for Rose (co-Chapter Head), Science Olympiad

Olivia Chen

A National Database Analysis of Neuromodulation in Cancer Patients

RESEARCH LOCATION:
Westchester Medical Center

CAREER PATH:
Undecided

INTENDED MAJOR:
Engineering

COLLEGE/UNIV/ TRADE:
Tufts University

AWARDS 2023-24
Participated in JSHS and WESEF

FAVORITE SCI RES MEMORY:
Getting pizza for lunch from the volunteer at JSHS.

WORDS OF WISDOM:
Don't procrastinate! Ask for help whenever you have questions. Reply quickly to emails.

MAJOR TAKEAWAYS:
How to conduct research, present, work with professionals.



Abstract: Cancer remains a significant global health concern, impacting millions of individuals both physically and emotionally. Despite the availability of various pain management options, a considerable proportion of cancer patients experience moderate to severe pain, emphasizing the need for alternative treatments such as neuromodulation. This study aims to explore the utilization of neuromodulation and neuro-ablative procedures for intractable cancer-related pain in the inpatient setting, leveraging the National Inpatient Sample (NIS) database from 2016 to 2019. The study identified socioeconomic disparities, revealing that patients undergoing these procedures were more likely to be older, Caucasian, and privately insured. Additionally, comorbidities such as hypertension were prevalent among the patients. The findings highlight the underutilization of these procedures in the inpatient setting and raise concerns about accessibility for individuals with lower socioeconomic status. Further research is necessary to assess the long-term efficacy and accessibility of these treatments, along with an evaluation of outpatient procedures to provide a comprehensive understanding of the disparities in healthcare access.

Select Extracurriculars: Varsity ski team, Vice-President of AAPI Non-Profit Org, black belt in MMA, internship at Gemini Law, Violin, Piano

Ava Choi

A Novel Spinal Detour Pathway after Spinal Cord Injury

RESEARCH LOCATION:
Burke Neurological Institute

CAREER PATH:
Doctor

INTENDED MAJOR:
Biology/Music

COLLEGE/UNIV/TRADE:
Undecided



SELECT EXTRACURRICULARS:
Grammy Award Winning New York Youth Symphony Orchestra
Music Presented at 2023 United Nations Climate Change Conference
New York Public Health Association Student Subcommittee Member and Advocacy Member
Mental Wellness Club President
Wellness Committee Student Representative
NCUFY Mental Health Director

FAVORITE SCI RES MEMORY:
STS Day

WORDS OF WISDOM:
Find a mentor in an area that you are passionate about as soon as you can. It is incredibly worth it to speak with other people at competitions and get to know them and their projects.

Abstract: The corticospinal tract (CST) is a crucial pathway for voluntary motor function, and propriospinal interneurons (PSINs), specifically C3–C4 PSINs, play a pivotal role in relaying motor commands for visually guided reaching. After SCI, PSINs in the C3-4 segment can bypass the injury site, potentially offering an alternative neural pathway for functional recovery. This study investigated the role of V2a interneurons (V2a INs) in mediating precise forelimb movements above the injury site. Chx10-cre mice crossed with the Ai14 reporter line allowed for specific labeling of V2a neurons using the Cro/lox system. Spinal cord contusion surgeries were performed. Perfusion and tissue processing procedures were critical in preparing the samples for subsequent analysis. Utilizing confocal microscopy and IMARIS software, we conducted 3D reconstructions and automated neuron counting. Our results demonstrated a significant reduction in V2a interneurons below the injury site during the subacute phase in SCI mice. This reduction correlated with observed motor control deficits, indicating a direct link between cellular changes and functional impairments. Interestingly, the decline in cell counts was specific to segments caudal to the injury, suggesting potential therapeutic targets for ameliorating deficits through alternative spinal pathways. This discovery highlights the potential for post-injury neural rewiring and offers promising avenues for targeted interventions to optimize functional recovery strategies.

David Coppola

Image Analysis & Machine Learning for Drusen Quantification Using 3D-Optical Coherence Tomography Images from the UK Biobank

RESEARCH LOCATION:
Regeneron

CAREER PATH:
Development of New AI Technology

INTENDED MAJOR:
Computational Neuroscience

COLLEGE/UNIV/TRADE:
University of Southern California

AWARDS 2023-24
Innovations in Biological Sciences Research Award (WESEF)
3rd place in the Biology/ Medicine room (JSHS)

FAVORITE SCI RES MEMORY:
"What is that?!?!" on the bus

WORDS OF WISDOM:
Work hard, play hard.
Become aware of science internships and opportunities for High-school mentee in your area

SELECT EXTRACURRICULARS:
High-school mentee, Caddy, Contributor to OpenStreetMaps Helped tracing maps online for developing countries or people in need due to natural disasters (e.g., Sri Lanka, Africa, rural Central America), Varsity Swimmer



Abstract: Age-related macular degeneration (AMD) is a leading cause of irreversible vision loss in the elderly. Early detection of drusen, a key early marker of AMD, is crucial for timely intervention. Optical Coherence Tomography (OCT) has emerged as a non-invasive, powerful tool for visualizing retinal layers and pathological alterations affecting ocular structures, including drusen. An automated algorithm able to detect drusen in OCT images would be a valuable tool to increase diagnostic sensitivity, obtain quantitative, objective measures of drusen load, and facilitate remote diagnosis in underserved areas. Leveraging the extensive OCT dataset collected in the UK Biobank, we evaluated the performance of a machine learning-based classifier to automate drusen detection. After manual image classification, dataset partitioning, and model training, a Convolutional Neural Network model was generated. The model was specific (73.9%) but had relatively low sensitivity (51.0%), with a 67% overall accuracy. These results demonstrate the feasibility of using machine learning to detect drusen in early AMD, and warrant further iterations and algorithm refinement to improve model performance. This field of research holds the potential to revolutionize early diagnosis and intervention strategies for AMD, marking a significant step towards personalized patient care.

Ashley Dang

Using Natural Language Processing Methods in Identifying Loneliness with Speech Data in Older Adults

RESEARCH LOCATION:
University of California San Diego

CAREER PATH:
Lawyer

INTENDED MAJOR:
Business

COLLEGE/UNIV/TRADE:
Georgia Institute of Technology

AWARDS 2023-24
Honorable Mentioning Behavioral Science at WESEF

SELECT EXTRACURRICULARS:
Gold Medalist Figure Skater
Pres. of AAPI Non-profit org
Pres. of Junior Board at Rye Figure Skating Club
Teacher Assistant at Chinese School

FAVORITE SCI RES MEMORY:
WESEF!

WORDS OF WISDOM:
Start early and find something you are genuinely passionate in. It was great to learn how to research and be exposed to a science mindset.



Abstract: The prevalence of loneliness, particularly among older adults, is a serious public health concern as it has been noted to be associated with many physiological and psychological problems. The current lack of a personalized measure is an issue in identifying such a subjective experience. This study investigated the potential of Natural Language Processing (NLP) to serve as a novel and personalized measure of loneliness and to address the shortcomings of current assessments such as the UCLA Loneliness Scale and the single item CESD-14. Through the analysis of speech data from interviews of residents in a senior housing community in Southern California, this paper examined two NLP features and their potential correlation with self-reported and objective measures of loneliness. Socio-demographic factors did not show significant statistics except for living situations by CESD-14. There was no significance in living situations by UCLA loneliness scale which demonstrates the complexity of self-perception in loneliness measures, and suggests that individual experiences of loneliness may not always agree with standardized assessment tools. The tested variables in this study, pronoun frequency and total number of words, did not show significant results in this particular study. Additional NLP features may yield more insights for more personalized and accurate assessment of loneliness. One example can be sentiment since previous studies have indicated an association with loneliness and depression.

Daniel Dolch

Optimizing Remote Controlled Cars with AI-Generated Design: Exploring the Benefits of Lightweight and Efficient Models

RESEARCH LOCATION:
Horace Greeley High School and Home

CAREER PATH:
Lead engineer of McLaren F1 Team/Rally Team

INTENDED MAJOR:
Masters Mechanical Engineering, Minor in Finance and Economics

COLLEGE/UNIV/ TRADE:
Syracuse University



AWARDS 2023-24
BASF Expanding Science Award (WESEF)

FAVORITE SCI RES MEMORY:
The laughs and the new friends!

WORDS OF WISDOM:
Get your work done early and study something that interests you. I leaned to like what I study and major in. I learned where I want to work and what I want to focus on. It has helped me plan my future and my career

SELECT EXTRACURRICULARS:
Eagle Scout, Volunteer Firefighter, Varsity and Club Lacrosse, Varsity Hockey Manager

Abstract: This research paper delves into the transformative potential of generative design and lightweighting (an auto-industry term for building cars and trucks that are less heavy to improve efficiency) in the context of remote-controlled car parts, and extends its implications to full-sized vehicles. The core objective is to investigate how generative design influences remote-controlled car performance, encompassing weight reduction, structural efficiency, and fuel efficiency. Our rigorous testing reveals three distinct populations of outcomes, each associated with a specific lightweight frame design. Notably, this research establishes a direct correlation between the changes made to the frame, which renders it lighter, and the observed performance improvements. Beyond the relevance to remote-controlled cars, this study underscores the proof-of-concept nature of generative design, paving the way for its adoption in full-sized cars. The anticipated outcome is a substantial reduction in emissions, augmented fuel efficiency, and more sustainable manufacturing practices. Additionally, the research considers the wider ecological implications and the potential role of generative design in lessening the environmental impact. In summary, this research opens new horizons for sustainable engineering, automotive innovation, and environmental conservation.

Advait Huggahalli

A Novel Atmospheric Astrobiological Signature Characterization System Validated with Thermodynamic Disequilibrium: Optimizing the Detection of Life on Earth-like Exoplanets

RESEARCH LOCATION:
NASA Goddard

CAREER PATH:
Space-tech company founder & CEO

INTENDED MAJOR:
Electrical Engineering Computer Science & Business (MET Program)

COLLEGE/UNIV/TRADE:
University of California, Berkeley

AWARDS 2023-24
NYSSEF Finalist
3rd Place @ WESEF

AWARDS 2021-22
NYSSEF Finalist
WESEF Grand Finalist
ISEF Finalist
Wolfram Alpha ISEF Special Award
3rd Place @ Somers

FAVORITE SCI RES MEMORY:
Nikita “griddying” on stage at JSHS

WORDS OF WISDOM:
Lock in and stay locked in

SELECT EXTRACURRICULARS
Co-Founder; Executive Director @ The LIFE Initiative, Rocket Star Internship, Stage Band, Space-Tech Public/Keynote Speaker, Eagle Scout @ Troop 2 Chappaqua, Captain @ HGHS Science Olympiad Team, Jazz Trumpeter: Founder @ HGHS Jazz Club



Abstract: The detection of Extraterrestrial Intelligence (ETI) holds the potential to greatly expand our understanding of the universe and our place within it. A recent planetary science-based approach for the search for ETI has been developed, which focuses on identifying technosignatures, or signs of technological activity, in the transmission spectra of exoplanets. This approach involves identifying specific chemical species that are known byproducts of industrial activity and determining their presence in exoplanetary atmospheres. However, previous research has not employed systematic methodologies for evaluating technosignatures as well as searching for technosignatures with Next-Generation Space Telescopes (NGSTs) such as the Habitable Worlds Observatory (HWO). This study proposes systematic criteria for selecting technosignature candidate species and a systematic methodology for evaluating experimentally observed exoplanetary molecular transmission spectra based on identifying unique features in the spectral signatures. By applying this systematic criterion, a list of promising technosignatures candidates is narrowed down, and a characterization system of known technosignature candidates is compiled to prioritize the detection of certain candidates on Earth-like (G-type) exoplanets through NGSTs, advancing the search for ETI. If we do detect a technosignature candidate, detection alone is not conclusive enough evidence. To further validate candidates, a thermodynamic disequilibrium calculation is performed to estimate the Gibbs Free Energy (GFE) of formation of specific technosignature candidates. If the GFE is a non-zero value and excess GFE is present, thermodynamic disequilibrium is also present which is an essential condition for biological or industrial activity on any planet. This research will be used to aid the design of the HWO and future NGSTs and significantly optimize the search for ETI.

Salena Kha

Assessing an Open-Set Classification Method to Improve Sound Anomaly Detection in Acoustic Modalities

RESEARCH LOCATION:
IBM Thomas J. Watson Research Center

CAREER PATH:
Computer Science

INTENDED MAJOR:
Computer Science

COLLEGE/UNIV/TRADE:
Undecided

AWARDS 2023-24
STS Participant
JSHS Participant
NYSSEF Participant
WESEF Participant

AWARDS 2021-23
3rd Place (Somers)

FAVORITE SCI RES MEMORY:
Bonding with other students at WESEF and listening to the wide variety of projects around me.

WORDS OF WISDOM:
Don't be afraid to pursue any topic you'd like! Work hard to make the project you love.
From beginning to explore my topic to working on my project and presenting at competitions, research has taught me professional communication, organizational, and time management skills.



Abstract: In today's technological era, the ability to detect anomalies is crucial for maintaining the integrity of complex systems. This paper addresses the challenge of anomaly detection, focusing on the classification and identification of sounds to identify anomalies within sound data. Used as a general anomaly detection method, efficient Out-of-Distribution (OOD) detection is used in fields such as ecosystem intrusion detection, security anomaly detection, fraud detection, and system health monitoring. Traditional machine learning models often struggle when confronted with unseen classes while frequently occurring in dynamic environments. In this paper, we propose and assess an open-set classification approach to mitigate this issue and improve the adaptability of AI models to handle previously unseen or unknown labels within audio data. In this study, we invent a classifier that makes use of a KNN model and test a set of labeled sounds for outlier detection against groups of 5, 10, 15, and 20 models. We find that this approach to anomaly detection is successful due to the classifier detecting at least one unknown value within the set of labels. We conclude that future research should enhance the number of models trained—with a larger number of compared sound labels, the recall value is expected to increase.

Select Extracurriculars: Reading tutor; South Asian and Middle Eastern Society Exec; Student Leadership Council Exec; Greeley Tribune; Volunteer at Hope's Door Domestic Violence Organization

Ruhi Khanna

Developing an animal-free media for growing MTC01, a 15 strain consortia

RESEARCH LOCATION:
Icahn School of Medicine at Mount Sinai

CAREER PATH:
Undecided

INTENDED MAJOR:
Econ and Math

COLLEGE/UNIV/TRADE:
Haverford College

AWARDS 2023-24

3rd place in microbiology at WESEF (WESEF)

FAVORITE SCI RES MEMORY:
Getting pizza from the teacher at JSHS

WORDS OF WISDOM:
Find your mentor early. Don't procrastinate.

Select Extracurriculars:
Varsity tennis,
Bharatnatyam,
Piano
SAMES Club
Girl Scouts
Secretary of AAPI non-profit, marketing internship, research internship at Mount Sinai



Abstract: Clostridium difficile infection (CDI) poses a severe threat to public health, resulting in significant morbidity and mortality in the United States. Recurrent CDI (rCDI) is a particularly challenging clinical problem that often needs fecal microbiota transplantation (FMT) for treatment. This study investigates the feasibility of developing an animal-free solid-state media, LYHvibV4, for growing MTC01, a 15-strain bacterial consortia, as an alternative to animal-based media in treating rCDI. The research focused on comparing the growth of specific bacterial strains within the vegetable-based media, LYHvibV4, and animal-based media. Results indicated that while LYHvibV4 supported the growth of certain bacterial strains, such as Bifidobacterium, it demonstrated limitations in promoting the growth of other bacterial genera required for effective rCDI treatment. Furthermore, a significant difference in bacterial growth was observed between LYHvibV4 and animal-based media for particular strains, including Bifidobacterium adolescentis and Bacteroides uniformis. These findings underscore the importance of selecting appropriate media for specific bacterial strains and highlight the need for further research to optimize animal-free media formulations. Successful development of an animal-free media, closely mimicking the environment of animal-based media, holds promise for more efficient and cost-effective treatments for rCDI, reducing the burden on patients and healthcare systems. Future investigations should focus on improving the vegetable media to support the growth of a wider range of bacterial strains essential for rCDI treatment, potentially leading to groundbreaking advancements in CDI management and prevention.

RamyaShree Kotagiri

Evolutionary Dynamics of CBF Genes in Cold-Tolerant and Cold-Intolerant Plants of Varying Plant Families

RESEARCH LOCATION:
Purdue University

CAREER PATH:
Public Health

INTENDED MAJOR:
Biology

COLLEGE/UNIV/TRADE:
New York University



AWARDS 2023-24
JSHS competitor
WESEF competitor,
STS Applicant

Major Takeaways
How to read journal articles and write research papers.

FAVORITE SCI RES MEMORY:
Making pens before break!

WORDS OF WISDOM:
Try and finish your project and some of the writing over the summer so you have more time when school starts to perfect everything.

Abstract: Cold tolerance is a characteristic in plants that helps them survive when they are exposed to low temperatures. The CBF gene family plays an important role in the plant cold tolerance which can vary among differing plant species. Our understanding of the evolution of the CBF genes is how species of varying cold tolerance levels remain incomplete. In this study, we used comparative genomics tools to identify CBF orthologs in cold tolerant - cold sensitive species pairs (Malus pumila, Arabidopsis lyrata, Setaria italica, Setaria viridis, Prunus mume, Vigna radiata, Arachis hypogaea, Solanum tuberosum, Arabidopsis thaliana), and CBF orthologs in different species were then compared based on their amino acid sequences. Comparisons were drawn between plants in similar plant families, but varying cold tolerance levels. CBF orthologs for all species were found to be placed in the same orthogroup despite their cold tolerance levels. We suggest that the cold tolerance level of the plant does not affect which CBF gene the plant expresses, this may lead to further research into the evolution of these plants and how CBF genes evolved over time. This supports previous studies, and future research can go more in depth on the evolution of the CBF gene to detect potential changes in the evolution of CBF genes across species.

Select Extracurriculars:
Co-president of Project Education, Outreach Coordinator of Letters for Rose, Marketing Team at Reinvented Magazine, Math Tutor, Bharatanatyam Dancer

Rithi Kumar

Single-Cell Transcriptomic Insights Into Pediatric Cerebral Palsy: Dissecting Muscle Pathophysiology in Spasticity and Contracture Formation

RESEARCH LOCATION:
Albert Einstein School of Medicine

CAREER PATH:
Prosthetics Designer

INTENDED MAJOR:
Mechanical Engineering and Biomedical Engineering

COLLEGE/UNIV/TRADE:
Carnegie Mellon University College of Engineering

AWARDS 2023-24
Regional JSHS, WESEF

AWARDS 2021-23
2nd Place Medicine & Health (Somers)

FAVORITE SCI RES MEMORY:
Powerpoint Karaoke: An improv game where you give a presentation from a slide deck you've never seen.

WORDS OF WISDOM:
Research is an opportunity to discover what you like, dislike, and to lean into your gut instincts. Stick with it, even when it gets challenging. It's also imperative that you select a topic you are passionate about rather than one you think is perceived as impressive.



Abstract: In this study, we explored the intricate transcriptional landscape of muscle cells in pediatric cerebral palsy (CP) using single-cell RNA sequencing (scRNA-seq). Our findings reveal significant gene expression alterations when compared with controls, suggesting novel molecular mechanisms contributing to CP pathophysiology. The identified genes, which displayed considerable log fold changes and robust statistical significance, inform potential pathways affecting neural and muscular development. Our approach builds upon previous genomic research, providing a detailed map of cellular dysregulation within CP-affected muscular tissue. The differential expression patterns reflect a complex interplay between neural and muscular factors in CP, indicating that muscle cells actively contribute to disease phenotype and progression. By correlating transcriptional signatures with clinical features of CP, such as spasticity and contracture formation, we propose potential biomarkers for disease classification and prognosis. The data underscore the utility of scRNA-seq in uncovering cell-specific responses to CP and in highlighting the muscle's role in motor disorders. Our results pave the way for targeted therapeutic interventions and lay the groundwork for future research into the development of personalized treatment strategies. This study enhances our understanding of CP at a molecular level and opens avenues for innovative therapies, emphasizing the importance of integrating genomics into clinical practice for complex neurodevelopmental disorders.

Select Extracurriculars: Greeley Theater (Stage Manager), Peer Leadership(Peer Leader), Chappaqua Volunteer Ambulance Corps (Youth Corps), Red Cross Club (President)

Lexi Marshall

Evolutionary History of the CBF Gene: Exploring the Effects of Orthology in Monocots and Dicots

RESEARCH LOCATION:
Purdue University

CAREER PATH:
Premed Track

INTENDED MAJOR:
Global Health

COLLEGE/UNIV/TRADE:
University of Wisconsin

AWARDS 2023-24
Honorable Mention in Plant Sciences at WESEF

AWARDS 2021-22
3rd place Greenlight Award

FAVORITE SCI RES MEMORY:
Decorating holiday pens

WORDS OF WISDOM:
Get excited about your research!
This course taught me that research is a collaborative effort and you can't do it alone. Whether it be your mentor, your teacher or your peers, you need each and every one of them to succeed!



Abstract: Cold stress is an abiotic stress that causes detrimental effects on plant growth and development. The C-repeat binding factors (CBFs)/dehydration responsive element binding (DREB1) genes induce the plant's cold stress response by inducing the cold-responsive (COR) genes. The purpose of this study was to develop a deeper understanding of the evolutionary history of the CBF gene using the monocot and dicot plant lineages. This was done by identifying diverse species from the monocot and dicot lineages. A BLAST analysis was performed on these species to determine gene matches to known CBF genes in Arabidopsis thaliana and Solanum lycopersicum. Regular expression was then utilized to determine which orthogroups these genes were in. The orthogroups that the gene matches were in were compared to the orthogroups that the known CBF genes of Arabidopsis thaliana and Solanum lycopersicum were in. Results suggest that the CBF gene is evolutionary conserved among monocot and dicot species. This provides new insights on the role that evolution of species played on the evolution of the CBF family in different plant lineages and can allow for future work in improving cold stress response in agronomic species.

Select Extracurriculars: Certified EMT at Chappaqua Volunteer Ambulance Corps (CVAC); President of SHARE; President and founder of Project Smile; Member of New Castle Sustainability Advisory Board; Madrichim at Temple Beth El; Varsity Track and Field member; Tutoring; Babysitting

Jonathan Notis

Secure Cloud-Based Medical Data Systems using Partially Homomorphic Encryption

RESEARCH LOCATION:
Pace University

CAREER PATH:
Have fun.

INTENDED MAJOR:
Computer Science and Linguistics

COLLEGE/UNIV/TRADE:
University of Virginia



Abstract: Medical patients are usually hesitant to share their data for research purposes to ensure their data remains private and secure. For researchers, traditional encryption methods require full decryption to conduct research on medical data sets, which take long periods of time to process and reveal specific patient data. In this study, a partially homomorphic encryption scheme was created and evaluated for plausible use in a cloud-based medical setting. PHE is an encryption method that allows users to conduct operations on data while it is still encrypted, never revealing a patient's data while allowing researchers to quickly conduct these operations on large amounts of data without the need to wait for decryption. This study created a cloud-based encryption scheme for a diabetes dataset using PHE and compared it to a similarly structured RSA encryption scheme. In addition to encryption and decryption times, other operations including scalar multiplication, calculating the mean, and finding the mean average deviation were tested with both encryption architectures. Results suggest that despite its longer encryption and decryption times, the lack of dependence on these processes while performing research combined with the speed in basic mathematical calculations make PHE a potentially feasible solution for research requiring secure medical data.

AWARDS 2022-23

4th place in computer science @ WESEF
Valedictorian

FAVORITE SCI RES MEMORY:
Making pens.

WORDS OF WISDOM:
Have a general idea of what you want to do going into the class.

Don't procrastinate.

Select Extracurriculars:

Published author to two children books

Alyssa Rose

Gender Disparities in Stress, Anxiety, and Burnout; An Empirical Examination Through Survey Analysis

RESEARCH LOCATION:
HGHS/Home

CAREER PATH:
Child Psychology

INTENDED MAJOR:
Psychology

COLLEGE/UNIV/TRADE:
University of Maryland

AWARDS 2023-24
4th place WESEF in Behavioral Sciences

FAVORITE SCI RES MEMORY:
STS day when I spent the whole day in the library. And competing at WESEF.

WORDS OF WISDOM:
Be on top of your work and try not to procrastinate. Things might not work out at first but keep trying and you will get to where you want to be.

Select Extracurriculars:
Varsity Field Hockey, Able Athletics Ambassador, SHARE executive



Abstract: Stress, anxiety, and burnout are all large factors that impact mental health. Experiencing these factors in important times of development, such as during teenage years, can lead to an increased risk of mental health problems in adulthood. Our understanding of how biological sex impacts feelings of stress, anxiety, and burnout in high school students remains incomplete. The purpose of this study was to look at the relationship between these variables and other factors, such as GPA and grade level, that may also lead to higher levels of stress, anxiety, and burnout. To examine if biological sex had any correlation with stress, anxiety, and burnout, 78 high school students aged 14-18 participated in the study. Students completed a survey that collected demographic information and used adapted scales such as the Beck Anxiety Inventory (BAI), Perceived Stress Scale (PSS), and School Burnout Inventory (SBI) to assess their respective levels of stress, anxiety, and burnout. It was found that biological sex does not have a significant impact on stress, anxiety, or burnout; however, trends suggest that males experience higher levels of anxiety and burnout and that females experience higher levels of stress. It was also found that grade level has no significant effect on these variables, However, there was a significance between GPA and school burnout. Further research should focus on understanding why these differences exist and how we can use these results to help improve the mental health of high school students and adolescents in general.

Diana Rosu

Investigating Parental Behavior Toward Academics as an Indicator of Adolescent Perfectionism

RESEARCH LOCATION:
Home

CAREER PATH:
Use Information science to develop sustainable solutions

INTENDED MAJOR:
Information Science/ Data Science

COLLEGE/UNIV/TRADE:
University of Illinois Urbana-Champaign



AWARDS 2022-23
United States Air Force Award (WESEF)

FAVORITE SCI RES MEMORY:
When Vansh slid on the floor and caught the woah

WORDS OF WISDOM:
Find something you think is cool and stick with it.
Its what you make of it, so have fun and don't procrastinate

SELECT EXTRACURRICULARS:
3rd degree black belt and taekwondo instructor, Co-president of Mock Trial, Learning Links ESL tutor

Abstract: In 2021, the rate of suicide increased from 13.5 (2020) to 14.0 per 100,000 (CDC, 2023). Depression and anxiety plague individuals of all ages but are particularly prevalent among adolescents who are navigating major life events. One of the most stressful life events for many adolescents is the college application process, during which students strive for competitive results in academics, sports, and extracurricular areas during their high school years. A link between college admission and adolescent anxiety may be drawn by perfectionism. Perfectionism is "the tendency to demand of others or oneself an extremely high or even flawless level of performance, in excess of what is required by the situation" (APA 2023). Young perfectionists are not only particularly sensitive to but even anticipate rejection and criticism, all present within academic settings (Magson et al., 2019). The hard work for competitive results and admission success might lead to the occurrence of perfectionist tendencies, as referenced in (Franco et al., 2023) with respect to competitive athletic events. This can lead to a greater sense of perfectionism among adolescents (Magson et al., 2019). As parents have a strong contribution to how adolescents handle academic work and preparation for college, in this study, we look at possible correlations between parent behaviors and beliefs related to academics and adolescent perfectionism.

Neel Roy

Bulk RNA-Sequencing Analysis Reveals Altered Expression of Select TGF-β Family Genes and Potential Drug Targets in High-Grade Serous Ovarian Cancer

RESEARCH LOCATION:
Online

CAREER PATH:
Physician/Researcher

INTENDED MAJOR:
Molecular and Cellular Biology

COLLEGE/UNIV/TRADE:
Harvard University

AWARDS 2023-24
JSHS 4th place, Placed for Upstate JSHS
STS Applicant
Valedictorian

AWARDS 2021-23
2nd Place Somers (Medicine and Health)
Innovations in Biological Sciences Award - WESEF
Tri County Science & Technology Fair - Top 10 Project
Honorable Mention NYSSEF

FAVORITE SCI RES MEMORY:
Going to Upstate JSHS and watching the presentations in the Ballroom.

WORDS OF WISDOM:
Work hard and have fun! Learn to manage your time well.



Abstract: The most lethal gynecological malignancy in the world, high-grade serous ovarian cancer (HGSOC) continues to afflict an estimated 19,710 new patients in the United States every year, 13,270 of whom will die from the disease. Through RNA sequencing analysis using count files from 121 different patients (each of whom had either tumor tissue, ascites fluid, or benign tissue), differentially expressed genes, molecular subtypes, biomarkers, and pathways associated with HGSOC progression were discovered. Genes with p-values less than 0.01 and log2fold change ≥ 1 or ≤ -1 were considered differentially expressed, and any pathways with p-values and q-values less than 0.01 were considered significantly altered. All analyses were conducted using R, including data visualization. Results indicate lowered expression of select TGFβ genes, including TGFBR3, TGFB3, TGFB1I1, and TGFBI in tumor tissue and ascites fluid versus normal tissue. Relevant molecular pathways enriched (p-value < 0.01, q-value < 0.01) inflammatory response (Tumor vs Benign), IL6/JAK/STAT3 signaling pathway (Ascites vs Benign), Kras signaling pathway (Tumor vs. Benign), and G2M checkpoint (Ascites vs. Benign). Drugs, including Torin-2 and AG-879, were identified as potential drug targets to reverse the expression of identified differentially expressed genes, possibly preventing the growth and spread of HGSOC. We conclude that there are several differentially expressed genes and altered pathways that affect the growth and spread of HGSOC. Future research is required to test the efficacy of the aforementioned drugs in HGSOC through patient-derived organoids, and the identification of more genes as potential drug targets.

Select Extracurriculars: EMT/Member, Mount Kisco Volunteer Ambulance Corps, Firefighter/Member, Millwood Fire Department

Ryan Schwartz

Effects of the Menstrual Cycle on Vocal Fold Vibration: A Longitudinal Single Case Study

RESEARCH LOCATION:
NYU Langone Voice Center

CAREER PATH:
Work in the area of business at the intersection of medicine and technology.

INTENDED MAJOR:
Business

COLLEGE/UNIV/ TRADE:
University of Texas at Austin, McCombs School of Business

AWARDS 2023-24
Excellence in Medical Research Award

FAVORITE SCI RES MEMORY:
Presenting at WESEF

Major Takeaways:
The presentation skills that you learn in this class will help you throughout all of high school and beyond. Organization and time management are essential to success.

WORDS OF WISDOM:
Work hard, find a mentor early, stay organized, and take risks.



Abstract: Hormone levels associated with the menstrual cycle have been determined to affect vocal function. The purpose of this study is to determine the effects of the phases of the menstrual cycle on the laryngoscopic appearance of the vocal folds and vocal function through videostroboscopy. This study presents the unique opportunity to examine consistent longitudinal data from an individual with a non-hormonal intrauterine device (IUD) and with a history of vocal fold nodules (treated). Videostroboscopy is a well established tool in clinical examination of vocal disorders and in research, despite the rise in the use of high-speed videoendoscopy. Laryngeal videos obtained through this process were segmented using the deep learning based program, Glottis Analysis Tools. The supporting trends identified in this study showed a decrease in asymmetry quotient and an increase in glottal area index. Both trends correlate to abnormal vocal fold movements and are evidence that the voice is more irregular, contributing to altered voice quality and potential hoarseness during the luteal phase. This study also demonstrates the difficulty in quantifying vocal changes during the menstrual cycle due to irregularity of cycle events and various methods used to delineate cycle phases.

Select Extracurriculars: President's Junior Leadership Council at Northern Westchester Hospital, “Helping Our Heroes” Veterans Club, Cryptocurrency Club, Horace Greeley Varsity Tennis, Volunteer at Pleasantville Cottage School

Charlotte Shih

Behavioral Responses of Tick Species Haemaphysalis longicornis to Metarhizium robertsii and Cinnamon Oil

RESEARCH LOCATION:
Fordham University

CAREER PATH:
Undecided

INTENDED MAJOR:
Environmental Systems

COLLEGE/UNIV/TRADE:
University of California San Diego

AWARDS 2023-24
JSHS - 4th place at the regional level, qualified for an upstate poster presentation
WESEF - Honorable mention

FAVORITE SCI RES MEMORY:
Upstate JSHS, especially the dinner.

WORDS OF WISDOM:
Start planning for everything early, always keep your end goal in mind when going through this course.
Science research is a course that helps you decide what you like in the process of research. There's so much that goes into it, between the background reading, experimental design, analysis, paper writing, and presenting, so finding what you like of that is helpful for both college decisions and career decisions.



Abstract: Haemaphysalis longicornis, the Asian longhorned tick, is an invasive species to the northeast US and has the potential to become a vector of disease. Control of its population is necessary, thus, a better understanding of how H. longcornis defends against biological controls should be explored. This study examines potential avoidance and grooming behaviors that H. longicornis exhibits against the entomopathogenic fungi Metarhizium robertsii and cinnamon oil. In the avoidance study, two ticks were placed in two separate petri dishes, one with an M. robertsii solution on a smaller filter paper. In the grooming study, one tick was observed at a time with either a cinnamon oil solution, coconut oil, a M. robertsii solution, or no solution applied. All ticks were videotaped and the footage was analyzed for time spent grooming, legs groomed, number of instances, and number of bouts. The control spent a significantly greater amount of time grooming, which could be indicative of recognition of the solutions applied. Further research should be conducted with a larger sample size and with a physiological aspect in order to fully understand this grooming behavior.

Select Extracurriculars: Orchestra President
Letters for Rose Club Executive
Varsity Tennis Player

Erin Song

Validating and Evaluating Expression of New Tumor Targets Across Cancers: Protein X as a Potential Target For Cancer Drug Development

RESEARCH LOCATION:
Regeneron Pharmaceuticals

CAREER PATH:
Medicine

INTENDED MAJOR:
Integrated Biology

COLLEGE/UNIV/TRADE:
Undecided

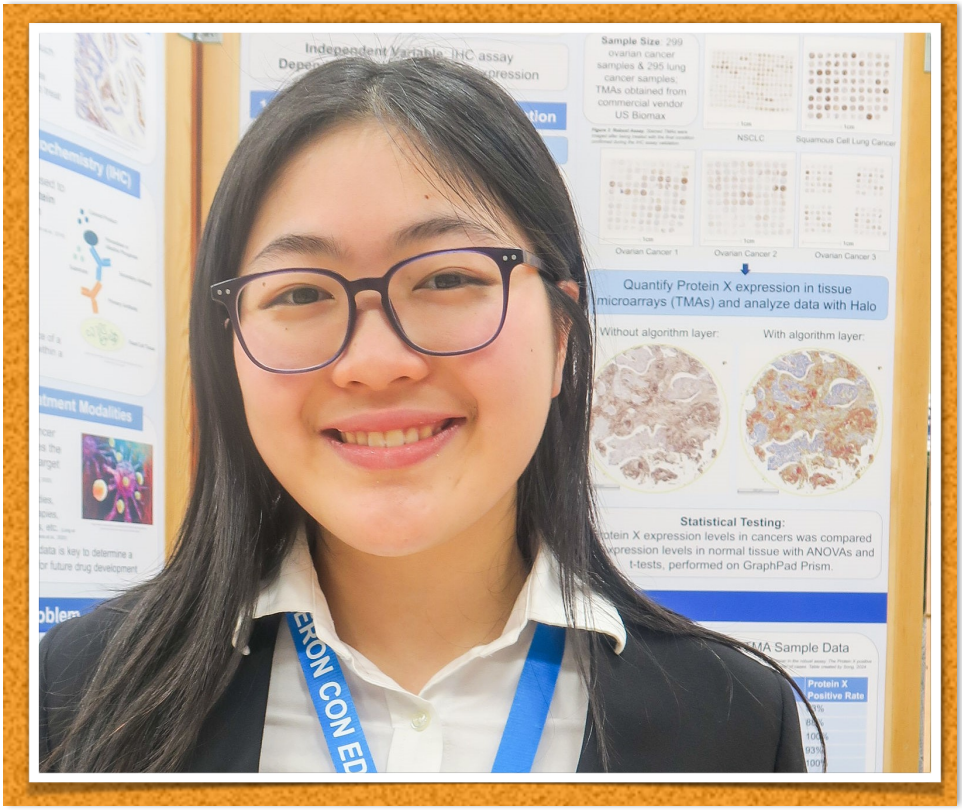
AWARDS 2023-24
Zeiss Microscopy Award
1st Place in Medicine & Health Category at WESEF
ISEF Finalist

AWARDS 2021-23
1st place in Medicine & Health category at Somers Science Fair
Greenlight Award for Outstanding School Community Engagement
2nd Place in Medicine & Health and Genius Olympiad Invitee at WESEF
Honorable Mention at International Genius Olympiad

FAVORITE SCI RES MEMORY:
Making WESEF memes after the competition day. And the International Fair at Genius Olympiad was really cool!

WORDS OF WISDOM:
Manage your time wisely and have fun! Presenting your project at competitions is 30% the research that you did, 60% how you package your project, and 10% luck.

Select Extracurriculars: Asian American Pacific Islander Association (President), Science Olympiad (Co-Captain), Girls Varsity Tennis (Co-Captain), The Greeley Voice (SciTech Director)



Abstract: Lung and ovarian cancers continue to be leading causes of cancer deaths in the United States, and refining the treatment of these cancers is needed to improve patient survival. The goal of this research project was to develop a methodology to identify protein biomarkers as potential targets for refined cancer treatment. This novel methodology combined an immunohistochemistry assay with a prevalence study. The immunohistochemistry assay was developed with an antibody selection test to confirm antibody specificity, a titration test to optimize antibody concentration, and an antigen retrieval test to optimize epitope-antibody binding. The prevalence study involved a robust assay, digital quantitative image analysis, and data analysis. With this methodology, the important immune system protein, Protein X, was quantified and evaluated across two indications of cancer: non-small cell lung cancer (NSCLC) and ovarian cancer. Protein X expression was quantified and evaluated across 594 samples from NSCLC and ovarian cancer patients. Data analysis demonstrated that Protein X was significantly expressed on NSCLC ($p<0.0001$) compared to its expression in normal tissue, and significantly expressed on one major NSCLC subtype, squamous cell lung cancer ($p<0.003$). Protein X was not significantly expressed in ovarian cancer. The findings from this project indicate that Protein X is a potential biomarker and refined treatment target for lung cancer. Furthermore, the optimized immunohistochemistry assay developed in this study is applicable to identify other novel cancer biomarkers for precision drug development in a standardized manner.

Austin Wang

Effect of Ibuprofen on Axonal Length in a 3D Collagen Gel Model

RESEARCH LOCATION:
NJIT

CAREER PATH:
Undecided

INTENDED MAJOR:
Biology

COLLEGE/UNIV/TRADE:
To be Determined

AWARDS 2023-24
STS Applicant
JSHS Competitor

AWARDS 2021-23
3rd Place (Somers)

FAVORITE SCI RES MEMORY:
Making pens.

WORDS OF WISDOM:
Don't procrastinate (that much).
Comic sans is a bad font.

Select Extracurriculars:
Piano
Varsity Cross Country
Varsity Track and Field



Abstract: Peripheral Nervous System (PNS) damage results in reduced quality of life through degradation and in some cases severing of axons in sensory neurons. Nonsteroidal Anti-Inflammatory Drugs like Ibuprofen have been shown to help promote axonal growth and regrowth, through RhoA pathway inhibition, making them a possible future treatment for PNS damage. However, no studies have been done utilizing in vitro models to simulate Ibuprofen's impact on axon length. In this study, we utilize a novel in vitro collagen model to study the effects of Ibuprofen on the axonal length of the Dorsal Root Ganglia. We measured data via fluorescent microscopy and quantified using ImageJ. Our results demonstrated that the presence of Ibuprofen has a significant positive correlation with overall axonal length. These findings suggest that both collagen-based models can accurately house nerve growth and that Ibuprofen can be a future treatment for PNS neuropathy. Future research needs to be conducted regarding the accuracy of the in vitro model and the potential downsides to RhoA inhibition.

Victor Zhou

The Evolution of Optimal Resource Distribution With Respect to Transgenerational Effects

RESEARCH LOCATION:
Proulx Lab

CAREER PATH:
Graduate studies in applied mathematics or theoretical computer science

INTENDED MAJOR:
Computer Science (Concentrations: Theory and Modeling & Simulation)

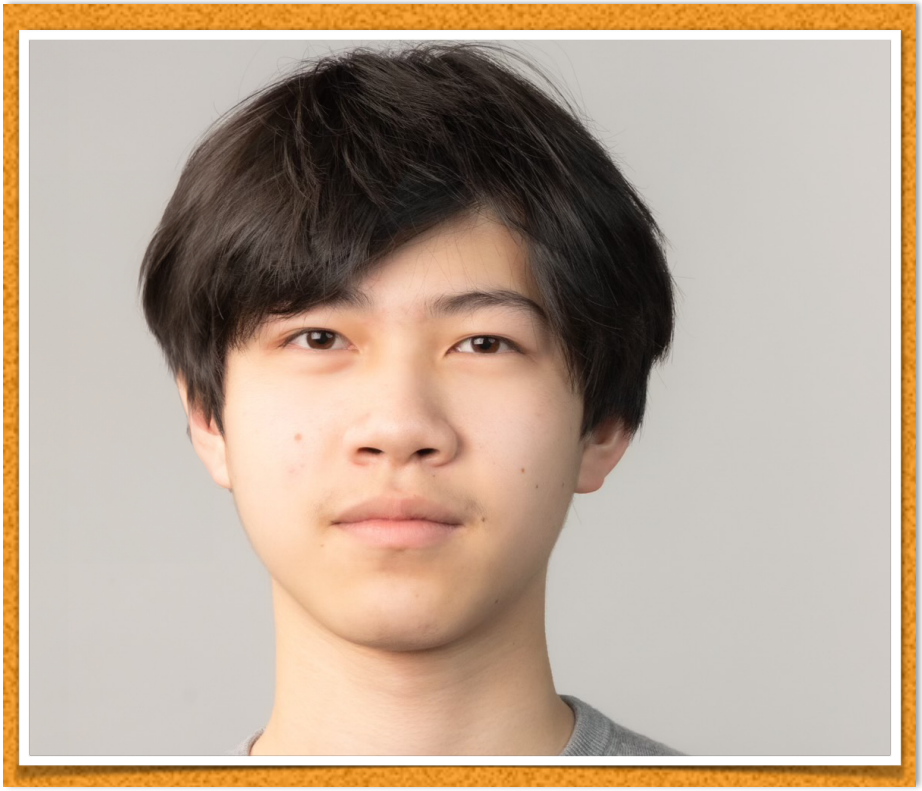
COLLEGE/UNIV/TRADE:
Georgia Institute of Technology

AWARDS 2023-24
Participated at JSHS
3rd Place in Mathematics at WESEF 3rd Place in Computer Science and Mathematics at Somers

AWARDS 2021-22
2nd Place in Environmental Science at WESEF
Grand Award at WESEF for STANYS
Honorable Mention at STANYS
3rd Place in Computer Science and Mathematics at Somers

FAVORITE SCI RES MEMORY:
Meeting new people at WESEF in 11th grade

WORDS OF WISDOM:
Try as many different things as you can if you're given a research opportunity. Practice good time management.



Abstract: The presence of transgenerational effects challenges the assumption that phenotypes of organisms are independent of the traits of their ancestors; however, these key elements are often overlooked in the modeling of resource distribution. With recent experimental results in bacterial aging, a framework capable of considering these effects is necessary. Here, we explore the impacts of transgenerational effects on resource distribution strategies. Proposing a model based upon the principles of bacterial aging, we investigate and derive the identity of and evolution towards optimal distribution schemes. Interestingly, the convexity of how age affects cellular functional contribution does not affect the evolution of resource distribution. Additionally, we consider the potential discrepancy between optimal strategies with respect to survivorship and to growth rate. We hope that our study may give rise to a more comprehensive model of resource distribution and give valuable insights into the motivations for the evolution of optimal resource distribution strategies.

Select Extracurriculars: Activities: Recreational Eating Clubs: Bio Club, National Science Bowl, FED Challenge

JUNIORS

CLASS OF 2025



SAMANTHA BUNJAJ

Brain Injury Environment Critically Influences the Connectivity of Transplanted Neurons

Abstract:
One possible method for rebuilding neural circuits after brain damage is cell transplantation. Selectively, transplanted neurons integrate into the mouse cerebral cortex circuits disrupted by neuronal ablation. How neurons function in a local context that is experiencing reactive gliosis, inflammation, macrophage infiltration, and scar formation, such as in traumatic brain injury (TBI), is still unknown. In order to clarify this, this study used adult mice with TBIs, inflammation only, or with an intact cerebral cortex using to be injected with cells from the embryonic mouse brain. Brain-wide quantitative monosynaptic rabies virus (RABV) tracing revealed graft inputs from appropriate locations throughout the brain under various circumstances, with distinct quantitative differences: abundant connectivity following a traumatic brain injury (TBI) compared to sparse in an intact and inflammatory brain. This work is a significant step toward the clinical translation of neuronal replacement strategies to restore an authentic circuitry following brain damage and support functional recovery in the injured brain. It also advances our understanding of the prerequisites for neuronal replacement in damaged brain circuits.

Extracurriculars:
Peer Leadership Neuroscience Classes
Part-time Job
Questbridge College Prep Scholars
Inspirit AI Coding STEM Clubs
Tutoring
Writing Competitions

NATALIE CAROUSSO



Irrelevant Contextual Information: Elucidating Cognitive Bias' Effect in Decisions Relating to the Assault of a Woman based on Occupational Bias

Abstract: Bias is very common in the medical field, but its effects are largely ignored(1) due to fear of error. New studies are showing correlation between bias and decision making(2). Medical professionals are assumed to be unbiased because of their expertise in their various fields(3), and because of this there is much resistance to bias education(4). Important fallacies of bias include the belief that technology is void of bias and bias can be controlled(5). Technology is often a reflection of the biases coming from the person who created it, and trying to control bias increases susceptibility to bias(5). An article studying implicit bias found that higher levels of implicit bias led to lower quality of care(6). Another article studied the administration of analgesia in children with appendicitis and found that black patients were much less likely to receive proper opioids than white patients(7). An article similar to my study focuses on the effects of irrelevant contextual information on the manner of death determination by forensic pathologists. The study found that pathologists were more likely to rule homicide in cases involving a black child victim than a white child victim(8), and this bias was extremely significant. This is important because after being exposed to bias, examiners become committed to their decisions which can lead to error in a judicial setting(9). No previous research has explored occupational bias and its effects on decision making. The goal of my study is to determine how bias affects the accusations which forensic pathologists make against men from careers with differing levels of prestige. My hypothesis is that if the man accused of assault has a prestigious career, the assessment will be biased more favorably toward his innocence than a man with a less prestigious career.

Extracurriculars:
CVAC (Chappaqua Volunteer Ambulance), Greeley Varsity Swim and Dive, Peer Leadership, Marlins swimming, Total Performance, Beach and Ocean Protection co-president, Student Council member, Lifeguard, Swim Coach, and Swim Instructor

BENJAMIN CHANG



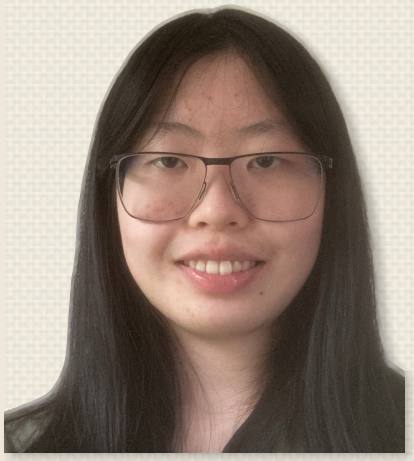
Carbon Footprint, Cost, and Accuracy of Large Language Models (LLM) for Academic Quizzes

Abstract: Since its public preview in November 2022, ChatGPT, a Large Language Model (LLM) , has shocked the world with its human-like language expression and interactions. Subsequently many studies and explorations commence to apply LLMs to education, business, health care applications. With larger and more powerful LLMs, a major downside is their costly energy consumption in training and deployment. Large Language models are projected to be the future of artificial intelligence, however our understanding of these models in conjunction with their abilities of answering questions and carbon footprint are lacking. In this study, we benchmarked eight state-of-the-art LLMs against academic quizzes across three difficulty levels and eight subject domains. Benchmark accuracies were used to test against hypotheses that larger models with 100 billion or more parameters outperform smaller models in difficult questions while smaller models, with less carbon footprint, could perform comparably well in simpler questions. A main finding in this study suggests larger models outperform even in middle school level quizzes. However, further examination suggested for questions in arts and geography domains, smaller models exceeded 90% accuracy in our benchmark set. This holds promise that carefully planned applications of LLMs with smaller model sizes have potential in a selected educational context to apply AI with a lesser carbon footprint and environmental impact.

Awards:
WESEF Excellence in Computer Science and Mathematics Award

Extracurriculars:
Biotech Club co-founder, BGNW Marlins Swim Club, Varsity Swim Captain (Senior year), Overseas English tutoring (children in Taiwan), Lifeguard at Birchwood Swim & Tennis, Piano

RACHEL CHEN



Cost-Benefit Analysis of Compost Transportation

Abstract: I plan to research a more efficient and sustainable system for waste management by analyzing the supply chain and food waste hierarchy. A deeper understanding of the impact of food waste on food, energy, water, and climate systems can contribute to waste prevention and reduction, and a way to achieve this is by creating a more complex and nuanced model that predicts the footprint of food waste in different sectors. Composting is a process that can reduce methane emissions and keep food waste out of landfills. It also has many other benefits, such as conserving water, preventing soil erosion, and creating healthier soil. An important part of the composting process is waste transportation. Transporting compost can be costly, which can be discouraging to restaurants and other producers of food waste. I plan to research the costs and benefits of compost transportation and explore methods for monitoring methane and carbon dioxide emissions from composting and waste management facilities. This research can be used to design a more efficient and sustainable system for waste management and encourage more composting. A deeper understanding of the cost-benefit analysis would make more communities favorable to composting both at an individual and local community level. This would lower carbon emissions and set the stage for a better environment in the long term. I hope to find the overall benefits of composting outweigh the costs, not just on time but also even the transportation of the materials to the composting plant.

Extracurriculars:

Varsity Track and Field (2021-24), Fun and Arts Club (2022-24), The Greeley Voice (2024), Varsity Cross Country (2021-2022)

ROSHAN DHAND



Rise in Deaths from Firearm Injury and Drug Overdose During COVID-19 Pandemic and its Impact on Organ Donation

Abstract: The Coronavirus disease 2019 (COVID-19) pandemic had a profound societal impact in the United States (US) which was associated with a decrease in overall life expectancy and an increase in substance abuse and firearm injury. Our understanding of changes in mortality trends during the pandemic and its effect on organ availability for transplantation is limited. We sought to examine trends of substance abuse and firearm injury fatalities, the impact of the pandemic on these trends, and correlate population and organ-donor deaths from these causes. Crude rates of population-based deaths among adults (18–75 years) from firearm injury and substance abuse from the period of 2014–2021 were obtained from Centers of Disease Control (CDC) WONDER database. Crude rates of causes of donor (18–75 years) deaths from 2014–2021 were obtained from the United Network for Organ Sharing (UNOS) database. Average annual percentage change (AAPC) deaths among the US population was 16.4% from substance abuse and 3.4% from firearm injury. AAPC in cause of death among organ donors was 10.9% from drug intoxication and 2.1% from gunshot injury. There was a significant ($P<0.01$) and progressive increase in mortality from both causes during the pandemic (2020–2021) and significant correlation ($P<0.01$) between population and donor causes of death. COVID-19 exacerbated trends in substance abuse and firearm mortality with a consequent increase in organ donation from donors who died from these two causes. Identifying the socioeconomic, regional, and racial discrepancies associated with this rise can guide current and post-pandemic health policies.

Extracurriculars:
President and co-founder of Next Step Tutors; director of TEDxYouth@Chappaqua event at the Chappaqua Library; Co-Captain of the Speech & Debate team; Peer leaderVarsity Outdoor Track and Field: All-County and state qualifiers for 4x800
Awards:
1st Place in Medicine and Health at Somers Science Fair WESEF: Medical Excellence Award, Tri-County: 1st place
STANYS Finalist (best of fair)

AMY FENG



Novel Small Molecule X on the Inhibition of Inflammation through IL-1Beta and its Impact on Alzheimer's

Abstract: 6 million people in the United States live with Alzheimer's Disease (AD), which has no effective cure and is growing in prevalence. One major factor of Alzheimer's is inflammation, in which the proinflammatory cytokine IL-1B plays an important role. There is still a need for effective inhibition of inflammation in the brain. The student utilized a novel lead compound, Compound X, to inhibit IL-1B's expression in the brain of mice. The student examined the cortex tissue of 40 mice, handled by the mentor. To prepare the mouse tissue for experimentation, the baseline mice were injected with Vehicles, the inflamed mice were injected with LPS, and the 3 experimental groups mice were injected with varying doses of Compound X and LPS. After tissue collection, the student ran Western blots and ELISA's to measure IL-1B's expression. These results suggest that Compound X can inhibit IL-1B. The Western blot's results were encouraging as the compound in a dosage of 50 mg/kg was able to lower the expression of IL-1B, although the changes were not statistically significant. The ELISA's results found that 50 mg/kg and 30 mg/kg Compound X were able to reduce expression of IL-1B significantly compared to the inflamed group ($p \leq 0.05$), suggesting that the novel compound reduced inflammation. This study concluded that Compound X is effective in inhibiting IL-1B in certain dosages, supporting validation and further experimentation of Compound X. This may lead to effective inhibition of inflammation, especially in patients with Alzheimer's.

Awards:
Somers Sci Fair - 1st in Med & Health
WESEF - 4th place in Med & Health
Tri County Competitor

Extracurriculars:
Speech & Debate (co-director of RF), SCIO captain, HG Invitational (co-organizer), FED Challenge, Science Greeley (Sr Writer), the Greeley Voice (Head of Video), Volleyball (club team), The Bittermelon (youth-led AAPI org), BIPOC, GWYOA

JUSTIN GOLDBERG



Promoting Well-Being: Investigating Impact on Specific Populations' Health Outcome

Abstract: Following a severe pandemic, the need for effective public health policy is as evident as ever. Effective policy must play a role in safeguarding our well-being and quality of life while encompassing regulations and initiatives that aim to improve the overall health of a specific population. Our understanding of the connections between public health policies and workplace conditions remains incomplete as studies have overlooked the direct perceptions and experiences of the policy implementers. In this study, the effects of public health policies on the working conditions, self-efficacy, job satisfaction, and burnout levels among policy implementers was analyzed through a survey approach. Data collected from the survey indicated that there are negative perceptions regarding the effectiveness of public health policies in achieving diversity, equity, and inclusion goals, with a notable room for improvement in these areas. Statistical analysis indicated that all data analyzed is significant as the anova and Kruksal-Wallis p-values were less than 0.05. When forming the most effective policy, these external factors must all be taken into account as the majority of respondents indicated that they have little to no connection with the community they create public health policy for. It can be concluded that these external factors lead to lower levels of job satisfaction, lower levels of self-efficacy, and high burnout ratings for the policymakers as they have a profound impact on health outcomes in specific populations.

Awards:
WESEF Competitor

Extracurriculars:
Mt Kisco EMS Junior Corps Member, Editor & Writer for NYU Journal of Public Health, Assistant Teaching assistant NYU School of Global Public Health, President of DECA at Greeley, Model UN Member at Greeley, Writer for The Greeley Voice

AUDREY HO



The Use of Cylindrical Inflatables to Construct a Lightweight Grasping Soft Robotic Appendage

Abstract: Development of soft robotic appendages constructed with cylindrical inflatables and strain limiting patches has not been investigated in depth. This study aimed to develop a deeper understanding of the role of soft robotics in various shapes of grasping objects through the use of cylindrical inflatables, as well as determining the ideal strain limiting patch placement for the grasping and holding of various objects. Strain limiting patches were constructed from spandex material and liquid latex and applied to the inflatables. Once inflated, the shape change was recorded. Next the inflatable tried to lift objects that varied in size and shape. Patch placement was changed to increase effectiveness of holding the objects for thirty seconds in subsequent trials. Through various configurations, the most ideal strain liming patch placement is a 0.25 width patch that is 4 cm in length, placed 18.0 cm along the 36.0 cm inflatable. This placement is significant due to its ability to use the same patch formation while still able to grasp and hold various objects. This research is one of the first to test different objects that are more applicable to the daily functioning of hands. The hope is that this research is a proof of concept for a soft robotic appendage that can potentially be applied in the construction industry, specifically in confined spaces.

Awards:
Somers 3rd place.
David M. Holmes WESEF
Engineering Innovation Award

Extracurriculars: Varsity swim, Medical Guide Executive, Science Olympiad, HG Invitational, BGCNW Volunteer/ assistant, AAPIA Exec, Club swim, Lifeguard, HOSA, consulting internship

SARA JANKOVIC



Toppling the Domino Effect: A Novel Approach to Predicting Systemic Banking Distress Using Interacting Networks Analysis

Abstract: Banking crises have dire consequences for societal welfare—15 million people became unemployed during the 2008 GFC and the banking sector's equity dropped by 20% due to the 2023 Banking Crisis—that highlight the profound importance predictive modeling holds as a tool to mitigate and prevent banking crises. However, existing regulatory frameworks and most existing predictive models remain inadequate. While avoiding crisis is challenging, understanding the underlying dynamics may prove sufficient or give direction. Therefore, this study aims to develop a predictive bottom-up model using an interactive networks system framework composed of two layers to understand financial crises for means of prevention and mitigation. A simplified model is first constructed to ensure the model is logically sound. Then, a model is developed, fitted using equity returns from the 2008 GFC and the COVID-19 pandemic, and tested using the 2012 Sovereign Debt Crisis and 2023 Banking Crisis to evaluate the model's predictive capabilities and accuracy. The model accurately predicted banking distress as it closely followed the progression of four past banking crises throughout the cycles and produced in-sample R-squared values above 0.7 and out-of-sample R-squared values above 0.5 and matching time-series profiles. This model holds significance as a one-of-a-kind tool for aiding monetary policymakers in navigating banking crises, holding the potential to revolutionize how monetary policy is applied in avoiding costly economic hardship. This is a pioneering tool capable of accurate prediction and significant flexibility, transcending the current art and bringing policymakers to a new stage of prediction.

Awards:
1st Somers Science Fair
1st Computer Science at WESEF
2nd Systems Software at NYSSEF

Extracurriculars:
Social Media Director at Speech & Debate, Co-Comms Director at BIPOC Student Union, Head of Comms at Greeley Voice, Bittermelon Team Leader (Asian-American activism org.), Economics Columnist at Science Greeley, Peer Leader in Greeley's Peer Leadership, GWYOA (Greater Westchester Youth Orchestra Assoc.)

SHREY KUMAR



Neural Biomarker-Based Diagnosis of Alzheimer's Disease Using Supervised Learning AI Models on Electroencephalography Data

Abstract: Millions of people in the United States suffer from Alzheimer's Disease (AD), an incurable form of dementia that continues to increase in prevalence. Current methods of AD diagnosis are limited to the late stage, by which time the treatment options are limited, quality of life is poor, and cost of treatment is exponentially high. However, early medical diagnosis of AD is difficult since standard non-invasive techniques require extensive tests and can still generate false positives and negatives, leading to misdiagnosis. This study proposes a supervised machine learning model trained on readily available Electroencephalography (EEG) patient data to diagnose potential AD patients. This study was conducted by extracting and analyzing relevant features from an open source EEG database, collected from 186 patients using the trained machine learning model of best fit. This AI model is an alternative to current late-state detection methods which require complex and risky procedures that can still lead to inaccuracies. In addition, current algorithms require feature manipulation and sort through hundreds of thousands of raw EEG data points to obtain unreliable results. The results demonstrate that, given EEG data of 93 close-eyed patients, the trained Logistic Regression model - the machine learning model of best fit - achieved a sensitivity of 100% and overall accuracy of 87%, using data recordings of only 8 second segments for each patient. This novel Alzheimer's Disease screening tool, with a cloud-based AI model can be easily deployed at primary health care clinics for screening patients for AD during their yearly clinical visits.

Select Extracurriculars:
Biotech, Access, Soccer (Club), NYSSMA (all 3 years), 914 Cares Volunteer, Neighbors Link Volunteer, Math Tutor (LearnToBe), Science Greeley, All County Band

Awards:
3rd Place Comp Bio @ WESEF
3rd Place @ Tricounty
STANYS alternate
BIOGenius competitor

XIAOCHUAN (SHAWN) LIANG



Generative Adversarial Networks in Modeling Patient Internal Motions

Abstract: Radiation therapy is a costly but effective treatment for cancer that beams energy into cancer cells. Patients' bodies must be observed while treatment occurs so that when the target area shifts due to respiration, treatment won't cause extraneous damage, and usually, a costly MRI is employed. In this study, we attempt to replace the MRI with a conditional generative adversarial network (cGAN) to lower the costs of radiation treatment and improve accessibility. To accomplish this, we used the pix2pix template provided by Google TensorFlow and edited it so that it would suit our purposes. We changed our data from the raw state to a much more simplified state of the outer skin, diaphragm, and target organ. The written cGAN was able to perform adequately as shown by the result analysis which showed the cGAN was able to keep generated results 9 pixels within the target 90% of the time. We conclude that this cGAN, though satisfactory in its accuracy, has been trained on a relatively skewed data set which will likely require much more testing before being commercially available, however, this is still a good proof of concept of using machine learning in an attempt to replace heavy machinery.

Select Extracurriculars:
Sci Greeley Content Contributor, Varsity Swim Team Captain, Warhammer Club Founder, Chamber Orchestra Violinist, BGNW Marlins Swim Team, Africa Cries Out Volunteer, Mount Vernon's Food Pantry Volunteer, Ridgeway Church Summer Camp, Orchestra, AMC 10 Distinction and Qualified for AIME and 3rd place locally, PSAT National Merit Scholarship

Awards: Somers, WESEF, and Tricounty Competitor

HARPER MARGOLIES



Associations Between Sound, Light, and PM2.5: an Analysis of Daily Life Exposures on Human Health

Abstract: Exposure to particulate matter poses large health risks to those living in densely populated areas. With both short and long term exposure, particulate matter causes an increase in mortality and disease. Our understanding of daily particulate matter exposures in suburban New York remains incomplete. In this study we aim to determine the correlation between sound, light, location and particulate matter concentrations in suburban New York to better understand how to reduce exposure. We assessed personal exposure using an ultrasonic personal air sampler (UPAS) and an Apple Watch SE. The subject wore both samplers for one week, collecting their exposures to particulate matter, sound, light, and CO2. We did this in order to evaluate potential correlations between particulate matter, sound and light in suburban New York. As predicted, we found significant correlations between PM2.5 and light exposure. However, no significant correlations were found between PM2.5 and sound exposure. Interestingly, we found that PM2.5 exposure significantly increased when the student was playing soccer on an artificial turf field. This research is imperative in aiding public health policies regarding PM2.5 to become safer and more accurate. Additionally, this study provides a foundation for future exposomic research due to its more accessible methods and materials.

Awards:
1st place at Somers science fair
NOAA award in WESEF
Tricounty Participant
Extracurriculars:
SHARE hgsf executive, member of student council, Madrichim (Hebrew student teacher), Religious school, Varsity soccer, Varsity track, Justice Brandeis Leadership Board (junior board), Lifeguard, Mt. Sinai. Volunteer

CHRISTOPHER MARLATT



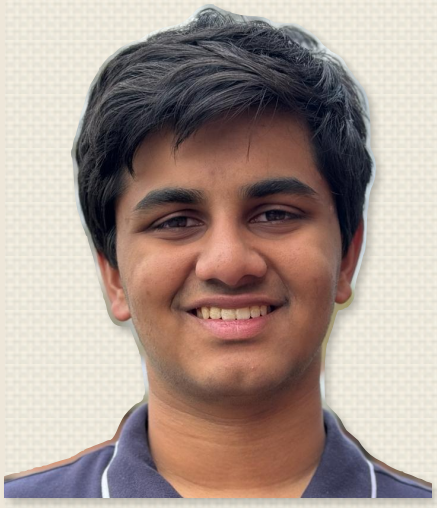
Using An Imbalanced Dataset and Testing Explainable Machine Learning in Credit Risk Management Using

Abstract: An explainable artificial intelligence model for credit risk assessment that leverages correlation networks and Shapley value explanations, with a focus on addressing imbalanced datasets where default events are rare. The agnostic, post-processing methodology interprets predictions by quantifying the contribution of each explanatory variable to the output using Shapley values computed efficiently via the TreeSHAP algorithm. By integrating TreeSHAP with XGBoost models optimized on GPU, the approach rapidly extracts explanations from complex machine learning models. The empirical analysis extends the framework to imbalanced data scenarios, where default occurrences are infrequent, by employing oversampling techniques suggested by Thomas and Crook (1997). Despite class imbalance, the correlation network analysis of Shapley explanations enables grouping of predictions with similar underlying rationales, even for rare default cases. This explainable AI approach enhances the interpretability of credit risk predictions, advancing the understanding of financial risk determinants crucial for risk monitoring and probability of default forecasting. The research findings have policy implications for regulators overseeing AI-driven financial services regarding consumer protection concerns arising from opaque, black-box AI models. The proposed methodology demonstrates the potential to make sophisticated machine learning models more transparent and trustworthy for high-stakes applications involving imbalanced data and low-probability, high-impact events.

Extracurriculars:

Varsity Hockey, Club Hockey, ACCESS HGHS Co-President, Hockey Coach, Model UN Member, DECA, VPAC, Robotics club, finance club member

ARJUN MENON



Awards 22-23: 1st Place at Somers, 2nd Place at WESEF, Gold Medal at International Genius Olympiad

Awards 23-24:
3rd Place at WESEF, 1st place NYSSEF, **ISEF finalist**

Select Extracurriculars:
Swim Team at Boys and Girls Club, Founder of Biotech Club

Determination of Primary Retinoblastoma Extracellular Vesicle Uptake Pathway via Surface Protein Inhibitors

Abstract: Retinoblastoma (Rb) is a form of rapidly developing retinal cancer, and like many cancers, metastasizes via the release of lipid-encased extracellular vesicles (EVs) which create desirable conditions for secondary tumor growth via local environment modification. Currently, there is limited understanding of specific Rb EV uptake proteins and mechanisms in target cells. My previous research has shown that using inhibitors to block surface protein activity on retinal cells allows for decreased EV uptake. However, the specific molecular mechanism that retinal cells use to internalize retinoblastoma EVs remains unknown. By finding the EV uptake pathway in Retinoblastoma, we would be able to identify drugs that can block metastasis, something which current treatments fail to address. We proposed two aims: 1) Test the novel drug MSC109438 in vitro by measuring extracellular vesicle uptake in cells; and 2) Identify specific molecular machinery of retinoblastoma EV uptake into retinoblastoma cells. MSC109438 caused a significant reduction of retinoblastoma EV uptake into retinal progenitor cells (p=.007). To characterize the specific molecular mechanism of EV uptake, we identified 41 important receptor proteins on the Rb EVs based on their specific endocytic pathways. We identified two inhibitors for our in vitro assay, dynasore and Methyl-β-Cyclodextrin that would inhibit the protein receptors specific for clathrin dependent (CDE) or clathrin independent endocytosis (CIE) respectively. Our results showed that CDE was the predominant uptake pathway in retinoblastoma cells, unlike most cancers. This methodology can be applied to find metastatic-inhibiting treatments in other cancers where the EV uptake pathway method is unknown.

NORA MORTON



Awards: 2nd Somers Sci Fair, NJ Coastal & Climate Resilience Conference

Extracurriculars: Marine Science Education Volunteer - NJBII, Project Terrapin Intern, HGHS Forest Preservation Club Exec., New Castle Art Center Teaching Assistant, BSU Unity Day Volunteer Educator, Downstate Juniors Volleyball

Creation of a Cost Effective Wave Action Device Utilizing Smartphone Technology

Abstract: Estuarine environments are at risk due to climate change, rising sea levels, and human activity specifically from recreational boating and boat wakes surrounding marsh islands which contributes to the erosion of shorelines and marsh edges. Wave action devices traditionally used to measure boat wakes and their effects on shorelines are very precise by design, but research-grade devices are also very expensive, and therefore are inaccessible to students and many researchers. In this study, we aimed to create an inexpensive wave-action device that would accurately measure boat wakes using low-cost materials while maintaining the ability for precise measurements and analysis. We constructed the device including a water-tight and anchored apparatus and an iPod Touch, with the Physics Toolbox Sensor Suite application installed to record acceleration movements during deployments. The device was placed in an area of high boat traffic between two vulnerable marsh islands in South New Jersey adjacent to the Intracoastal Waterway. We found that the device could measure boat wakes while deployed. To determine if the device could measure wave heights accurately, the device was tested with artificial waves created by a pulley system. We found out that the device was able to accurately measure artificial wave heights after comparing the artificial waves' actual height to the height that was measured by the device. Following this successful validation, we will extend this work to the analysis of measured boat wake waves from data already collected. We concluded that the device can be used by many to generate accurate wave action data cost-effectively.



Extracurriculars:
Drawing
beach and ocean protection club since 2021

ZARA SHAHID

Identifying Biomarkers for Epilepsy in Patients with CASK Associated Pathogenic Variants

Abstract: CASK is a gene widely expressed in the developing brain, and any alteration can lead to disorder [4]. The many phenotypes of CASK of alteration include optic nerve hypoplasia, pontocerebellar hypoplasia, moderate to severe intellectual disability, neurodevelopmental disorders with presynaptic dysfunction, and more [1][4][5][6]. 50% of CASK-related disorders are linked to epilepsy [3]. Little has been done to narrow down reasons why only 50% of CASK-related cases develop epilepsy or to link epilepsy to other conditions. In linking epilepsy to other disorders, it has been found that chart review is an effective and efficient method of comparison and trend finding [2]. This study aims to use chart review of de-identified CASK-related disorder patient data to find variant trends indicating potential markers of CASK-related epilepsy. This will help lead to increased surveillance of children found to be at higher risk, leading to earlier diagnosis and early intervention, increasing positive neurological outcomes.



Awards:
2nd Place Somers Award in Bioinformatics

Extracurriculars:
Tourette Association of America Youth Ambassador, Young Adult Rare Representative, Aceing Autism Volunteer, Co-founder of ACCESS Club, Internal Affairs Director of Biotech Club, Writer for Science Greeley, Debate Club, JV Tennis,

NOAH SHAPIRO

The Impact of Galanin Receptor 1 Preferring Analog, NAX 5055 to Inhibit Infantile Epileptic Spasms

Abstract: Infantile spasms are seizures manifesting in infantile epileptic encephalopathies that are associated with poor epilepsy and cognitive outcomes. The current therapies are not always effective or are associated with serious side effects. Early cessation of spasms has been proposed to improve long-term outcomes. To identify new therapies for infantile spasms with rapid suppression of spasms, we are using the multiple-hit rat model of infantile spasms, which is a model of refractory infantile spasms. Here, we are testing the efficacy and tolerability of a single dose of the galanin receptor 1 preferring analog, NAX 5055, in the multiple-hit model of spasms. After the onset of spasms, rat groups will be injected with either NAX 5055 (0.5, 1, 2, or 4mg/kg) or vehicle. Video monitoring for spasms will include a 1h pre-injection period, followed by 5h of recording post-injection, and two 2h sessions on PN5. Neurodevelopmental reflexes will be assessed daily as well as at 2h after injection. Respiratory function, heart rate, pulse distension, oximetry and blood glucose will be measured 4h after injection. Our hope is neurodevelopmental reflexes, vital signs, blood glucose measured 4h post-injection, and survival will not be affected.

ZIRUI (REMEY) SONG



The Effect of Circadian Rhythm Disruptions on Serotonin Neurons and Time-of-day Dependent Serotonergic Chemosensitivity

Location: University of Iowa, Buchanan Lab

Abstract: Epilepsy is a neurological disease characterized by spontaneous seizures. One in every 26 people will develop epilepsy in their lifetime (Hesdorffer 2011). Through unknown mechanisms, some seizures can be fatal. This is known as sudden unexpected death in epilepsy (SUDEP). SUDEP primarily occurs during the night, which is often attributed to seizures occurring during sleep. Accumulating evidence in mouse models of seizure-associated death also demonstrates nighttime risk independent of sleep state (Purnell 2021, Kreitlow 2022. The neurotransmitter serotonin (5-hydroxytryptamine, 5-HT) has been implicated in SUDEP due to its role in CO2 chemosensitivity. 5-HT is involved in CO2 arousal, awakening in response to increased CO2 (Buchanan 2010). 5-HT neurons also modulate seizure severity and seizure-associated mortality (Buchanan 2013, Petrucci 2020). Levels of 5-HT appear to change throughout the day, with levels lowest during the nighttime in both humans and rodents. Seizures may impair normal serotonergic activity, preventing appropriate respiratory and arousal responses to increasing CO2. Our goal is to understand how circadian rhythm disruption influences 5-HT neurons and how time of day influences serotonergic breathing and arousal physiology. Chronotherapeutic strategies may be used to reduce the nighttime risk of SUDEP. The research questions include: (1) how does circadian rhythm disruption influence the quantity of 5-HT neurons in the dorsal raphe nucleus and (2) how does time-of-day influence serotonergic CO2 chemosensitivity? We hypothesized that (1) disruption of circadian rhythms will result in fewer 5-HT neurons, that (2) 5-HT-dependent chemosensitivity (CO2 arousal and autoresuscitation) will be time-of-day-dependent, and that (3) nighttime seizures would exacerbate deficits in 5-HT-dependent chemosensitivites.

Extracurriculars: USABO Semifinalist, BBO Gold Medalist, Brain Bee: Regional 5th Place, USMDO Gold Medalist, Team USA Skyliner Junior Synchronized Skating Team, UIOWA Student Training Program, SHARE Blood Drive Execs, Chinese Club President

Awards:
Somers & Tri-County (applicant)
NYSSEF finalist (HM)

MORGAN TSAI



Developing an Affordable Air Quality Detector: Advancing Affordability and Accessibility via Phone Camera

Abstract:
Air pollution causes over 6 million premature deaths annually worldwide. High quality air pollution detectors are costly and hefty, making it less feasible for daily use. Existing apps lack the simplicity of photo based air quality assessment, relying on monitoring stations whose accuracy is contingent on location. In smaller or lower income communities, fewer stations can possibly lead to inaccurate data. Assessing air quality based on photos enables accurate air quality information, crucial to those with health vulnerabilities. In this project we hypothesized that existing large language models like ChatGPT will not be able to accurately predict the air quality from images, and we developed a custom machine learning model to predict air quality. I used air pollution images to demonstrate how deep learning models can efficiently identify air quality from photographs, offering a cost-effective solution to measuring air quality world wide. Our model shows superior performance compared to ChatGPT's model, contributing to a wider range of access to accessible environmental data, helping others make better informed decisions based on their environment. We were able to design a program that can be used on any smartphone, increasing accessibility to a wide range of users.

Awards:
Somers competitor
Davidsons Fellow Competitor

Extracurriculars:
Varsity tennis, Mind Matters Vice President, Science Greeley writer, volunteer work with young kids at elementary schools, babysitter, volunteer tennis coach, cultural immersion travel during the summer.

CHAITRA MYNAMPATI



The Presence of Genes Aiding in Cold Tolerance on the Growth of Different Tomato Ecotypes

Abstract:

Plants have developed in face of growing human societies for millennia. In doing so, various species have diverged from each other and have refined their ability to grow and be harvested at a large scale to sustain populations in numerous environments. This study plans to explore cold tolerance in different ecotypes of tomatoes. I plan to compare genomes using an online databases in different regions from different parts of the world and explore the similarities and differences. I will then isolate different genes and grow those tomatoes in our green house. The tomatoes will then be exposed to different environmental conditions and compare the phenotropic effects on the tomatoes. I hope to find commonalities in cold tolerance we will then be able to focus our attention on certain genes. This will allow future plants to be grown in various environments and even survive possible life in space.

Extracurriculars:
Veena/Sangeetham, Tennis, Science Olympiad, SAMES, Academic Challenge, FIRST Tech Challenge, Girl Scouts,Flute, and Badminton Club

Awards:
2nd Place Biochemistry at Somers Science Fair

ANDREW PANG



Berberine: Inhibitory Effects on SARS-CoV-2-Induced Long-COVID Syndrome

Abstract: In the aftermath of the COVID-19 global health emergency, about 65 million individuals worldwide still experience long-lasting neurological and systemic complications, known collectively as “long-COVID”. Hallmarks of long-COVID include elevated cell death and apoptosis in the nervous system, as well as the irregular expression of Matrix metalloproteinase 9 (MMP-9) and Brain Derived Neurotrophic Factor (BDNF). This study investigated the mitigating effects of berberine, an isoquinoline alkaloid with anti-cancer and anti-inflammation effects, on long-COVID syndrome. Molecular docking simulations were conducted to evaluate the bioactivity of berberine with COVID spike protein and vulnerable human receptors. Further, MTT, ELISA, and Caspase assays were carried out in order to investigate the specific effects of berberine on COVID-induced cell death, apoptosis, and MMP-9 and BDNF expression respectively. It was found that berberine was able to effectively dock with not only the COVID spike protein, but also human receptors ACE2 and NRP-1, suggesting that berberine will likely be able to prevent the spread of COVID infection and subsequent complications. Further, in vitro, berberine was found to significantly decrease COVID-induced cell death (-36.55% to -8.57% ; p = 0.000559), as well as reverse the effects which the spike protein had on MMP-9 (-8.36% to 3.57% ; p = 0.0000327), BDNF (-6.11% to 1.73% ; p = 0.00938), and Caspase-3 expression (90.91% to -18.18% ; p = 0.0267). This study provides strong evidence of the mitigating capabilities of berberine on the long-term neurological and inflammatory effects of SARS-CoV-2 infection.

Extracurriculars:
Editor-In-Chief of Science Greeley, Boys Varsity Tennis, USACO Silver,
Author of 2 published books.

Awards:
ACAP Semifinalist,
WESEF 4th place in Biochemistry

ELIZABETH XIU



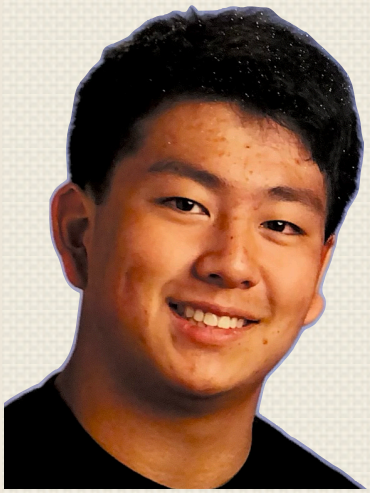
Enhancing Tumor Detection in X-Ray Images: Optimizing the Parameters for a Target Contrast-to-Noise Ratio with a Monte-Carlo Simulation-Based Approach

Abstract: Radiation therapy is a highly targeted treatment for cancer, the leading global cause of death, contributing to approximately 40% of worldwide cancer cures. X-ray imaging plays a pivotal role in the visualization of radiation therapy, but low image contrast and image graininess can hinder accurate tumor detection and successful radiation therapy planning. Our understanding of the optimal amount and energy level of x-rays that produce an image with a desired ratio of 1 between contrast and graininess is incomplete. This study proposed a model to optimize these parameters of x-ray imaging to achieve this ideal ratio for improved tumor visibility and clarity in x-ray images. Several different Python modules were applied to model a scenario mimicking a patient positioned within a typical clinical environment and to replicate the interactions of photons traveling through the patient's tissue and tumor, eventually generating simulated x-ray images which were later used to analyze the ratio between image contrast and graininess across numerous distinct images. There was less graininess in images produced with higher amounts of x-rays in comparison to images produced with lower amounts, and the calculated ratio between image graininess and contrast of these images was also relatively higher. We found that the optimal amount of x-rays to produce the desired target ratio of 1 was 2570312.5 becquerels. We conclude that 2570312.5 becquerels of x-ray radiation produce a ratio between image graininess and contrast of 1, which may lead to improved tumor detection and enhanced radiation therapy planning.

Awards:
3rd Place at Somers Science Fair
4th place in Computer Science at WESEF

Extracurriculars: Treasurer for Sci Greeley, Treasurer for AAPIA, Bittermelon Teen Leader (AAPIA activism organization), Horace Greeley Voice Columnist, Volunteer at Phelps Hospitality staff), Hoff Barthelson Music School Chamber Program

DANIEL YE



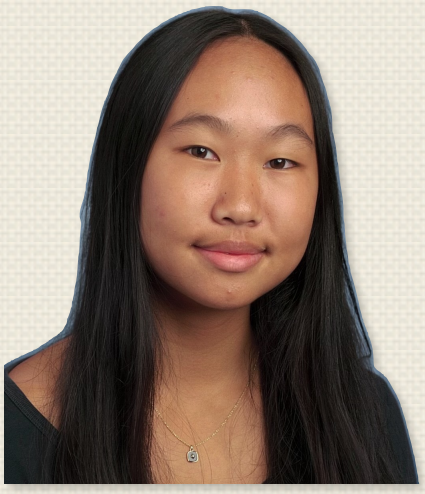
Ice Growth Velocity of Antifreeze Proteins Purified From *Tenebrio molitor* Larvae in Vegetables

Research Location: Yeshiva University

Abstract: Antifreeze proteins (AFPs) are a group of biological molecules found in fish, insects, plants, fungi, bacteria, and other microorganisms that reduce the freezing point of water. AFPs adsorb to the surface of ice and limit ice growth through thermal hysteresis, which increases the difference between the water's freezing and melting point. AFPs possess different TH values, which influence the growth velocity of ice crystals. The objectives of this study were to purify AFPs from Tenebrio molitor and to evaluate the use of AFPs when freeze-preserving vegetables by monitoring ice growth velocity. The purified T. molitor AFP binded to multiple crystal planes, creating a hexagonal-shaped ice crystal that indicated high TH activity. Cucumber, carrot, zucchini, and onion samples treated with AFP or the control were frozen to measure ice growth velocity. Upon freezing, all AFP-treated vegetables exhibited a significantly lower ice growth velocity than the control groups. AFP-treated vegetables more effectively maintained their texture and cellular structure than the control groups. In particular, the ice growth velocity of a cucumber was most effectively reduced when treated with AFP and correlated most with the TH value of the AFP. These results indicate the potential value of the AFP from T. molitor larva in inhibiting ice crystal formation and preserving the quality of frozen vegetables.

Extracurriculars:
Indoor and Outdoor Track and Field (Competed at Nike Nationals, New Balance Nationals, State Championships, Millrose Games, and Louck's Games; named All-State, All-Section, All-County, All-League for throwing), volunteer at Phelps Hospital, National Latin Exam medalist (gold and silver), selected for the Physics and Chemistry Olympiad, Academic Challenge, & Math club.

MEADOW ZHANG



Exploring the Role of Corticospinal Connectivity in Motor Function: A Machine Learning-Based Investigation Using Fezf2 Null Mice

Location: Burke Neurological Institute

Abstract:The corticospinal tract involves a complex web of neural circuits that must be stripped away in order to understand the specific role of the tract in motor function and design targeted therapeutics to treat corticospinal injuries. Loss-of-function tests have been modeled on mice through the creation of lesions, however, they lack the specificity required for isolating the function of the corticospinal tract. Genetic silencing techniques allow for specific targeting of genes to create mice models without corticospinal tracts. Therefore, the purpose of this study was to explore the role of the corticospinal tract in motor function using mouse models deficient in the Fezf2 gene. Recordings of mice completing a balance beam task were processed using a machine learning-based program, DeepLabCut, to track body part motion. Major findings of this study showed a trend where Fezf2 null mice experienced less precise paw placement during strides compared to WT and HET mice. DeepLabCut body part tracking was shown to be over 80% accurate in all trials. These findings add to the exploratory knowledge of the specific role of the corticospinal tract in the precise execution of skilled motor function in mice and demonstrate the capabilities of using DeepLabCut for motor function assessments. These analyses will contribute to the development of targeted interventions for treatment of corticospinal and traumatic brain injuries, serving as a pipeline for future analysis of motor function using DeepLabCut.

Extracurriculars:
1st at Somers, 3rd place at WESEF, Tricounty competitor

Extracurriculars:
HOSA Co-President, AAPIA Vice President, Varsity Tennis Co-Captain, HG Science Olympiad Invitational Organizer, Science Olympiad Competitor, PJLC Member, Ambulance Corps Volunteer, Hospital Volunteer, Tennis Coach, US Open Ballperson

JUNIORS

CLASS OF 2025

SOPHOMORE CLASS OF 2026

JUDE AL-MUFTI



TITLE: *USING MACHINE LEARNING TO DETECT FACIAL DROOP FOR EARLY DETECTION OF ACUTE ISCHEMIC STROKE*

EXTRACURRICULARS: COMPETITIVE SABRE FENCING, DRAWING/SKETCHING, CREATIVE WRITING, SPEECH AND DEBATE, READING, GARDENING, & BAKING

NATALIE BACCAY



TITLE: *THE EFFECT OF VARYING FREQUENCIES ON COGNITIVE FUNCTIONING IN PATIENT WITH EARLY ONSET ALZHEIMER'S DISEASE*



JONAS BALCETIS

TITLE: *THE EFFECT OF AFUCOSYLATED IGG1 GLYCOFORM LEVELS ON THE SEVERITY AND PROGRESSION OF INFLUENZA INFECTION*

EXTRACURRICULARS: VARSITY SWIMMING, VIOLIN (NYSSMA LEVEL 6 99 SCORE 2024), 2023 DIVING JUNIOR NATIONAL QUALIFIER IN CA, 2024 ZONES DIVING QUALIFIER IN VIRGINIA, VOLUNTEER AT PHELPS HOSPITAL, & SCIENCE GREELEY SENIOR WRITER



MUKUL BATTU

TITLE: *VALIDATION OF A CONFOUNDLESS 2D GENERAL ADVERSARIAL NETWORK (GAN) IN IDENTIFYING ALZHEIMER'S DISEASE THROUGH MRI DATASETS*

EXTRACURRICULARS: CVAC (CHAPPAQUA VOLUNTEER AMBULANCE CORPS), JV BASEBALL, VOLUNTEERING AT BRONXCARE HOSPITAL INTERNSHIP & CHAPPAQUA LIBRARY, SCIENCE GREELEY, BIOLOGY CLUB, LETTERS FOR ROSE, SPEECH AND DEBATE, SCIENCE OLYMPIAD IN 7B (REGIONAL AND STATE MEDALIST), TRUMPET (NYSSMA ALL-COUNTY AND AREA ALL-STATE)



CLAIRE BOWERS

TITLE: *THE EFFECT OF FERUMOXYTOL IN MAGNETIC RESONANCE ANGIOGRAPHY IN THE DETERMINATION OF ESTIMATED CORONARY CALCIUM BURDEN ON PREDICTING 50 DAY POSTOPERATIVE CARDIOVASCULAR RISK INDEX*

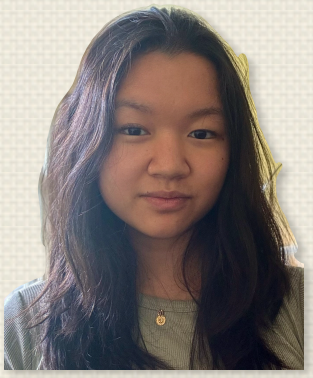


BAILEY CARD

TITLE: *A NEW MODEL FOR ALZHEIMER'S DISEASE*

EXTRACURRICULARS: SHARE CLUB, MOCK TRIAL CLUB, MAC ANGELS CLUB, 914CARES JR ADVISORY BOARD, QUAKER NOTES A CAPPELLA GROUP MEMBER, RENAISSANCE TUTORING, COTTAGE SCHOOL VOLUNTEER

CINDY CHEN



TITLE: DOWNREGULATION OF CYTOPROTECTIVE GENES SENSITIZES RESISTANT LUAD TO LCS3 AND FERROPTOSIS

EXTRACURRICULARS: GIRLS VARSITY SWIM AND DIVE, DEAR ASIAN YOUTH, LETTERS FOR ROSE, AAPIA, GWYOA, PIANO, HOSA, VOLUNTEER AT PHELPS HOSPITAL

WENDY CHEN



TITLE: *THE EFFECT OF LONG TERM CALORIE RESTRICTION ON AGING IN HUMANS*

EXTRACURRICULARS: VARSITY SWIM TEAM, DEBATE CLUB, SCIENCE OLYMPIAD, AND BIOLOGY CLUB

DAYUAN CHENG



TITLE: *AN ARTIFICIAL INTELLIGENCE PLATFORM FOR TURBULENCE RESPONSE IN UNMANNED AERIAL VEHICLES*

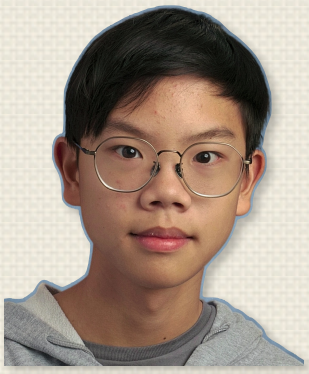
EXTRACURRICULARS: JV SOCCER, TRACK AND FIELD, BSU, AAPIA

JULIANNA CHIN



TITLE: THE EFFECT OF PERFORMING POWER YOGA ON THE PROGRESSION OF PARKINSON'S DISEASE

TINGRAY CHUNG



TITLE: *ACOUSTIC IDENTIFICATION OF KEYSTROKES WITH STEREO MICROPHONES AND TEXT CRYPTOGRAPHY WITH LANGUAGE MODELS*

EXTRACURRICULARS: SCIENCE OLYMPIAD, AAPIA, TENNIS, PIANIST, CHESS PLAYER, ROBOTICS, ACADEMIC CHALLENGE

JULIETTE DAY



TITLE: *THE EFFICACY OF AN ANT-BASED COORDINATE SYSTEM TO OPTIMIZE ELECTRODE PLACEMENT IN DEEP BRAIN STIMULATION OF REFRACTORY PARKINSON'S*

KATHERINE EVANGELINOS



WARREN FU



TITLE: *DESIGNING A FEDERATED-LEARNING BASED MOBILE DIAGNOSTIC SYSTEM FOR CERVICAL CANCER: REDUCING LONG DELAYS OF CLINICAL DIAGNOSIS AND IMPROVING PATIENT SURVIVAL IN DEVELOPING COUNTRIES*

ISABELLA GARCIA



TITLE: *THE EFFECT OF ENVIRONMENTAL TEMPERATURE ON EQUINE COLIC CLINICAL SIGN SEVERITY*

EXTRACURRICULARS: COMPETITIVE HORSEBACK RIDING, THERAPEUTIC HORSEMANSHIP VOLUNTEERING, BARN VOLUNTEERING, SHARE HGHS, HELP ANIMALS CLUB

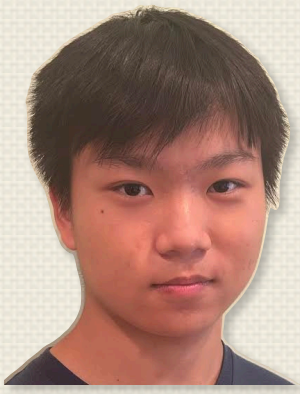
ZOE GOLUB



TITLE: *THE EFFECT OF ANTIHISTAMINES ON ORAL IMMUNOTHERAPY FOR CHILDREN WITH PEANUT ALLERGIES*

EXTRACURRICULARS: CHAPPAQUA AMBULANCE CORP VOLUNTEER, QUAKER NOTES A CAPELLA MEMBER, 914 CARES JUNIOR ADVISORY BOARD MEMBER, NO KID HUNGRY CLUB MEMBER, EB CLUB MEMBER

KEVIN GUO



TITLE: *OPTIMIZING DELIVERY MECHANISMS FOR ANTI-BRUTON'S TYROSINE KINASE SIRNA FOR THE TREATMENT OF CHRONIC LYMPHOCYTIC LEUKEMIA*

EXTRACURRICULARS: BIOTECH CLUB (DIRECTOR OF INTERNAL AFFAIRS), TENNIS (JV A), TEACHER'S ASSISTANT AT HUAXIA CHINESE SCHOOL OF GREATER NEW YORK, CHINESE CLUB (PRESIDENT), HGHS SOLES4SOLES (FOUNDER), & GREELEY HOSA (EXECUTIVE)

BENJAMIN HARRIS



TITLE: *USE OF SHAPE MEMORY ALLOYS FOR ACTIVE FRAMES IN ADAPTIVE, LIGHTWEIGHT, AND FAST WHEELED PIPE-CLIMBING TENSEGRITY ROBOTS*

EXTRACURRICULARS: ROBOTICS CLUB, SCIENCE OLYMPIAD, NEIGHBORS LINK ESL

JONAH HERMAN



TITLE: *REFINEMENT OF DIAGNOSTIC CRITERIA FOR TRAUMATIC ENCEPHALOPATHY SYNDROME (TES)*

EXTRACURRICULARS: VARSITY TENNIS, SHARE CLUB, & DEBATE CLUB

ALBERT HUANG



TITLE: *SUBSTITUTIONAL DOPING OF TUNGSTEN DISELENIDE USING THE TWO-STEP FLUX SYNTHESIS METHOD*

EXTRACURRICULARS: VIOLIN, SCIENCE OLYMPIAD, ACADEMIC CHALLENGE, VARSITY TRACK, & GWYOA

LILY HUBSCHMAN



TITLE: *THE EFFECT OF NEUTROPHIL DEPLETION ON PREDICTING OUTCOMES OF TUMOR REMOVAL AND RADIOTHERAPY USING NEUTROPHIL EXTRACELLULAR TRAPS*

EXTRACURRICULARS: VARSITY GOLF, JV SOCCER, MODEL UN, TEMPLE BETH EL CARING COMMITTEE, VICE PRESIDENT OF LOCAL B'NAI BIRTH YOUTH ORGANIZATION CHAPTER, ENOUGH CLUB, VOLUNTEER WITH VIP AND THE MOUNT KISCO CHILDCARE CENTER

ADAM KAMAL



TITLE: *USING ML TO IMPROVE ENERGY DISTRIBUTION EFFICIENCY IN THE ELECTRIC GRID*

EXTRACURRICULARS: CO-FOUNDER OF THE CODE FOR A CAUSE CLUB, STATE AND FEDERATION WINNING VARSITY SWIMMER, CO-FOUNDER OF THE FEEDING WESTCHESTER CLUB

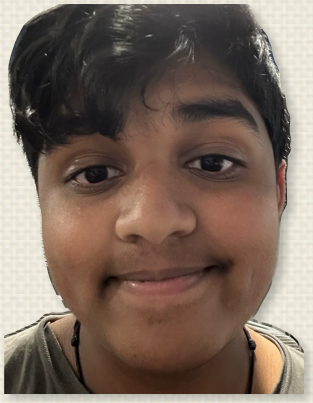
LINDSAY KIM



TITLE: *THE EFFECT OF LACTOFERRIN VS OTHER COMMON IRON CHELATORS ON BONE MASS*

EXTRACURRICULARS: HOSA, STUDENT GOVERNMENT, SCIENCE OLYMPIAD, VARSITY TRACK & FIELD, PIANO, & FIGURE SKATING

RISHI KUMAR



TITLE: *THE EFFECT OF GLUTAMATERGIC NEURONS ON RELIEVING ANXIETY AND FEAR.*

EXTRACURRICULARS: SPEECH & DEBATE, SAMES, CASA ESL, & SAGV

EVE LANSFORD



TITLE: *PERSPECTIVES ON COLLEGE TRANSITION: AN EXPLORATORY STUDY OF AUTISTIC YOUTH AND THEIR PARENTS*

EXTRACURRICULARS: SHARE CASA DE LENGUA TUTOR, PIANO, YARN CLUB(CROCHET), SCIENCE OLYMPIAD, PIANO

ALEXANDRA LEINBERGER



TITLE: *USING AI TO IMPROVE THE QUALITY OF PROTEIN STRUCTURE AND FOLDING PREDICTIONS AS THEY ARE AFFECTED BY AN AQUEOUS ENVIRONMENT*

EXTRACURRICULARS: STUDENT GOVERNMENT, THE GREELEY VOICE, FIELD HOCKEY, LEARNING LINKS, COLUMBIA PRECOLLEGE PROGRAM FOR CELL AND MOLECULAR BIOLOGY OF MEDICINE (SUMMER OF 9TH GRADE), MY SISTER'S PLACE SUMMER LEADERSHIP INSTITUTE (SUMMER OF 9TH GRADE)

MEREDITH LEVINE



TITLE: *A COMPARISON OF THE SHUANG CHEN WEATHERING CAVE CC METHOD, AND STANDARD 14C DATING: UTILIZING NEW MEANS OF DATING, ENHANCING RESEARCH*

EXTRACURRICULARS: PLAYS FOR RJS VOLLEYBALL, WORKS AT WORLD CUP GYMNASTICS, & GUITAR

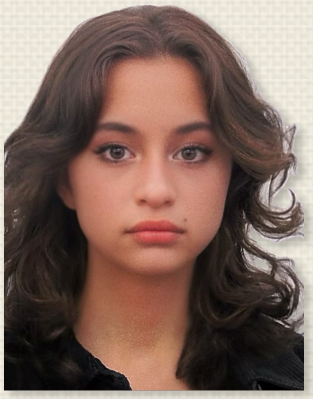
GIANNA LIMONGELLO



TITLE: *COMPARING RETURN-TO-SPORT TIMES FOLLOWING ACL DAMAGE USING THE BEAR METHOD VS. TRADITIONAL ACLR WITH BONE-PATELLAR TENDON-BONE GRAFT*

EXTRACURRICULARS: VARSITY SOCCER, VARSITY LACROSSE, SHARE, ABAM, WORLD CLASS FC ECNLRL 08, COMPASS LACROSSE, AYSO BUDDY, CIT FOR CHAPPAQUA TOWN CAMP AND TOTS CAMP

ANDREA MEZGRAVIS MIANI



TITLE: *THE EFFECT OF TRANSFER LEARNING ON PREDICTING DISSOLVED OXYGEN CONCENTRATIONS FROM OPTICALLY INACTIVE WATER QUALITY PARAMETERS*

EXTRACURRICULARS: NATIONAL CIRCUIT LINCOLN-DOUGLAS DEBATE, HGHS CO-DIRECTOR, SCIENCE OLYMPIAD TEAM EXECUTIVE, & CO-FOUNDED PHD (PALMER HILLS DEBATE) NON-PROFIT TO HELP UNDERFUNDED DEBATERS

EVA MILLERMAN



TITLE: *TESTING THE EFFICIENCY OF TARGETING PTK7 VS. EGFR THROUGH CAR T CELL THERAPY FOR NSCLC*

EXTRACURRICULARS: EXECUTIVE IN THE E.N.O.U.G.H. CLUB, VARSITY GIRLS SWIM AND DIVE, JV LACROSSE, QUAKER NOTES, JUNIOR CORPS AT THE MOUNT KISCO VOLUNTEER AMBULANCE CORPS, VOLUNTEER AT AN ESL TUTORING PROGRAM, WORK AS A LIFEGUARD AT THE BOYS AND GIRLS CLUB

SAMUEL MULLEN



TITLE: *BLOOD SAMPLE LEVELS OF MIR-1-3P AS PREDICTORS OF MYOCARDITIS AFTER THE COVID-19 VACCINE*

EXTRACURRICULARS: CLUB SOCCER ALL 3 YEARS, VIOLIN ALL THREE YEARS, SCIENCE GREELEY SECTION EDITOR PAST 2 YEARS, AND BOOK DONATION ASSOCIATION MEMBER PAST YEAR.

STELLA MYERS



TITLE: *ENHANCING MEMORY SKILLS IN PATIENTS WITH MILD COGNITIVE IMPAIRMENT: A NOVEL DIGITAL PLATFORM OF THE "FACE-NAME" PARADIGM*

EXTRACURRICULARS: CHAPPAQUA VOLUNTEER AMBULANCE CORPS, SAILING INSTRUCTOR, JV VOLLEYBALL, DEBATE CLUB, CLUB VOLLEYBALL, GEORGETOWN PRE-COLLEGE COURSE IN MEDICINE

LORELAI NOCCA



TITLE: *ADOLESCENT PREFERENCES FOR UPCYCLED FOOD BASED ON SENSORY ATTRIBUTES AND THE EFFECT OF A GIVEN DEFINITION OF UPCYCLED FOOD: A BLINDED CONTROL STUDY*

EXTRACURRICULARS: VARSITY GOLF, CLUB VOLLEYBALL, SPEECH AND DEBATE, VOLUNTEER WORK AT THE LIBRARY, JV VOLLEYBALL, JV FIELD HOCKEY, TRUMPET

KATHLEEN PASKOWITZ



TITLE: *THE IMPACT OF WASTEWATER TREATMENT PLANT UPGRADES ON ESTUARINE WATER COLUMN RESPIRATION IN JAMAICA BAY, NY*

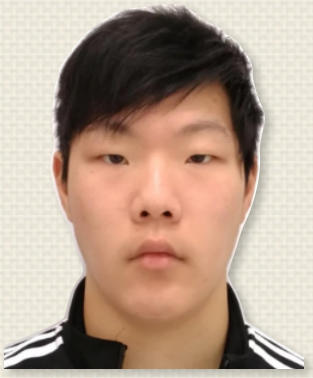
EXTRACURRICULARS: VARSITY FIELD HOCKEY, MAKE A WISH CLUB, MOUNT KISCO CHILD CARE CENTER VOLUNTEERING, ART FOR A CAUSE CLUB

MADDIE PETERS



TITLE: *THE EFFECT OF BRAF V600E MUTATION ON METASTATIC MELANOMA*

SHAWN QIU



TITLE: *COMPARING OUTCOMES OF COVID-19 INFECTED TRANSPLANT PATIENTS WITH NON-INFECTED COVID-19 TRANSPLANT PATIENTS*

EXTRACURRICULARS: CREATED BOOK DONATION ASSOCIATION CLUB AT SCHOOL (DONATES BOOKS TO PLACES IN NEED), JV WRESTLING, TEACHING ASSISTANT AT HUAXIA NEW YORK CENTRAL CHINESE SCHOOL

KYLE RIGGER



TITLE: *THE EFFECT OF A SUPERHYDROPHOBIC SURFACE ON MACROPHAGE ADHESION*

EXTRACURRICULARS: VARSITY FOOTBALL, VARSITY WRESTLING, & RENT-A-WRESTLER PROGRAM

EVE RUTMAN



TITLE: *THE EFFECT OF PRE-EXISTING CONDITIONS ON PNEUMATOSIS INTESTINALIS IN THE PEDIATRIC POPULATION*

EXTRACURRICULARS: VARSITY FIELD HOCKEY, SHARE CLUB EXEC, ABLE ATHLETICS CLUB, JV LACROSSE

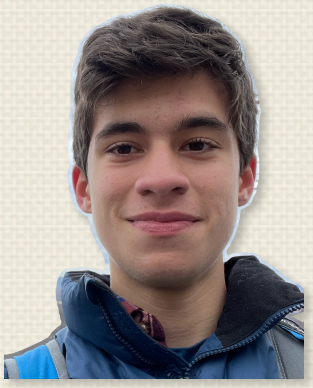
HADRIAN SANDT



TITLE: *SUBTRACTING THE SECOND ANTIBODY FROM SANDWICH ELISA*

EXTRACURRICULARS: ESP WORK, PIANO, BOOK DONATION ASSOCIATION, CHURCH'S YOUTH ORCHESTRA, APPLIED PROGRAMMING, ROBOTICS CLUB, INTERNED FOR ICAMP, TUTOR, CHINESE CLUB, TRACK & FIELD, TENNIS, WRITING, PURPLE BELT IN TAE KWON DO

BENJAMIN SCHIFRIN



TITLE: *A SYSTEMATIC EVALUATION OF THE DEGRADATION AND WEATHERING OF DYNAMIC COVALENT POLYMER NETWORKS*

EXTRACURRICULARS: SECTION EDITOR OF THE SCIENCE GREELEY MAGAZINE, CAPTAIN OF VARSITY TRACK & FIELD, SENIOR PATROL LEADER (BOY SCOUTS), GREELEY STAGE BAND, GREELEY JAZZ CLUB EXEC, PIANO, BARITONE SAXOPHONE, REGULAR VOLUNTEER OF THE FULLER CENTER FOR HOUSING OF GREATER NEW YORK CITY, MATH TUTOR

UMA SHARMA



TITLE: *THE EFFECT OF GENDER-SPECIFIC DIAGNOSTIC QUESTIONNAIRES ON EARLY DIAGNOSIS OF AUTISM SPECTRUM DISORDER IN FEMALES WITH IQ > 70*

EXTRACURRICULARS: MENTAL WELLNESS CLUB, CASE WESTERN RESERVE PRE-COLLEGE: “NEUROSCIENCE”, PRE-COLLEGE PSYCHOLOGY PROGRAM AT COLBY COLLEGE, YALE UNIVERSITY: “THE SCIENCE OF WELL-BEING FOR TEENS”, VARSITY SOFTBALL

JAKE SHEEHY



TITLE: *THE EFFECTS OF CLIMATE CHANGE ON HURRICANE STEERING WINDS CAUSED BY THE BERMUDA HIGH.*

EXTRACURRICULARS: VARSITY BASEBALL, VARSITY BASKETBALL, MAC ANGELS CLUB PRESIDENT, ORLEANS FIREBIRDS VOLUNTEER.

TESS SONNE



TITLE: *THE EFFECT OF AN EDUCATIONAL INTERVENTION ON TREATMENT-RESISTANT SCHIZOPHRENICS AGES 21-60*

EXTRACURRICULARS: JV SOCCER, MODEL UN, SHARE CLUB, CHAPPAQUA AMBULANCE CORPS. VOLUNTEER, RENAISSANCE CLUB

JASON STAUDENMAIER



TITLE: *THE IMPACT OF LARAZOTIDE ACETATE ON THE GUT MICROBIOME DIVERSITY IN CELIAC DISEASE PATIENTS MAINTAINING A STRICT GLUTEN-FREE DIET*

EXTRACURRICULARS: ANNUAL VOLUNTEER AT THE CELIAC DISEASE GALA, COTTAGE SCHOOL VOLUNTEER, FIRE DEPARTMENT VOLUNTEER, & WORKER AT BIRCHWOOD OVER THE SUMMER SIGNING IN GUESTS

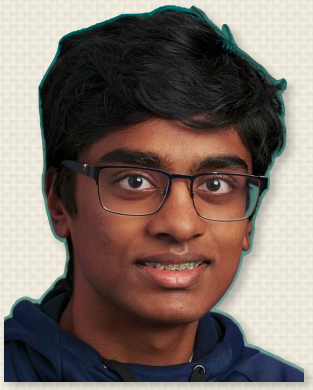
SAMUEL STRYKER



TITLE: *BUILDING A FRAMEWORK FOR QUANTUM ERROR MITIGATION*

EXTRACURRICULARS: VARSITY TRACK AND FIELD, CROSS COUNTRY, FIREFIGHTER AT THE CHAPPAQUA VOLUNTEER FIRE DEPARTMENT, SCIENCE OLYMPIAD, GREELEY FEEDING WESTCHESTER CLUB PRESIDENT

NAVEEN TALLA



TITLE: *UTILIZING SPATIAL TRANSCRIPTOMICS TO IDENTIFY FACTORS DRIVING MYOPATHY IN LONG-COVID PATIENTS*

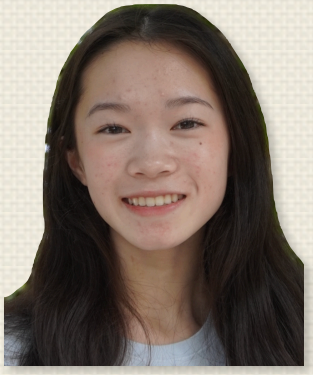
EXTRACURRICULARS: JV TENNIS, CHAMBER ORCHESTRA, SCIENCE GREELEY EDITOR, & MEMBER OF THE ACADEMIC CHALLENGE CLUB



JAXSON THOMAS

TITLE: *USING A CONVOLUTIONAL NEURAL NETWORK TO ANALYZE A BASKETBALL PLAYERS JUMPSHOT FORM*

EXTRACURRICULARS: VARSITY BASKETBALL. FOUNDER OF CODE FOR A CAUSE, & AAU BASKETBALL



EMMA TONG

TITLE: *THE EFFECT OF CERVICAL CONTUSION INJURIES ON THE ACTIVITY OF RESIDUAL MICROGLIA IN THE SPINAL CORD*

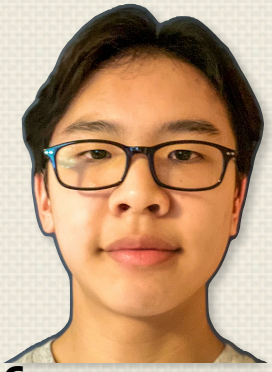
EXTRACURRICULARS: VARSITY SWIM, HOSA, INTERN AT ASSEMBLY MEMBER BURDICK'S OFFICE, STUDENT AT ART STUDENTS LEAGUE OF NEW YORK



SYDNEY TSAO

TITLE: ELUCIDATING THE RELATIONSHIP BETWEEN EZH2 AND SKP2 IN EMT REGULATION IN TUMOR GROWTH AND PROGRESSION: A RESCUE EXPERIMENT USING SKP2 PLASMID TO REVERSE THE EFFECTS OF EZH2 KNOCKDOWN

EXTRACURRICULARS: VARSITY CROSS COUNTRY, MODEL UN, SHARE, THE GREELEY VOICE, HOSA, CERAMICS

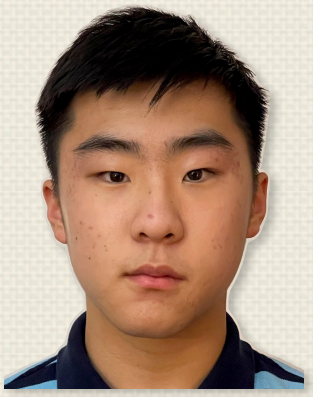


RUDOLF TSENG

TITLE: *TESTING CONFORMAL CYCLIC COSMOLOGY WITH THE COSMIC MICROWAVE BACKGROUND POWER SPECTRUM*

EXTRACURRICULARS: ROCK CLIMBING, SCIENCE OLYMPIAD, ROBOTICS, VIOLIN, TUTOR, CULTURAL AMBASSADOR,

BRADY WANG



TITLE: COMPARISON OF EFFECTS OF IGG AND IGE IMMUNOGLOBULIN ON THE EFFICACY OF ANTIBODY OLIGONUCLEOTIDE CONJUGATES FOR INHIBITION OF SOLID TUMORS

EXTRACURRICULARS: BIOLOGY CLUB, COOKS IN FREE TIME, SPEECH AND DEBATE VARSITY PUBLIC FORUM, VARSITY SWIM, & SCIENCE OLYMPIAD

SYEDA WANIA



TITLE: *MACHINE LEARNING APPROACH TO LIQUID BIOPSY BASED CANCER DETECTION AND SENSITIVITY*

EXTRACURRICULARS: NATIONAL SCIENCE BOWL & SCIENCE GREELEY

NEVIN WILDSTROM



TITLE: *THE EFFECT OF SODIUM-GLUCOSE COTRANSPORTER 2 INHIBITORS ON UNTREATED FELINE DIABETES*

EXTRACURRICULARS: SCIENCE OLYMPIAD, & BOY SCOUTS

RYAN ZHANG



TITLE: *GRADIENT FREE OPTIMIZATION FOR QUANTIZED LARGE LANGUAGE MODELS ON RESOURCE CONSTRAINED EDGE DEVICES*

EXTRACURRICULARS: FRC ROBOTICS(PRESIDENT OF SOFTWARE), PROGRAMMING CLUB(EXECUTIVE), HISTORY CLUB(CO-PRESIDENT), VARSITY TRACK AND FIELD

The Following Freshmen Are Currently Signed Up For Science Research Next Year

1. Brooke Ackerman
2. David Allen
3. Riya Aron
4. Jackson Barr
5. Christopher Correia
6. Emma Covey
7. Jason Dang
8. Owen Dirks
9. Jesse Dolch
10. Emma Feig
11. Caleb Fijman
12. Parvathy Gopikrishna
13. Thomas Gorkin
14. Anya Gunnar
15. Maya Harel
16. Lasya Hota
17. Andy Ji
18. Serene Jourdy
19. Ashna Khan
20. Emma Knapp
21. Madeline Lamb
22. Ben Leinberger
23. Isabella Liu
24. Shahak Livne-Tarandach
25. Livia Low
26. Anderson Marchesano
27. Tanish Mynampati
28. Andrew Nam
29. Chanakya Nayudu
30. Alexis Oh
31. Addison Pinnow
32. Ryan Ramirez
33. Saket Reddyjarugu
34. Olivia Regan
35. Jake Pickles
36. George Rojek
37. Mila Rymarczyk
38. Slara Samuelson
39. Srihaan Seelam
40. Nicholas Serini
41. Savannah Smith
42. Erin Suk
43. Ryan Sykes
44. Priyanka Talla
45. Connie Tao
46. Aadhya Vijil
47. Aditi Vijil
48. Emily Vu
49. Matthew Weissman
50. Matthew Wohlstädter
51. Allan Xu
52. Henry Cue
53. Kevin Yan
54. Edward Yang