



**Friday, August 22<sup>nd</sup>, 2025**  
**Queens College, CUNY**

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## About

The Queens College Undergraduate Research Symposium is an annual celebration of scholarly achievement, showcasing the innovative work of undergraduate students across a wide range of disciplines. Through engaging poster presentations and interactive discussions, participants share their research findings, creative projects, and original insights with peers, faculty, and the broader college community.

This event not only highlights academic excellence but also provides a valuable platform for students to refine essential skills in communication, critical thinking, and collaboration. It fosters a vibrant culture of inquiry, inspiring deeper engagement with knowledge and discovery.

This year, we are pleased to welcome undergraduate presenters from both our home institution and our sister CUNY college, LaGuardia Community College, reflecting our commitment to collaboration and the exchange of ideas across campuses.

## Agenda

<b>Friday, August 22<sup>nd</sup>, 2025</b>	
<b>9:45 AM to 2:15 PM</b>	
<b>Student Union Ballroom (4<sup>th</sup> Floor), Queens College</b>	
9:45 AM – 10:10 AM	Check-In for Guests and LaGCC Students
10:20 AM – 10:30 AM	Welcome and Opening Remarks
10:30 AM – 11:10 AM	Guest Speaker: Dr. Jennifer Valad and Q&A
11:15 AM – 12:05 PM	Poster Session 1
12:10 PM – 1:00 PM	Lunch
1:05 PM – 1:55 PM	Poster Session 2
2:00 PM – 2:15 PM	Closing Remarks Certificate and Swag Bag Distribution for Student Presenters

# Keynote Speaker



## Dr. Jennifer Valad

*The Power of Perspective:  
How Psychological Insight Shaped My Doctoral Journey*

Jennifer Valad, Ed.D. serves as the Substitute University Academic Affairs Director in the Office of Faculty Affairs at CUNY Central. She has extensive experience in grant-funded program management, faculty development, and student success initiatives across CUNY.

Previously, Dr. Valad served as Project Director for several federally funded grants, including *HSI-STEM: Bridges Across Eastern Queens*, a collaboration between Queens College and Queensborough Community College funded by the U.S. Department of Education. In this role, she oversaw learning collectives that placed peer mentors in introductory STEM classrooms to support ongoing pedagogical enhancements. She

later served as Project Director for Queensborough Community College's Title V grant, where she led the college's inaugural supplemental instruction program.

Her background also includes international faculty development through the Global Faculty Development program, a partnership between Queens College and Toyohashi University in Japan. In addition, Dr. Valad has taught as an adjunct in the Queens College psychology department for more than 15 years, contributing to the department's curriculum and DEI committees. A proud CUNY alumna, Dr. Valad earned her B.A. and M.A. in Psychology from Queens College and her Ed.D. in Learning and Organizational Change from Baylor University.

# Abstracts

# Afsheen Rahman, Ei Kay Khaing Myo, & Rojina Magar

*Nature's BARDS- Biotechnological, Artistic, Researchful Data Sonifiers' Nanobody Score Part 1*

## Authors and Affiliations

Afsheen Rahman<sup>1\*</sup>, Ei Kay Khaing Myo<sup>1,3\*</sup>, Rojina Magar<sup>1,3\*</sup>, Samantha Barrera<sup>2,3</sup>, Fatima Ali<sup>3</sup>, Jacob Sagrans<sup>3,4</sup>, and Thomas M. Onorato<sup>1,3#</sup>

<sup>1</sup>LaGuardia Community College,

<sup>2</sup>Santa Monica College,

<sup>3</sup>Antibody Engineers Hackathon 2025,

<sup>4</sup>Institute for Future Intelligence & Tumblehome, Inc.,

\*QSTEM Summer Research Academy Apprentice; #QSTEM Research Mentor

## Abstract

Nanobodies are very small single-domain antibodies, derived from camelids (Hamers-Casterman et al., 1993). Nanobodies are a versatile tool in multiscale imaging and have increasing value as imaging tools and molecular diagnostics for pathologies (Erreni et al., 2022). There is a need to develop nanobody-specific computational protocols and approaches to deliver life-saving cellular therapeutics. Additionally, basic research with unique model organisms such as echinoderms (e.g. sea stars, sea urchins, etc.) that have potential roles in translational research in areas like reproduction and regeneration (Oulhen et al., 2024; Oulhen et al., 2016) is impeded by the lack of commercially available antibodies, and even fewer nanobodies, that recognize echinoderm proteins. Therefore, we ask can sound, more specifically musical patterns, be used to identify and design nanobodies that bind sea star proteins? Nature's BARDS is exploring the use of music as a novel tool to characterize nanobody-antigen binding interactions. Here we report our preliminary steps in translating nanobody sequences into musical compositions to inform and enhance nanobody design. We used Python-based algorithms to convert amino acid sequences into musical notes by mapping each amino acid to a specific pitch or frequency. The resulting compositions were exported as MIDI or WAV files for auditory and visual pattern analysis. All code and documentation will be publicly available through GitHub to ensure reproducibility and open collaboration. Ultimately, we aim to develop an innovative and functional music-based bioinformatics STEA(arts)M approach to nanobody design.

**Faculty Mentor:** Dr. Thomas Onorato

**Research Area:** Computational Biology

# Amrin Karim

*Gentrification: The Price to Pay for Affordable Housing and Community Investment in Jamaica, Queens*

## **Authors and Affiliations**

Amrin Karim, Department of Urban Studies, Queens College, CUNY

Dr. Natalie Vena, Department of Urban Studies, Queens College, CUNY

## **Abstract**

The New York City Department of City Planning has introduced the Jamaica Neighborhood Plan, a major rezoning proposal to transform 344 blocks in downtown Jamaica and surrounding areas. As a form of up zoning, there will be new housing units, promotion of mixed-use zoning, and changes to zoning to permit high-rise development to drive real estate investment in the area. While the plan mandates that developers include affordable housing in new residential buildings, its “mandatory inclusionary housing” quotas are insufficient to prevent the displacement. Of the 12,000 units projected, 4,000 will be affordable. The influx of 8,000 market-rate units will increase rents and property taxes in the region, while only 800 of these affordable units will be accessible to residents. Following the settlement of a lawsuit regarding lottery housing, lottery units will no longer be 50% reserved for residents in low-income areas and will decrease to 15%-20% over the next years for non-local residents to move in, by encouraging racial integration in predominately Black and Latino neighborhoods. Queens Borough President Donovan Richards has stated that the average tenant in these 4,000 affordable units will be making 60% of AMI (Area Median Income) which in 2025, is \$59,580 for a single person and \$85,080 for a family of four. This is significantly higher than the incomes of the residents in Jamaica. The data from the U.S. 2020 Census and the 2019-2023 American Community Survey demonstrate that the plan’s anticipated affordable units will fail to meet the needs of Jamaica, Queens, where the median income is roughly \$57,630 in an area of 65,971 people. Public testimony helps analyze why parties oppose and support the plan based on social positions, economic interests, and political agendas. The research addresses whether up zoning is positive or detrimental for communities of color facing socioeconomic challenges.

**Faculty Mentor:** Dr. Natalie Vena

**Research Area:** Urban Studies

# Andrew Napoletano

*The Effect of Gravid State on Locomotion in Daphnia magna: Exploring Speed and Movement*

## **Authors and Affiliations**

Andrew Napoletano<sup>1</sup>

Maral Tajerian<sup>1</sup>

Sebastian Alvarado<sup>1</sup>

<sup>1</sup>Department of Biology, Queens College, CUNY

## **Abstract**

*Daphnia magna*, also known as water fleas, are essential species that are crucial for freshwater ecosystems, playing a role in controlling phytoplankton and serving as a prey for larger organisms. Their movement affects as well as impacts energy allocation, predator avoidance, and overall fitness, yet the impact of reproductive status on locomotion remains unclear. Through this research, I investigated swimming speeds of gravid and non-gravid by recording videos and analyzing with TReX tracking software and Spyder. We discovered that gravid *Daphnia*, on average, swim faster and are less likely to remain stationary compared to non-gravid individuals. These findings suggest that gravid state influences movement patterns, potentially as behavioral adaptation to reduce predation risk despite increased size despite being larger. This work provides insight into the relationship between reproduction and mobility, with implications for understanding population dynamics and trophic interactions in aquatic ecosystems.

**Faculty Mentor:** Dr. Sebastian Alvarado

**Research Area:** Biology

# Ashley Jew

*The Advantages of Continuous Sensors for Understanding Mechanisms of Dissolved Oxygen Depletion in Urban Embayments.*

## **Authors and Affiliations**

Ashley Jew

Gregory O'Mullan

<sup>1</sup>School of Environmental Science, Queens College, CUNY

## **Abstract**

Traditional low-frequency discrete water quality monitoring programs, used to inform environmental management decisions, may miss ephemeral low dissolved oxygen (DO) conditions and therefore mischaracterize the full range of variability caused by combined sewage overflow (CSO) pollution. Low DO conditions can be a source of waterway impairment and contribute to fish-kill events, degraded water quality, and greenhouse gas emissions. Thus, investigating the advantages of continuous sensor monitoring can strengthen our understanding of the mechanisms driving DO depletion improve coastal management decisions, and better inform pollution reduction efforts. This study aimed to 1) determine if DO measurements from discrete monitoring programs differ from continuous sensors, 2) identify what factors contribute to low DO levels, and 3) determine if higher frequency data allows better understanding of waterbody dynamics and the predictability of hypoxia and anoxia. Continuous Onset HOBO loggers were deployed in Flushing Bay from July-September 2024 to measure DO, pressure, and conductivity at 15-minute intervals. Discrete and continuous data were compared to investigate differences in the central tendency and range of the observed values. Factors such as precipitation, tide, and time of day were compiled with continuous DO data to identify drivers of low oxygen conditions. The central tendencies of discrete vs continuous sensor records revealed no significant difference; however, the range of continuous data captured larger DO variability and indicated instances of waterway impairment from hypoxia. Periods of lowest DO tend to occur at low tide closest to dawn, and periods of prolonged hypoxia tend to occur a few days after heavy rainfall. Continuous oxygen sensors demonstrate Flushing Bay is subject to frequent and sustained periods of hypoxia/anoxia in summer, which traditional monitoring does not reveal. Continuous data suggests that the waterway should be considered impaired for DO. A reevaluation of water quality monitoring practices and focus on reducing CSO source inputs are needed.

**Faculty Mentor:** Dr. Gregory O'Mullan

**Research Area:** Environmental Science

# Bessie Velasquez Galdamez

*Characterization of Shea, Pseudomonas aeruginosa Virus Levels*

## Authors and Affiliations

Bessie Velasquez<sup>1</sup>

Crystal Matos<sup>1</sup>

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<sup>1</sup>Department of Biology, Queens College, CUNY

<sup>1</sup>Department of Biology, Queensborough Community College, CUNY

## Abstract

*Pseudomonas aeruginosa* is a major opportunistic pathogen, noted for its antibiotic resistance, its capacity to grow in biofilms, and its role in severe healthcare-associated infections. Bacteriophages, viruses that infect only bacteria, offer a promising complementary strategy to fight antibiotic resistant bacteria. Phage therapy, the use of phages to kill susceptible bacteria, is gaining ground as a tool to cure antibiotic resistant bacterial infections. Phages offer several advantages, including high specificity for targeted bacteria and the ability to penetrate biofilms. Therefore, new phages that infect *P. aeruginosa* need to be characterized and studied. This project examines Shea, a *P. aeruginosa* phage, with the goal of understanding its life cycle and distinct characteristics. This phage was isolated from soil close to the Shea stadium in Queens, NY: it was visualized using Transmission Electron Microscopy and the phage has been sequenced. To further characterize the Shea phage lifestyle, we compared its behavior to a confirmed lytic phage. Lysis curves for Shea were done using plate reader assays. Our *P. aeruginosa* strain is infected by the filamentous bacteriophage Pf4. This phage plays a complex role, influencing biofilm formation, antibiotic resistance, and virulence of the bacteria. To investigate if the presence of Pf4 had any effect on the Shea infection we measured lysis time and burst size of Shea when infecting an engineered *P. aeruginosa* strain that lacks Pf4. Single cell lysis was visualized using a CellASIC ONIX microfluidic platform. Shea *P. aeruginosa* colonies were characterized using Polymerase Chain Reaction. Our results show that Shea behaves differently than a confirmed lytic phage. However, the sequencing data suggests Shea does not integrate into the bacterial chromosome. We discuss possible lifestyles for Shea and its potential use for phage therapy.

**Faculty Mentor(s):** Dr. John Dennehy and Dr. Monica Trujillo

**Research Area:** Microbiology

# Candy Shen

## *The Effect of Gravid State on Locomotion in Daphnia magna: Exploring Speed & Movement*

### **Authors and Affiliations**

Afsheen Rahman, Candy Shen, Anas Es-souli, and Luigi Arias

LaGuardia CC, QSTEM Research Academy Apprentices, Dr. Thomas M. Onorato, Faculty Mentor

### **Abstract**

We sonified KN035, a cancer-targeting nanobody, and TP53, a tumor suppressor gene. KN035 binds to PD-L1, a protein that helps cancer cells evade immune attack. We extracted its amino acid sequence from PDB entry 5JDS and assigned each amino acid a unique frequency based on a predefined vibrational scale, then used Python to generate audio from that sequence. Amino acids forming hydrogen bonds with PD-L1 were emphasized, since they play a key role in binding strength and stability. We identified these bonding residues using the PDBsum database. We assigned frequencies 440 Hz to 1318 Hz to the full sequence and 466 Hz to 1244 Hz to the hydrogen bond residues, marked with overlay tones. We also produced a frequency graph in Python, highlighting hydrogen bonds as red dots.

We also created a website that converts gene sequences into musical notes called “Genome Music Synth”. It allows users to assign different instruments and frequencies to each sequence. Using this tool, we sonified the TP53 gene, which encodes a critical tumor suppressor protein. TP53 regulates cell division which prevents the formation of cancer. By adjusting instruments and pitch, we could hear variations in sequence patterns and compare them to other proteins.

By translating amino acid and gene sequences into vibrational frequencies, we can explore patterns that may be harder to spot visually. This combination of sonification, visualization, and interactivity offers an alternative way for researchers and learners to engage with complex molecular structures for better understanding of cancer immunotherapy.

**Research Area:** Computational Biology

# Devorah Moadab

*Iodine catalyzed preparation of 2,3-dihydrofurans and cyclopropanes*

## Authors and Affiliations

Devorah Moadab<sup>1</sup>, Ethan Choi<sup>1</sup>, Samuel Hee<sup>1,2</sup>, Yu Chen<sup>1,2</sup>

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<sup>2</sup>. The Graduate Center, City University of New York, New York, NY, USA.

## Abstract

Iodine-catalyzed oxidative coupling reactions between benzoylacetonitrile and styrene are being investigated, as they can either produce 2,3-dihydrofurans or cyclopropanes. It has been observed that the use of varying oxidants—and the resulting pH—significantly affects the regioselectivity. When benzoylacetonitrile is reacted with styrene in the presence of iodine and ammonium persulfate, a 4-cyano-2,5-diphenyl-2,3-dihydrofuran is formed. The acidic environment generated by ammonium persulfate favors the formation of a 2,3-dihydrofuran. When tert-butyl hydroperoxide replaces ammonium persulfate in this reaction, conditions are basic, and 1-benzoyl-2-phenylcyclopropane-1-carbonitrile formation is observed. The aim of our research is to investigate the underlying mechanism of this reaction.

**Faculty Mentor:** Dr. Yu Chen

**Research Area:** Organic Chemistry

# Deyon Wijewardana

*BitHelix: translating digital files into biologically viable DNA sequences while safeguarding data integrity.*

## Authors and Affiliations

LaGuardia CC, QSTEM Research Academy Apprentices, Dr. Thomas M. Onorato, Faculty Mentor

## Abstract

BitHelix is a full-stack, reversible DNA storage pipeline designed to translate arbitrary digital files into biologically viable DNA sequences while safeguarding data integrity. The system uses a Python-based backend and a React/Next.js frontend to perform encoding, decoding, error correction, constraint validation, and visualization.

During encoding, BitHelix transforms binary data into base-4 and applies configurable Reed–Solomon error-correction codes to bolster reliability. Constraint-aware sequence validation ensures synthesized strands meet biosynthesis requirements, including GC content balance, homopolymer avoidance, and detection of unstable motifs. The resulting DNA-format output is optimized for both synthesis and sequencing.

The backend, built with FastAPI, supports seamless RESTful interactions with the frontend, enabling file uploads via drag-and-drop UI and real-time analyses of encoded DNA. Users can switch between encoding and decoding modes—entering FASTA inputs to retrieve original files or exporting DNA sequences and decoded outputs.

BitHelix supports a broad range of input file types (text, images, PDFs, audio, archives) and provides detailed sequence analysis metrics including GC percentage, homopolymers, motif frequency, sequence lengths, and file size comparisons. The system offers multiple launch options: a one-command startup or separate manual runs for backend and frontend. Command-line operation remains available for flexibility, with `main.py` enabling encode/decode operations.

By coupling robust error correction, constraint-aware design, and accessible UI/CLI interfaces, BitHelix advances the practical implementation of DNA-based digital storage across diverse formats and user workflows.

**Faculty Mentor:** Dr. Thomas M. Onorato

**Research Area:** Computational Biology

# Donna Shair

*Lexical Effects on Vowel Quality of like in Speakers of NYCE*

## **Authors and Affiliations**

Donna Shair (Department of Linguistics and Communication Disorders, Queens College, CUNY)

## **Abstract**

The study of words with multiple different functions that share a single wordform in colloquial speech reveals patterns in reduction that allow us to better understand language shifts. Previous sociophonetic research suggests that productions of these kinds of words, specifically in the instance of like, contain minute phonetic differences that are based on the word's function and can index certain social traits, such as what ethnic group a speaker belongs to. More recent analyses of sociolinguistic trends reveal an ongoing shift towards a more raised /aɪ/ vowel in speakers of New York City English (NYCE). My research aims to further understand the link between word function and phonetic production, and whether this fits into the ongoing NYCE vowel shift. A total of 17,114 tokens from 140 different speakers across New York were extracted from the CoNYCE corpus (an audio-aligned database of New Yorkers' speech) and processed to find possible phonetic differences based on lexical category. This poster investigates phonetic properties of the /aɪ/ vowel in four different functions of the word like (verb, adverb, discourse particle, and quotative). Using R, Formants 1 and 2, as well as vowel duration in milliseconds, were each plotted against function, speaker ethnicity, and speaker sex in a set of linear mixed effects regression models. Though data analysis is ongoing, preliminary findings suggest that verbal like is most different from other categories in terms of vowel height (F1) and duration, whereas quotative and adverbial like are most different in terms of vowel frontness (F2). This finding provides support for the idea that phonetic differences in words are conditioned by function in speakers of NYCE. LmerTest will be performed to determine any link between ethnicity, sex, and differences in like production.

**Faculty Mentor:** Dr. Bill Haddican

**Research Area:** Linguistics

# Elissa Patin

*A Language Learning Tool for Garifuna*

## **Authors and Affiliations**

Elissa Patin (Department of Linguistics and Communication Disorders, Queens College, CUNY)

Daniel Kaufman (Department of Linguistics and Communication Disorders, Queens College, CUNY)

## **Abstract**

Garifuna is an Arawak language spoken by a transnational population of African and Indigenous descent who trace their history to St. Vincent in the Lesser Antilles. Presently, the future of Garifuna rests with a generation whose exposure to the language decreases decade by decade. Due to its highly complex word structure, Garifuna is a daunting language for second language learners. Grassroots revitalization efforts throughout Central America and the diaspora seek new pedagogical tools for teaching the complex grammar of Garifuna.

Six popular computer-assisted language learning (CALL) tools were examined in how they teach Turkish, a similarly agglutinative language (words are made up of smaller units threaded together). Only the language learning application Drops broke down Turkish words into their morphological components, but it did not teach the meaning and function of each component. For this project, a CALL tool prototype was developed that guides the user to build and generate words out of smaller parts. The words and their corresponding English translations are color-coded so that the word structure is broken down in a visual manner. Two versions of the prototype, which differ in how descriptive information is displayed, have been sent out to 12 participants who have no prior exposure to Garifuna. The corresponding survey data is still being collected.

The present project adapts a derivational word-building analysis for pedagogical purposes using a web app. The grammatical components are coded visually in a way that clarifies their meanings and correspondence to the learner's first language. The goal is to replace rote memorization of conjugation tables with a more scientific approach based on general linguistic principles of word-building. If successful, this program could be adapted to myriad other endangered indigenous languages whose communities face a similar struggle.

**Faculty Mentor:** Dr. Daniel Kaufman

**Research Area:** Linguistics

# Hanan Latiff

## *Effect of Gabapentin on Neuropathic Pain in Prrxl1-KO Mice*

### **Authors and Affiliations**

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<sup>2</sup>Master's in Behavioral Neuroscience, QC CUNY

<sup>3</sup>Transfer for Stem Student Success, CUNY

<sup>4</sup>CUNY Graduate Center

### **Abstract**

Paired related homeobox protein-like 1 knockout (Prrxl1-KO, DRG11-KO) mice are candidate models of neuropathic orofacial pain, exhibiting aberrant grooming and self-injury behaviors that may reflect chronic discomfort. Prrxl1 mice lack somatotopic organization in the barrel cortex and show aberrant peripheral connectivity, leading to facial hyperalgesia and rear body hypoalgesia. The gate control theory of pain suggests that fine touch suppresses pain, positing grooming behavior as a measure of pain.

Building on previous work suggesting that Carprofen reduces evoked peripheral pain but not neuropathic grooming behaviors in Prrxl1 mice, we examined the effect of Gabapentin, a GABA agonist commonly used to treat neuropathic pain. Mice received Gabapentin or Sham injections and were recorded in their home cages, with behaviors evaluated for grooming, locomotion, and exploration using machine vision tools.

Behavioral analysis followed the same framework used in the Carprofen and Sham groups, enabling direct comparison of grooming frequency, duration, and activity patterns across treatments. This allowed us to test whether Gabapentin altered grooming in DRG11-KO mice.

**Faculty Mentors:** Dr. Giuseppe Cataldo and Gaozhen Li

**Research Area:** Neuroscience

# Hector Cordova

*Detecting drainage basin rearrangements due to lithologic heterogeneity*

## **Authors and Affiliations**

Hector Cordova<sup>1</sup>, Pedro Val<sup>1</sup>

<sup>1</sup>School of Earth and Environmental Sciences, Queens College, CUNY

## **Abstract**

Drainage divides are key features in landscape evolution, separating river networks and regulating the movement of water, sediment, and nutrients. These features can monotonically migrate due to a cross-divide erosional imbalances or rapidly via river capture events. Tectonically quiescent landscapes are mistakenly thought to be at or near equilibrium due to slow erosion rates and/or uniform precipitation rates. In areas with lithologic heterogeneity, variability of rock erodibility causes perturbations of base level. It can be a first-order influence on drainage divide migration, even in divides situated away from lithologic contacts. While it is straightforward to identify tectonic and/or climatic influences of divide migration, the role of lithology is less well understood. Here, we aim to identify drainage network reorganization due to lithologic perturbations of base level. Landscape evolution numerical modeling shows that when hard rocks outcrop, large drainage basins crossing them tend to expand at the expense of neighboring, parallel-flowing smaller drainage basins. Therefore, the distribution of drainage area for basins upstream of the lithologic transition (soft-to-hard in the downstream direction) systematically varies as a function of time since the outcropping of the hard rock, with small basins disappearing over time. Furthermore, the loss of drainage area drives wholesale surface uplift of the shrinking basins, producing positive relationships between drainage area and elevation during the transient phase. We examined the drainage areas and their relationship with elevation and relief in the San Rafael Swell and the Appalachian Plateau, both marked by soft-to-hard lithologic transitions in the downstream direction. We observe positive relationships between drainage area, relief, and elevation, consistent with numerical modeling results. These correlations suggest that basins in these landscapes are systematically changing size in response to lithologic control of base level. Our results suggest that drainage area distributions can reveal drainage network reorganizations in response to lithologic heterogeneity.

**Faculty Mentor:** Dr. Pedro Val

**Research Area:** Geomorphology

# Hemlata Gocool

## *Genetic Transformation of Ceratopteris richardii to Evaluate Phytochrome 1 Photoreceptor Function*

### **Authors and Affiliations**

Hemlata Gocool, Biology, Queens College, CUNY

May Myat Moe, Biochemistry, CUNY Graduate Center

Kelly Tatiana Garcés Trujillo, Biology, Queens College, CUNY

### **Abstract**

Light-mediated signaling pathways are essential for plant growth and development with individual photoreceptors responsible for specific roles within the process. The phylogenetic position of ferns provides unique opportunities to study the evolution of these photoreceptors. *Ceratopteris richardii* is a model fern that produces photoreceptors—phytochromes, cryptochromes and phototropins—which are conserved across lower and vascular plants. It can easily be genetically manipulated, with a shorter growth period compared to other ferns. The focus of this study, full-length phytochrome 1A cDNA, was cloned into an entry vector and sequenced, alongside a negative control phytochrome 1A containing an early stop codon, then recombined into compatible destination shuttle vectors pMDC 43 and pMDC 83. Plasmid amplification and maintenance in *E. coli* is consistently tested using minipreps and gel electrophoresis for verification and bulking constructs in preparation for stable transformation into *C. richardii* callus tissue via particle bombardment. The phenotypic results due to overexpressing lines of the transformed ferns will be monitored to aid in determining the roles of phytochrome 1A within the signaling pathway and inform the evolutionary history of the gene itself.

**Faculty Mentor:** Dr. Timothy W. Short, Department of Biology, Queens College, CUNY

**Research Area:** Molecular Biology

# Jiale Lin, Justen Gallagher, & Melvin Schwartzbart

*Hudson River Park Project*

## **Authors and Affiliations**

Students: Jiale Lin, Justen Gallagher, Melvin Schwartzbart

Faculty Mentors: Shenglan Yuan, Yun Ye

Department of Mathematics, Engineering and Computer Science (MEC)

QSTEM Research Academy Research Scholars

## **Abstract**

Underwater anthropogenic noise has become a growing concern for aquatic ecosystems, impacting organisms across the entire marine food web. Research has shown that noise pollution from human activities like shipping, construction, and recreational boating, can alter behavior, impair hearing, and disrupt physiological processes in marine life, ultimately threatening biodiversity. This project investigates the three-dimensional distribution of artificial noise in the Hudson River Estuarine Sanctuary, a high-traffic area for both commercial and recreational vessels.

Using a vertical array of three synchronized hydrophones spaced one meter apart and deployed from 2 to 4 meters below the surface, sound data is collected at two locations (Pier 97 and Pier 26) during multiple scheduled time intervals. The hydrophones capture a frequency range of 10–70 kHz, and recordings are synchronized via a multi-channel recorder operating at 96 kHz. GPS tracking and video footage of vessel activity are integrated with acoustic data to identify and correlate noise levels with specific surface events. The collected measurements will be used to generate a high-resolution 3D noise map and compared to prior studies to estimate potential ecological impacts on the estuarine ecosystem. Calculating different sound pressure levels from our recordings on MATLAB will allow direct comparison with thresholds established by the National Oceanic and Atmospheric Administration, providing a quantitative framework for assessing biological risk. Unlike previous single-sensor studies, this methodology captures simultaneous depth-resolved measurements, enabling a more accurate characterization of noise sources and their propagation. The results aim to inform long-term research initiatives, enhance public awareness, and guide conservation strategies for improved protection of aquatic wildlife habitats in the Hudson River.

**Faculty Mentors:** Shenglan Yuan and Yun Ye

# Jillana Mariele Mendoza & Jennifer Guaman

*PM<sub>2.5</sub> and Public Health in NYC Transit: Evaluating Commuters' Exposure Differences Between Underground and Above-Ground Subway Stations*

## **Authors and Affiliations**

Jillana Mariele Mendoza, CUNY LaGuardia Community College & QSTEM Scholar, Jennifer Guaman, CUNY LaGuardia Community College & QSTEM Scholar, Dr. June Morrison-Jones, CUNY LaGuardia Community College & Mentor Naomi Abel, Mentor QSTEM Research Academy Research Scholars

## **Abstract**

Particulate matter (PM) presents a serious public health risk. PM<sub>2.5</sub>, in particular, penetrates deep into the lungs and other organs, affecting the respiratory, cardiovascular, and cerebrovascular systems. In the New York City subway system, PM<sub>2.5</sub> originates from train emissions as well as from subway-specific sources such as rail friction and brake wear. This exposes commuters to elevated levels of PM<sub>2.5</sub> on a daily basis. This study hypothesizes that individuals frequently exposed to elevated concentrations of PM<sub>2.5</sub> through regular subway commuting may face an increased risk of developing respiratory and cardiovascular conditions compared to those with lower exposure levels. Although New York City meets the National Ambient Air Quality Standard (NAAQS) for PM<sub>2.5</sub>, maintaining an annual average below 9  $\mu\text{g}/\text{m}^3$  and a 24-hour average below 35  $\mu\text{g}/\text{m}^3$ , localized concentrations within the subway system may exceed these thresholds, warranting closer examination. Understanding PM<sub>2.5</sub> exposure is both timely and essential given NYC's extensive transit system, with over one billion annual riders and 472 stations. To quantify commuter exposure, we used the AirBeam 3 device and AirCasting mobile app to measure PM<sub>1</sub>, PM<sub>2.5</sub>, and PM<sub>10</sub> concentrations across four stations. Data was collected at two underground stations (Roosevelt–Jackson Heights & Flushing–Main Street) and two above-ground stations (Gun Hill Road & Freeman Street) during weekday peak and off-peak hours. Results show significantly higher PM<sub>2.5</sub> levels in underground platforms with multiple train lines, especially during peak hours, suggesting increased health risks and the need for targeted mitigation strategies.

**Faculty Mentors:** Dr. June Morrison-Jones and Naomi Abel

**Research Area:** Environmental Science

# Jazmin Solorio Pulido

*Investigating Social Communication in Boys and Girls with a Fragile X Premutation.*

## **Authors and Affiliations**

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## **Abstract**

Fragile X Premutation (FXPM) is defined as the FMR1 gene containing 55-200 CGG repeats. Previous research has found mild social difficulties in some FXPM children. The objective of the current study was to determine if children with FXPM were at increased risk for autism spectrum disorder (ASD), and whether boys with FXPM were at greater risk than girls with FXPM. 152 children aged 8-13 years were recruited from a larger study identified via prenatal genetic testing. 72 had FXPM and 80 were controls. The Social Communication Questionnaire (SCQ) lifetime version was used to screen for Autism Spectrum Disorder (ASD). The SCQ contains 40 yes/no response questions focusing on a parent-report of their child's social interaction, communication, and behaviors. SCQ scores were dichotomized such that >12 was coded as increased risk of ASD and scores 0-11 were coded as within normal limits. Chi-square tests determined group differences. Age was not significantly different between FXPM children and control children (mean  $\pm$  SD; FXPM = 94.38  $\pm$  25.20, Control = 89.03  $\pm$  32.11;  $t = -1.026$ ,  $p = .153$ ). Risk of ASD did not differ between the groups: there were 2/70 controls (2.6%) and 6/77 FXPM (8.6%) participants with elevated SCQ scores ( $\chi^2 = 2.543$ ,  $p = 0.111$ ). Additionally, no sex differences were noted in SCQ scores ( $\chi^2 = 0.199$ ,  $p = 0.656$ ): 3/29 (10.3%) of FXPM girls and 3/41 (7.3%) of FXPM boys had an elevated SCQ score. Children with FXPM did not score significantly higher on the SCQ, and there were no sex differences among children with FXPM. Results did not suggest that children with a FXPM are at higher risk of ASD.

**Faculty Mentor:** Dr. Veronica Hinton

**Research Areas:** Neuropsychology

# Joanne Sun

## *Egg Masses, Muscles, and Morphology: Shaping Marine Gastropods*

### **Authors and Affiliations**

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### **Abstract**

Marine gastropods, or sea snails and sea slugs, are a diverse group within the phylum Mollusca with about 30,000 species. Despite their ecological importance, many remain poorly studied in terms of reproduction and life history. To address this gap, we examined the embryonic development and adult morphology of *Haminoea* sp. (bubble snail), *Aplysia* sp. (sea hare), and *Elysia crispata* (lettuce sea slug). *Haminoea* species have a classic dorsal shell that emerges during embryonic development. *Aplysia* sp. has a reduced internal for organ protection. *Elysia crispata*, a true sea slug, loses its shell during juvenile development. This provides a unique opportunity to explore how shell reduction or loss relates to reproductive strategies and ecological adaptation and shed light on the evolutionary pressures that shape marine invertebrate diversity.

We began by examining egg masses and embryonic development of each of the three species. The hypothesis was that since *Haminoea*, *Aplysia*, and *Elysia* all produce juveniles with dorsal shells, differences in adult patterns might emerge after hatching. Due to the continuous supply of *Haminoea* embryos (approximately 1 egg mass per day), we performed in-depth analysis of their growth, feeding behaviors and development. Over a 2–3-week period, *Haminoea* embryogenesis was documented from the 2-cell stage, and fluorescence staining revealed differences in localization of nuclei (DAPI) and filamentous actin (phalloidin) within the cells, while EdU labeling identified regions of cell division and potential stem cell populations. Algal feeding assays were used to assess the influence of diet on development in *Haminoea* embryos and *Elysia* adults over 5–6 weeks. Comparative analyses of adult anatomy highlighted differences in feeding strategies and reproduction among the three species. Collectively, these findings provide insight into how morphology, life history, and diet interact in shaping species' ecological niches, offering a framework for understanding evolutionary divergence in marine gastropods.

**Faculty Mentor:** Dr. Timothy DuBuc

**Research Area:** Biology, Embryology, Marine Invertebrate Biology

# Kabina Purja & Jennifer Jean Louis

*Development of Potential Irreversible Dual-Action Inhibitors of Nek2 and EGFR Kinases for Treatment of Metastatic Cancers*

## **Authors and Affiliations**

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## **Abstract**

The Never-In-Mitosis-A (NIMA)-related kinase 2 (Nek2), a serine/threonine kinase, plays critical roles in the regulation of cell cycling, centrosome integrity, cilia activity, and DNA splicing. The epidermal growth factor receptor (EGFR), a receptor tyrosine kinase, regulates cell growth, survival, and differentiation. Studies have shown that the overexpression and dysregulation of both Nek2 and EGFR are associated with a wide variety of aggressive cancers, such as triple-negative breast, cervical, and ovarian cancers. There are EGFR inhibitors in clinical trials, however there are currently no small molecule Nek2-specific inhibitors that have advanced to clinical trials. In our laboratory, using a Nek2 overexpression model in *Drosophila melanogaster*, we have identified a novel, non-toxic, quinoline-based pharmacophore from a library of EGFR inhibitor candidates that also inhibits Nek2 activity in a competitive manner. We therefore hypothesize that a small molecule dual-action inhibitor of both Nek2 and EGFR will yield potent anti-cancer activities. To test this hypothesis, we have developed a synthetic strategy to generate a library of quinoline-based inhibitors of both Nek2 and EGFR kinases. The design of the molecular structures of the potential inhibitors are based on preliminary studies from Computational Binding Models. We predict that our library of dual-action inhibitors will yield a greater therapeutic index in cancers with both Nek2 and EGFR overexpression.

**Faculty Mentor:** Joshua Mukhlall, Ph.D.

**Research Area:** Chemistry

# Kevin Bermejo

## *Using Multimodal Time Series Data to Predict Language Outcomes in Infants at Familial Risk for Autism*

### **Authors and Affiliations**

Kevin Bermejo

Department of Psychology, Queens College, CUNY

### **Abstract**

Altered sensorimotor signatures, including heightened motor variability during sleep and atypical motor attunement during speech, are among the earliest detectable features in infants at high familial risk (HR) for autism spectrum disorder (ASD; Denisova & Zhao, 2017; Denisova, 2019; Denisova & Wolpert, 2024). This study investigated: (1) sensorimotor activity across EEG-defined sleep stages in HR and low-risk (LR) infants, (2) language exposure and caregiver-infant interaction using Language Environment Analysis (LENA), and (3) whether combining physiological and environmental measures enhances prediction of early outcomes and ASD-related traits.

For the HR infant (Subject 02), EEG revealed fragmented sleep across 250.85 minutes (Wake = 60.53 %, Transitional = 18.41 %, NREM = 4.44 %, Movement = 16.41 %). Accelerometry showed persistent, high-intensity activity (Average Movement Range = 3.2011 mm; Standard Dev. of Speed = 0.3313 mm/s; CoV = 0.0188). LENA recorded a decline in Adult Word Count (AWC; 1,816.81 → 346.51) and low Conversational Turns (CTC; Avg. 29.5), aligning with reports that maternal responses to HR infants are less reciprocal (Leezenbaum et al., 2014).

In contrast, the LR infant (Subject 02) displayed stable sleep over 102.58 minutes (NREM = 97.56 %, Movement = 2.44 %). Accelerometry indicated low-intensity, low-variability movement (Average Movement Range = 1.0218 mm; Standard Dev. of Speed = 0.0876 mm/s; CoV = 0.0055). LENA revealed a richer, reciprocal language environment, with AWC > 750 on both days and higher CTC on Day 1 (37 turns), consistent with typical early social communication.

These multimodal contrasts suggest that elevated sensorimotor variability, reduced NREM sleep, and limited caregiver reciprocity jointly mark developmental risk. Integrating high-resolution movement, EEG-based sleep staging, and naturalistic language sampling provides a promising, non-invasive framework for identifying early biomarkers of atypical trajectories and informing timely intervention strategies.

**Faculty Mentor:** Dr. Kristina Denisova, PhD

**Research Area:** Developmental Neuroscience

# Kristen Sosa

## *Migration Patterns of Live Daphnia Within the Presence of Daphnia Carcasses*

### **Authors and Affiliations**

Kristen Sosa, Biology, Queens College CUNY

Hygia Tang, Zaylin Brown Sebastian Alvarado, Maral Tajerian

### **Abstract**

Collective animal behavior often arises from simple individual responses, yet the role of mortality cues in shaping these dynamics is not well understood. In freshwater ecosystems, *Daphnia* are key species that link primary producers to higher trophic levels. Studying how *Daphnia* respond to dead conspecifics can provide insight into how stress and mortality affect populations, nutrient cycling, and water quality. This study examined behavioral and survival responses of *Daphnia* to different carcass densities. Three 20-minute trials were conducted with treatments of 0, 5, 10, and 15 carcasses. Survival outcomes and movement trajectories were analyzed using TReX tracking software and Spyder. Increased proximity to carcasses was observed as density rose, with the highest interaction frequencies at 15 carcasses ( $F(2, 234) = 19.48, p < 0.001$ ). These findings suggest that mortality cues alter collective movement patterns, offering new insight into how small-scale interactions can influence population health and freshwater ecosystem stability.

**Faculty Mentor:** Dr. Alvarado

**Research Area:** Biology

# Krystian Boruch

## *Automating Chemical Inventory Management with RFID and Database Integration*

### **Authors and Affiliations**

Krystian Boruch, Department of Chemistry and Biochemistry, Queens College, CUNY

### **Abstract:**

The tracking of chemicals is important for safety in the lab, compliance with regulations, and maintaining efficient operations. Paper based methods or spreadsheets are laborious, error prone, and frequently outdated. In response, we developed an inexpensive Radio Frequency Identification (RFID) based system for tracking lab chemistry that incorporates an Arduino microcontroller and a Microsoft Access database. RFID tags on each chemistry container allow it to be easily scanned, track check ins and check outs automatically, and record a central inventory in real time. The database contains significant information such as the name of the chemical, quantity present, hazard type, where it's stored, and references to Safety Data Sheets (SDS).

The system is able to locate chemicals in several lab rooms easily, minimizes the risk of using expired or lost materials and satisfies OSHA and EPA regulations. It is modular, barcode compatible, and easily updatable with automatic access control. The system prototype was designed for the use of Chemical Inventory in Queens College, the design of the system is intended as scalable, adaptable, maintainable, and affordable.

The initial testing showed increases in accuracy, speed, and reliability compared to manual inputs. Comparative to commercial chemical inventories, it is low cost and with a solid database combined, this RFID-based system offers an economical, expandable, and safety-focused solution for a Chemical inventory control.

**Faculty Mentor:** Dr. Cherice Evans

**Research Area:** Applied Chemical Engineering

# Lauren Mistretta

## *Computational Analysis of Martial Arts Positioning*

### **Authors and Affiliations**

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Oleg Kogan, Physics Department, Queens College, CUNY

### **Abstract**

Artificial Intelligence has given rise to the field of Computer Vision, in which computers interpret camera footage. Human Pose Estimation, a subfield of Computer Vision, can accurately computationally analyze and predict human movements in various domains, including motion capture, healthcare, and sports, such as in our martial arts research.

Our goal is to computationally analyze martial arts sequences by inputting keyframes composed of skeletal nodes onto a plot. To gather data for our analysis, we shot camera footage of taekwondo and judo fighters and uploaded it to the AlphaPose Pose Estimation software. The AlphaPose software allows for a markerless form of capturing pose movements by constructing a skeleton of nodes representing a person's joints without the constraint of body cameras or other motion capture devices. The output skeletal keyframes are uploaded into the plotting software, Matplotlib, to create a more quantifiable plot.

This model has numerous applications, including being able to visualize and quantify key events during martial arts matches, such as strikes, evasions, and changes in distance. While martial artists can already gain feedback from their instructors, being able to computationally analyze trends between movements utilizing existing software such as AlphaPose can further deepen our understanding of what truly can warrant victory, such as the distance between fighters.

**Faculty Mentor:** Oleg Kogan, Physics Department, Queens College, CUNY

**Research Area:** Computational Biophysics

# Naomi Barreto-Ayala

*The Impact of a High-Fat, High-Sugar Diet on Dopamine Dynamics and Satiation During Naturalistic Free-Feeding.*

## **Authors and Affiliations**

Naomi Barreto-Ayala, Psychology Department, Queens College, CUNY

Cayla E. Murphy, Biology Department, Graduate Center, CUNY

Arony Rodriguez, Psychology Department, Queens College, CUNY

## **Abstract:**

Obesity is a chronic disease that is extremely prevalent in today's society, which can often be associated with the Western diet, consisting of foods high in fat and sugar. The highly palatable properties of these foods are believed to cause overconsumption and compulsive eating behaviors present in obesity which are hypothesized to override one's reward system, similar to drugs of abuse. However, how a high-fat high sugar (HFHS) diet changes feeding behaviors and dopamine (DA) dynamics during naturalistic free feeding remains poorly understood. Using a naturalistic free-feeding paradigm with fiber photometry, we aimed to assess how the highly palatable properties of food change feeding behaviors and DA dynamics in lean D1 Cre mice. Within our paradigm, the mice had access to automatic feeders (FED3s) for 4 days which provided them with either a grain-based or HFHS diet. On day 4, we recorded a 4-hour session of fiber photometry at the onset of the dark cycle using a red DA sensor (rDA1m) virally expressed in the nucleus accumbens core (NAc) to measure DA dynamics coming from awake, behaving mice. Due to the hedonic properties of their diet, we expect to see compulsive eating and overconsumption behaviors. We anticipate the mice on the HFHS diet will eat smaller, more frequent meals indicating they are reaching satiety quicker, but are not staying satiated. Likewise, we expect to see great increases in dopamine during food approach, which we would attribute to the mouse's drive to consume the highly palatable food supported by theories of incentive sensitization.

**Faculty Mentor:** Jeff Beeler, PhD

**Research Area:** Neuroscience

# Niya Exil

## *Variation in Interpreting Negative Concord and Double Negation in African American English*

### **Authors and Affiliations**

Niya Exil, Department of Linguistics and Communication Disorders, Queens College, CUNY

Dr. Bill Haddican, Department of Linguistics and Communication Disorders, Queens College, CUNY

### **Abstract:**

This poster investigates how speakers of African American English (AAE) interpret negation and whether the choice of negator (ain't vs. didn't) affects acceptance of Negative Concord (NC) and Double Negation (DN) readings. Double negation is when two negatives cancel out to form a positive meaning. This is the structure taught in Standard American English. Negative concord is a grammatical structure where multiple negatives express a single negation. While negative concord is well documented in other languages, its interpretation in AAE, particularly among speakers who are also fluent in Standard American English (SAE), remains underexplored.

Participants completed one of three counterbalanced surveys containing 16 target sentences and 16 filler sentences. Target sentences varied by negator and were paired with either an NC or DN interpretation prompt. Prompts were rotated across lists so that each sentence appeared in both conditions across participants. Fillers contained other negative constructions, and two cloze items tested preference for any vs. no in "ain't have" and "didn't have" contexts.

Preliminary results indicate that AAE speakers rated NC interpretations higher than DN interpretations overall. DN ratings were generally low. These results suggest that NC is the preferred reading in AAE and that SAE-like DN forms may create interpretive difficulty in code-switched contexts. It is also indicated that AAE speakers prefer combinations of ain't/no, and didn't/any.

**Faculty Mentor:** Dr. Bill Haddican

**Research Area:** Linguistics

# Omar Ibrahim

## *Dual Inhibition of Mitogenic NEK2 and EGFR Kinases Synergistically Attenuates Glioblastoma Cell Proliferation*

### **Authors and Affiliations**

Omar Ibrahim<sup>1</sup>, Karl R. Fath<sup>1</sup>, Sana Khan<sup>1</sup>, Sarbani Ghoshal<sup>2</sup>, Fnu Manisha<sup>2</sup>, & Sanjai K. Pathak<sup>3</sup>

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### **Abstract**

Glioblastoma (GBM) cells form extremely aggressive brain tumors that are characterized by rapid proliferation, diffusion infiltration into surrounding brain tissue, and poor responsiveness to current chemoradiation treatment. As a result, the median survival for most patients is extremely short (approximately 12 to 15 months). Amongst other changes, the overexpression of two cell proliferation-regulating kinases has been shown in GBM cells. One is the never in Mitosis A (NIMA)-related kinase 2 (NEK2), a centrosomal serine/threonine kinase that regulates centrosome disjunction and spindle assembly. The other is the epidermal growth factor receptor (EGFR) receptor tyrosine kinase that drives proliferation/mitosis utilizing several pathways. We and others have proposed that the dual inhibition of both kinases may be advantageous in decreasing the rapid division of GBM cells.

In this study, we tested the effects of various small molecule inhibitors of EGFR and NEK2 kinases on hallmarks of tumorigenicity, namely cell viability and proliferation. We used the well-established rat C6 glioblastoma cell line. Previous immunoblot studies have shown an overexpression of EGFR and NEK2 in these cells. Cultures were treated with the commercially available NEK2 inhibitor (Rac; Rac-CCT250863) and the commercial EGFR inhibitor Lapatinib (Lap) either singly or in combination. In WST assays we found that EGFR inhibition using Lap (2.5 $\mu$ M) had no significant effect on viability over solvent control, however NEK2 inhibition with 2.5 $\mu$ M Rac decreased viability 30%. When both EGFR and NEK2 were inhibited at the same inhibitor concentrations, there was a 75% decrease in viability. These results suggest that dual inhibition has a combined effect on cell survival. We next explored the effects of the inhibitors on cell proliferation using clonogenic assays. We found that 1 $\mu$ M Lap had a significant 15% decrease in proliferation and 0.5 $\mu$ M dual inhibition has a combined effect on cell survival. We next explored the effects of the inhibitors on cell proliferation using clonogenic assays. We found that 1 $\mu$ M Lap had a significant 15% decrease in proliferation and 0.5 $\mu$ M Rac inhibited proliferation 86%. The dual inhibition with the same concentration of the inhibitor, led to a proliferation inhibition of 89%. All % inhibitions listed above for both assays were significant at  $p < 0.05$ .

These results suggest that the combined inhibition of both kinases may be more potent in the inhibition of glioblastoma proliferation than with each alone. We are currently extending these studies by using the inhibitors on the CTX normal astrocyte cell line in which these kinases are not overexpressed. Further, the Pathak laboratory has synthesized a novel dual inhibitor of NEK2 and EGFR kinases in a single molecule and we are testing its efficacy on C6 viability and proliferation.

**Faculty Mentor:** Karl R. Fath, PhD

**Research Area:** Cell Biology — Cancer Pharmacology

# Pablo Perez

## *Does Vagal Activation Predict Differential Post-Oral Sugar Sensitivity in Inbred FVB and C57BL/6 Mice?*

### **Authors and Affiliations**

Pablo J. Perez<sup>1</sup>, Omar Ibrahim<sup>1</sup>, Nicolas A. Perez<sup>1</sup>, Cinthia Narciso<sup>1</sup>,  
Giuseppe Cataldo<sup>1</sup>, and Richard J. Bodnar<sup>1</sup>

<sup>1</sup>Department of Psychology, Queens College, City University of New York, Queens, NY, USA

### **Abstract**

Sugars stimulate intake and preferences through T1R2+T1R3 taste receptors and post oral appetite actions, where intestinal sugar infusions increase intake and can shift preference from a nonnutritive sweetener to sugar after separate exposures. This effect is sugar specific: glucose reliably stimulates intake/preferences more than fructose, and fructose induces appetite in some strains but not others. In C57BL/6 mice, intestinal glucose but not fructose, activates vagal afferents, explaining their glucose only appetite.

The vagus nerve is a key pathway for transmitting nutrient signals from the gut to the brain. While C57BL/6 mice show vagal activation and increased intake only for glucose, FVB mice increase intake for both glucose and fructose. This study tests whether both sugars activate vagal afferents in FVB mice. Under anesthesia, the right cervical vagus nerve will be exposed and fitted with an electrode for electrophysiological recording. Each mouse will receive infusions of glucose or fructose into the small intestine and vagal firing rates will be recorded post infusion. It is expected that both glucose and fructose will significantly increase vagal firing rates in FVB mice, with glucose producing the strongest effect. These results would suggest that vagal activation of both sugars explain why FVB mice, but not C57BL/6 mice, show appetite for both.

**Faculty Mentors:** Dr. Giuseppe Cataldo and Dr. Richard J. Bodnar

**Research Area:** Neuroscience - Behavioral Neuroscience

# Renee Dansker

## *Neighborhood Opportunity and Placental Neurodevelopmental Gene Expression in an NYC Birth Cohort*

### **Authors and Affiliations**

Renee Dansker<sup>1</sup>, Claire J. Brabander<sup>2</sup>, Sameera Ramjan<sup>2</sup>, Abid Fahim<sup>1</sup>, and Yoko Nomura<sup>1,2</sup>

<sup>1</sup>Department of Psychology, Queens College,

<sup>2</sup>City University of New York, The Graduate Center

### **Abstract**

Fetal neurodevelopment is profoundly influenced by the maternal social environment, potentially through placental regulation of gene expressions involved in brain development. The Child Opportunity Index (COI) is a measure of neighborhood resources (i.e. educational opportunity, health and environment, and social and economic) and is associated with adverse birth outcomes and neurodevelopmental trajectories. This study investigates whether maternal metropolitan-level COI at delivery is associated with placental expression of neurodevelopmental gene clusters in a New York City-based birth cohort. Placental tissue was collected from a subset of mothers (n=343) as part of the Stress in Pregnancy study. Factor analysis was conducted on gene expression data to identify co-expressed gene clusters. The Factor 1 neurodevelopmental gene cluster (reliability=0.79) consists of MAOA, CDKL5, ZNF507, and MECP2, while the Factor 2 gene cluster (reliability=0.70) includes FOXP1, SRD5A3, and ZNHIT6. Metropolitan-level COI z-scores were assigned to participants based on maternal residential address and linked to data from the public database diversitydatakids.org. We hypothesized that COI would be associated with a change in placental expression of neurodevelopmental gene clusters. Linear regressions were used to examine these associations. After adjusting for maternal age, maternal race and other covariates, higher COI was significantly associated with lower expression of Factor 1 genes,  $\beta=-0.142$ ,  $p=.014$ , however no significant associations with Factor 2 were found. In lower-opportunity environments, higher expression of the Factor 1 neurodevelopmental gene cluster may represent an adaptive response, reflecting the need for upregulation to effectively support brain development. This highlights the biological impact of social determinants that can inform policy changes and public assistance initiatives imperative for improving neighborhood resources and supporting the healthy development of future generations.

**Faculty Mentor:** Dr. Yoko Nomura

**Research Area:** Neuroscience

# Samiha Zaman

## *AI Agents for Large Language Model-as-Judge Evaluation: A Use Case in Automated Patient Engagement Analysis in Healthcare*

### **Authors and Affiliations**

Samiha Zaman, Computer Science Department, Queens College, CUNY

Dr. Bon Sy, Computer Science Department, Queens College, CUNY

### **Abstract**

Patient engagement plays a pivotal role in managing chronic conditions such as type 2 diabetes, influencing adherence to care plans and overall health outcomes. Traditionally, clinicians review engagement metrics and make personalized recommendations for each patient, but this process is resource-intensive and difficult to scale.

This research focuses on developing a reusable design pattern for AI agents that enables behavioral analytics and drives improved patient engagement in clinical settings. The pattern follows a three-stage workflow: Fetch → Analyze → Evaluate. First, the agent fetches relevant patient engagement data; second, it analyzes behavioral trends in the context of clinical goals; and third, a second agent evaluates the recommendations of the “analyzer” agent against a ground truth to ensure alignment with clinical standards.

For demonstration, the design pattern is applied to use cases for (1) automating the review of patient engagement data traditionally handled by clinicians, and (2) generating treatment plan draft from encounter summary note. Using the Strands Agents framework, an analyzer agent processes engagement data obtained from patient devices, identifies patterns such as changes in engagement rate, and generates personalized recommendations (e.g., preventive actions, onboarding activities, or specific tests). These recommendations are assessed by an “evaluator” agent implementing the Large Language Model-as-Judge (LLM-as-Judge) paradigm, comparing AI outputs to clinician recommendations on predefined metrics such as correctness, completeness, relevance, helpfulness, etc.

My summer research focus is on a diabetes use case for gaining insights into using the open-source standardized framework “Strands agents” for developing AI agents. One such prototype via Strands will be illustrated. The outcome of this summer project will guide future research on formalizing a scalable, adaptable design pattern that can be applied to multiple healthcare scenarios — with the goal of reducing clinician workload while empowering patients to take ownership of their health to achieve a better health outcome.

**Faculty Mentor:** Dr. Bon Sy, Computer Science Department, Queens College, CUNY

**Research Area:** Cross disciplines of Artificial Intelligence in Computer Science, Health Informatics, Behavioral Analytics

# Samreen Randhawa

*Parsing the Pulse: A standardized framework for EDA, HRV, and RSA analysis.*

## **Authors and Affiliations**

Samreen Randhawa, Barbara Kinsella-Kammerer, Aditi Bhatt, Rebecca Lee, and Yoko Nomura

## **Abstract**

Psychophysiology research generates complex datasets that include measures such as electrodermal activity (EDA), heart rate variability (HRV), and respiratory sinus arrhythmia (RSA). These data demand objective and standardized processing to ensure validity and reliability. This poster outlines a preliminary standardized protocol for processing psychophysiology data in a psychology laboratory setting. Standard operating procedures (SOPs) were created to guide researchers through detecting event markers and segmenting data into baseline, startle, and recovery periods. After segmentation, noise and artifacts are removed before extracting and analyzing specific skin conductance responses (SSCRs) with AcqKnowledge software. This protocol also details multi-epoch HRV and RSA spectral and statistical analyses to extract RSA and Root Means Square of Successive Differences (RMSSD) from electrocardiogram (ECG) and respiration signals. Documentation templates and metadata standards were implemented to enhance transparency and facilitate data sharing. Pilot testing demonstrated improved efficiency and reduced variability in processing decisions. For interreliability and quality assurance, each file underwent processing by two researchers, with future plans to introduce blinded data extraction to further reduce bias. This framework is adaptable for different experimental paradigms to extract a range of psychophysiological measures, serving as a model for other psychology labs seeking to optimize data processing workflows.

**Faculty Mentor:** Dr. Yoko Nomura

**Research Area:** Psychology

# Sarra Mikhaylov

## *Evaluating Pragmatic Language in Children with and without Fragile X Premutation: Associations with Age and Parent Report*

### **Authors and Affiliations**

Sarra Mikhaylov<sup>1</sup>, Rachel Goldman<sup>1,2</sup> & Veronica J. Hinton<sup>1,2</sup>

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<sup>2</sup> The Graduate Center, City University of New York, New York, NY, USA.

### **Abstract**

Pragmatic language (PL) is the skill of applying language appropriately in social settings, minimizing miscommunication, supporting richer interactions, and building stronger interpersonal connections. PL skills grow steadily as children get older, with subtle difficulties often becoming clearer in adolescence when social and language demands are more complex. The goal of the current study is to examine performance on two measures of pragmatic language – a child assessment and a parent report. Additionally, we examined the impact of age on child performance. Data from a larger study examining cognitive skills in children ages 8-13 (N=150) identified prenatally as either having a Fragile X premutation or not. Children were administered The Pragmatic Language subtest of the Comprehensive Assessment of Spoken Language (CASL), a standardized measure that is structured to test using real-life situations to evaluate PL. Parents were administered the Social Rating Scale as a measure of their appraisal of their child's social language skills. Pearson correlation was used to determine if standardized scores from each measure were associated, and to examine whether age was associated with CASL raw scores. Results indicated that the two measures were not correlated ( $r = -.077$ ,  $p = .352$ ). Age was strongly positively correlated with CASL-PL raw scores ( $r = .527$ ,  $p < .001$ ). Contrary to our expectations, performance on the two PL measures (child assessment and parent report) were not associated with one another. We did show, that even in a fairly narrow age range, that as age increases, children's PL skills improve. This shows that there is a gradual progression of PL skill development.

**Faculty Mentor:** Dr. Veronica Hinton

**Research Area:** Neuropsychology, Psychology

# Sean Hart

## *Autonomous Drone Navigation Exploration*

### **Authors and Affiliations**

QSTEM Research Academy Research Scholars

### **Abstract**

Autonomous navigation of lightweight indoor drones presents unique challenges in environments where standard positioning feedback is limited. The CoDrone EDU platform uses a patterned mat to aid in coordinate position, but this visual feedback is disrupted when navigating through a uniformly colored obstacle. In this study, a low-cost play tunnel is introduced as a navigation challenge. The CoDrone EDU drone is programmed in Python using the CoDrone SDK to fly to a fixed waypoint and then enter a custom behavior loop upon detecting the purple tunnel. Within the tunnel, the drone must maintain straight flight without access to positional correction from the mat. The absence of GPS or onboard camera systems forces the drone to rely on limited onboard sensors and color detection. A working prototype has been developed and tested in controlled conditions. Flight data is logged throughout each run to evaluate detection reliability, entry/exit precision, and flight path stability. This experiment tests the feasibility of sensor-triggered autonomous flight through featureless environments and evaluates the reliability of onboard color sensors as navigation cues. Future analysis will examine consistency across multiple trials.

The navigation logic is structured using simple conditionals and loops, designed to switch behavior based on real-time sensor input. This framework allows easy iteration as the drone's behavior becomes more refined. In future stages, we aim to add altitude adjustments, obstacle avoidance, and compound visual triggers. The study offers insight into practical constraints and creative workarounds in micro-UAV autonomy within constrained sensing environments.

**Keywords:** Indoor navigation, micro drone, CoDrone EDU, color sensing, Python, autonomy

**Faculty Mentor:** Dr. Abdellah Ait Elmouden

**Research Area:** Data Science and Engineering

# Sonika Rawal

## *Analyzing the Impact of Solar Panels on Aircraft Electrical Systems: A Case Study on the Boeing 777-300ER*

### **Authors and Affiliations**

Sonika Rawal - LaGuardia Community College

Malgorzata Marciniak- LaGuardia Community College, Department of Mathematics, Engineering and Computer Science

### **Abstract**

Commercial aviation relies heavily on fossil fuels, producing high greenhouse gas emissions. While most energy is consumed by propulsion, a significant portion powers aircraft electrical systems, including lighting, avionics, and environmental controls. This research explores how solar panels could supplement these electrical loads in large passenger aircraft, using the Boeing 777-300ER as a case study due to its extensive wing and fuselage area suitable for panel installation.

Under optimal conditions, flying at the equator during solar noon, with the Sun directly overhead, solar irradiance can reach approximately  $1000 \text{ W/m}^2$ . Calculations based on the surface area and efficiency of commercially available high-performance panels suggest that onboard solar generation could meet about 10% of the aircraft's electrical demand during cruise. While this does not replace engine power, it meaningfully offsets fuel otherwise burned to operate onboard generators.

The results indicate a realistic pathway toward integrating solar energy into hybrid aircraft systems. A proposed next step is a "solar-buffered hybrid assist" concept, in which surplus solar power generated during cruise is stored in dedicated high-voltage batteries. This stored energy could then provide additional power during climb, one of the most fuel-intensive phases of flight, thereby reducing engine load, fuel consumption, and emissions.

This study demonstrates that solar integration on large commercial aircraft is technically feasible for partial electrical load offset and hybrid assist, paving the way for incremental adoption of cleaner technologies. Continued advances in solar cell efficiency, aerodynamics, and energy storage will further improve the viability of solar-assisted and eventually electric propulsion in aviation.

**Faculty Mentor:** Malgorzata Marciniak

**Research Area:** Mechanical Engineering: Sustainable Aviation

# Steven Herrera

*Pre- and post-synaptic activity of the direct and indirect pathway in the nucleus accumbens core across associative learning*

## **Authors and Affiliations**

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## **Abstract**

Associative learning allows animals to predict outcomes based on environmental cues by relying on previous experiences. In this experiment, we used a Pavlovian conditioning paradigm to train mice to associate a light cue with a reward through two stages: magazine training and presentation of the conditioned stimulus (CS) paired with reward delivery. Neural activity in the nucleus accumbens (NAc) core was monitored using dual-color fiber photometry, enabling for cell-specific assessment of presynaptic glutamate release and postsynaptic calcium activity. Recordings are focused on D1 (direct) and D2 (indirect) medium spiny neurons (MSNs) to examine differences in signaling dynamics. Data were collected during the first and last days of magazine training, as well as on day 1 of CS training, the midpoint of CS training, and the final day of CS training, allowing us to observe how glutamate and calcium signaling patterns change throughout different learning stages in D1 and D2 MSNs.

**Faculty Mentor:** Dr. Jeff Beeler

**Research Area:** Psychology

# Tiffany Grapsas

## *Effects of Extracellular Matrix Biomechanics on Microglial Activity*

### **Authors and Affiliations**

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<sup>1</sup>Department of Biology, Queens College, CUNY

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### **Abstract**

The extracellular matrix (ECM) is a dynamic network of macromolecules that lends structural support to every tissue in the body. The ECM is also critical in regulating cellular processes like differentiation and migration, as well as for the pathophysiology of various conditions. Maladaptive ECM remodeling in the brain has been implicated in inflammation and neurodegenerative disease progression through an altered expression of certain glycoproteins.

Microglia, the brain's resident immune cells, also play a crucial role in modulating inflammation by releasing pro-inflammatory cytokines, as well as in maintaining homeostasis through continuous environmental surveillance. Recent literature has shown that the ECM displays altered rigidity following injury, causing heightened microglial activation and potentially supporting the transition from acute to chronic pain. However, the precise mechanisms of ECM-microglia interactions in the context of inflammation remain in large part to be explored.

Previous research has focused primarily on the cellular mechanisms underlying the development of neuropathic pain. This study aims to measure how varying ECM rigidity influences microglial activity in vitro. BV-2 murine microglia will be plated on synthetic matrices of varying stiffness (0.2-64 kPa) and their activity will be examined by staining calcium ions, critical secondary messengers in the central nervous system. It is hypothesized that Ca<sup>2+</sup> activity will vary with matrix stiffness and intensify at higher and lower rigidity extremes. Elucidating the influence of the ECM on microglial behavior, rather than analyzing cell behavior alone, can inform a more complete understanding of the pain brain and ultimately provide a basis for novel therapeutic targets.

**Faculty Mentor:** Dr. Maral Tajerian

**Research Area:** Biology/Neuroscience

# Victor Barrientos

## *Evaluating Photoinactivation for Pathogen Removal in an Urban Coastal Environment*

### **Authors and Affiliations**

Victor Barrientos, Gregory O'Mullan

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### **Abstract**

Overflowing combined sewer systems release pathogens into urban waterways when the volume of sanitary waste and stormwater exceed the infrastructure capacity. Enterococci are bacteria regularly found in the intestines of humans and are used as EPA approved indicators of fecal pathogen contamination in coastal water quality monitoring. In recent years, nature-based solutions, in addition to traditional engineering approaches, have been utilized to address poor water quality resulting from sewer overflows. A constructed tidal wetland has recently been added to Alley Creek in Flushing, Queens in order to promote mechanisms of pathogen removal, including photoinactivation, particle settling, and particle capture on wetland vegetation. This study evaluates photoinactivation as a mechanism for pathogen removal by experimentally exposing enterococci to sunlight under controlled conditions. Water samples collected from Alley Creek were placed in UV permeable Whirlpak bags with differentially shaded treatments and submerged in an outdoor temperature-controlled water bath for 3 hours, simulating the period of shallow water exposure within the constructed wetland. Sub samples of water were filtered through a 3.0  $\mu\text{m}$  polycarbonate membrane to calculate the fraction of particle associated bacteria. All samples were processed using IDEXX Enterolert media and the Most Probable Number (MPN) of Enterococci were enumerated from 100 ml water samples. Percent removal was highest in samples exposed to full light, with some experiencing up to 90% removal of enterococci. Samples with only 25% incoming light saw a wider range of removal, but significantly lower in magnitude. Particle association demonstrated a complex interaction with pathogen removal under differing levels of light. These data support the potential for photoinactivation to serve as a major mechanism of pathogen removal within constructed wetlands. Further mechanistic studies will ultimately help to optimize wetland evaluation and design.

**Faculty Mentor:** Gregory O'Mullan

**Research Area:** Coastal Water Quality Monitoring

# Poster Session and Assignments

## Poster Session 1

Student Name	Poster Board #
Amrin Karim	1
Ashley Jew	2
Devorah Moadab	3
Elissa Patin	4
Hemlata Gocool	5
Joanne Sun	6
Kristen Sosa	7
Lauren Mistretta	8
Naomi Barreto-Ayala	9
Pablo Perez	10
Samiha Zaman	11
Steven Herrera	12
Victor Barrientos	13
Candy Shen	14

## Poster Session 2

Student Name	Poster Board #
Andrew Napoletano	1
Bessie Velasquez Galdamez	2
Donna Shair	3
Hanan Latiff	4
Hector Cordova	5
Jazmin Solorio Pulido	6
Kevin Bermejo	7
Krystian Boruch	8
Niya Exil	9
Omar Ibrahim	10
Renee Dansker	11
Sarra Mikhaylov	12
Tiffany Grapsas	13
Deyon Wijewardana	14

Afsheen Rahman, Ei Kay Khaing Myo, & Rojina Magar	15		Sean Hart	15
Sonika Rawal	16		Kabina Purja & Jennifer Jean Louis	16
Jiale Lin, Justen Gallagher, & Melvin Schwartzberg	17		Jillana Mariele Mendoza & Jennifer Karina Guaman	17
Samreen Randhawa	18		X	18