Wednesday, August 21st, 2024

Queens College

About

Queens College's Undergraduate Research Symposium is an annual event that showcases the innovative and scholarly work of its undergraduate students across various disciplines. Through presentations, posters, and interactive discussions, participants share their research findings, insights, and creative endeavors with peers, faculty, and the wider community. The symposium provides a platform for students to develop essential skills in communication, critical thinking, and collaboration while fostering a culture of academic excellence and intellectual curiosity. It celebrates the diverse interests and achievements of undergraduate scholars, promoting a deeper engagement with knowledge and inquiry within the Queens College community.

Agenda

9:00 AM – 9:30 AM	Check-in
9:30 AM – 9:40 AM	Welcome Opening remarks
9:45 AM – 10:30 AM	Poster Session 1
10:35 AM – 11:45 AM	Guest Speakers Dr. Jonathan Gryak and Dr. Megan Victor
11:50 AM – 12:20 PM	Lunch
12:30 PM – 1:15 PM	Poster Session 2
1:20 PM – 1:30 PM	Closing Remarks

Guest Speakers

Dr. Jonathan Gryak

Intelligent Integration of Multimodal Data for Clinical Decision Support

Dr. Jonathan Gryak is an Assistant Professor of Computer Science and Data Science at Queens College and the Graduate Center, CUNY. As the principal investigator of the Interdisciplinary Data Science Lab (IDSL), Dr. Gryak and his team work to solve problems in biomedical informatics and computer science by developing novel artificial intelligence (AI)/machine learning (ML) methods that can leverage a problem's underlying morphology and work within its operational limitations. They then translate these techniques to commercial settings where they may make a broader impact on society.

Prior to joining CUNY, Dr. Gryak was the Senior Scientist for the Michigan Institute of Data Science and a Research Scientist in the Department of Computational Medicine and Bioinformatics at the University of Michigan, Ann Arbor.

Dr. Megan Rhodes Victor

Playing with Data: Archaeology, Digitization, and Archaeogaming

Dr. Megan Rhodes Victor is an Anthropological Archaeologist with a specialization in Historical Archaeology. Their research focuses on commensal politics, drinking spaces, trade and exchange, informal economy, the 18th-century queer community in the English Colonial World, gendered spaces, digital archaeology, and community-driven projects. They received their BA from University of Michigan in Ann Arbor, Michigan in 2010. They earned their MA (in 2012) and their PhD (in 2018), both from the College of William & Mary in Williamsburg, Virginia. They then had a postdoctoral scholarship at the Stanford Archaeology Center at Stanford University, in Stanford, California, where they directed the archaeological excavations of the Arboretum Chinese Labor Quarters (ACLQ). They are now an assistant professor here at Queens College in the Anthropology, where they teach courses on Archaeology including Intro to Archaeology, the Archaeology of North America, Digital Archaeology, and run internships out of their Digital Archaeology Lab, of which they ae the Director.

Abstracts

Abid Fahim

Relationship Between Prenatal Heatwave Exposure on Birthweight and Gestational Age

Authors and Affiliations
Primary: Abid Fahim, Sameera Ramjan, MA, Donato DeIngeniis, MA, Yoko Nomura, PhD (Department of Psychology, Quens College, CUNY)
Secondary: Chia-Ling Tsai, Galib Monwar, BS, Adriel Fung, BA (Department of Computer Science, Queens College, CUNY)

Abstract
Background Prenatal exposure o to ambient heat d has been associated with an increased likelihood of adverse birth outcomes, including low birthweight, stillbirth, and preterm delivery. It is important to note that sensitivity to heat may also vary by the biological sex of the fetus with differential risks being present. This study investigates the potential association between prenatal heatwave exposure during each trimester and birth outcomes (i.e., birthweight and gestational age). Potential differences in these associations by biological sex are also explored.

Methods: Participants were recruited between 2010-2015 at two hospitals in New York to participate in the Stress in Pregnancy Study and this project investigated data that was already collected on a subset of participants in the Stress in Pregnancy Cohort (n=617). We used daily temperature estimates extracted from weather stations in New York City to determine if participants were exposed to a heat wave during each trimester of pregnancy.

Results: A linear regression was used to determine whether heat exposure, defined as the number of heat waves during each trimester of pregnancy, was associated with birth weight and gestational age. We found a significant positive association between heatwave exposure and birthweight ($b = 108.529$, $p = 0.11$). Each additional heatwave exposure was associated with an increase of 108.529 grams to the birth weight. Upon further analysis, we found differential relationship by sex. The association was significant in males ($b = 159.564$, $p = .007$), but not females ($p > .05$).

Conclusion: Prenatal exposure to heatwaves, is associated with a larger birthweight . The differential impact based on the child's sex indicates that males are more sensitive or greater risk to heatwave exposure, which could have significant developmental health implications, such as higher risk of obesity and diabetes.

Faculty Mentor: Dr: Yoko Nomura
Research Area: Psychology and Computer Science

Alan Cantos

How does BMP signaling execute its fat regulatory function at the subcellular and molecular levels?

Authors and Affiliations
Primary authors: Alan Cantos, Dr. Cathy Savage-Dunn (Biology Department, Queens College CUNY)
Secondary author: Kat Yamamoto (Department of Biology, Queens College)

Abstract
Lipid metabolism is involved in different active functions of our body, such as energy storage, hormone regulation, nerve impulse transmission, and fat-soluble nutrient transportation. The aberrant increase or decrease of lipids can cause various human diseases. For example, increased triglycerides, LDL, instead of HDL can mediate the transport of bad cholesterol . Similarly, the accumulation of fatty LDLs and triglyceride can damage the arteries and have serious consequences for cardiovascular health.

Previous work in DBL-1 the C. elegans homolog of bone morphogenetic protein 2/4 (BMP2/4) has been identified as a significant regulator of body size and lipid metabolism in *C. elegans*. The phenotype of a worm containing wild type DBL-1 conveys a long body size with normal fat level. DBL-1 mutants have shorter body size and low fat level phenotype. DBL-1 is involved with fat storage by interacting with SMAD signaling in hypodermis in which it inhibits insulin-like ligand pathway and stimulation of lipid storage.

In this study we used *C. elegans* to answer the question of how does BMP signaling carries out its fat-regulatory function at the subcellular and molecular levels. It was hypothesized that genetic suppressors of the low-fat phenotype of *dbl-1* mutants will reveal regulatory networks that interact with BMP signaling to modulate fat storage.

Faculty Mentor: Dr: Cathy Savage-Dunn
Research Area: Biology

Avraham Zion Kuighadush

Female Mate Choice in Astatotilapia Burtoni: Familiarity or Something Else?

Authors and Affiliations
Avraham Zion Kuighadush, Biology Department, Queens College CUNY
Anastasia Martashvili, Biology Department, Queens College, CUNY and CUNY Graduate Center

Abstract
Many variables can shape reproductive behaviors in the wild. Photoperiod, social interactions, and ambient temperature can be triggers that precipitate various reproductive outcomes. We chose to study the behavioral and morphological adaptability of female Astatotilapia burtoni to changes in their ambient visual environment. Males of this species are predominantly blue or yellow and can also change their social rank to become either territorial or non-territorial. Territorial males display behaviors related to territoriality and mating, while non-territorial males don't. There's limited understanding of female-specific preferences for body coloration. By investigating female interpretation of male cues, we learn how female sexual selection can be modulated by male phenotypic plasticity. Females can also develop yellowish or bluish coloration based on their rearing environment and our study asks whether visual factors influence social dynamics in females and their choice of mate. We predicted that yellow-reared females would prefer yellow males and blue-reared females would favor blue males. If females prefer males of the opposite color, it suggests that male behavior holds more weight than visual cues in female mate selection. In the first phase (n=24), half of size-and age-matched females were placed in a blue environment, and the other half in a yellow environment. Following a month, their color preferences were assessed without the male presence, and then they interacted with blue and yellow males. Female gonads were examined to calculate the Gonadosomatic Index (GSI) and overall reproductive readiness. Yellow and blue-induced females showed a preference for the yellow male over the blue. Notably, blue-induced females favoring the blue substrate, later spent more time with the yellow male. Females with higher GSIs, indicating readiness to mate, favored the yellow male. This trend suggests that the reproductive behaviors of yellow males might override the influence of visual ecology entirely.

Faculty Mentor: Dr. Sebastian Alvarado, Biology Department, Queens College CUNY
Research Areas: Biology, Neuroscience, and Neuroepigenetics

Brittany Pompey

The Impact of Maternal PTSD on Early Childhood Temperament and Hair Cortisol Levels

Authors and Affiliations

Brittany Pompey, [1]Psychology Department, Queens College, City University of New York,

Claire Brabander, [1]Psychology Department, Queens College, City University of New York, [2]The Graduate Center, City University of New York

Yoko Nomura [1]Psychology Department, Queens College, City University of New York, [2]The Graduate Center, City University of New York

Abstract

Exposure to stress in-utero is known to have an alternation on early childhood temperament along with a altered HPA activity in early childhood more specifically when they are 36 months. Previous research has shown that children exposed to maternal stress due to PTSD in-utero may be more likely to have negative affectivity. These changes in temperament may be explained by the transmission of stress hormones from the mother to the child through the placenta. This may lead to HPA dysregulation in early childhood, which can be associated with altered child temperament. Mothers who experience PTSD symptoms during pregnancy have been shown to have high cortisol levels. This may explain the higher cortisol levels exhibited in early childhood following exposure to prenatal PTSD. However, most results on the difference in early childhood temperament have been inconsistent. In our study, we aimed to examine how prenatal exposure to PTSD affects a child's temperament, and how is it mediated by the child's hair cortisol level. To achieve this, mothers self-reported their PTSD symptoms during pregnancy on the Post-Traumatic Stress Disorder Checklist for Civilians (PCL-C) questionnaire, mothers also reported on their child's temperament using the Children's Behavior Questionnaire (CBQ), and samples of the child's hair that were collected at 36 months and cortisol levels were analyzed. Hayes PROCESS macro will be used to conduct a mediation analysis. Results are pending.

Faculty Mentor Name: Dr. Yoko Nomura

Research Area: Psychology/Neuropsychology

Cynthia Gan

The changing syllabification of yod

Authors and Affiliations
Cynthia Gan (Department of Linguistics and Communication Disorders, Queens College, CUNY)
Aidan Malanoski (Department of Linguistics, CUNY Graduate Center)
Bill Haddican (Department of Linguistics and Communication Disorders, Queens College, CUNY)

Abstract
This poster investigates speaker differences in the syllabification of yod (the /y/ sound) in /Cyuw/ sequences. 645 participants took part in data collection and judged whether pairs of /uw/-words and /yuw/-words (such as boot/mute, zoo/view) rhymed or not in a survey. The results indicated that younger participants and participants from bilingual/multilingual homes were less likely to judge the pair as rhyming, meaning that they were somehow taking yod into account when judging the rhyme. One possible interpretation of this is that these speakers are perceiving the yod as part of the rhyme - historically, /Cyuw/ in modern English originated from the diphthong /iw/.

An additional preliminary survey of 12 participants was conducted to further investigate this hypothesis. Participants were given a Pig Latin type task where they moved the onset of a single syllable word, where the yod should be moved if it is part of the onset, and kept if it is part of the rhyme. In addition to the new task, participants also answered the original rhyme judgment task. The results were inconclusive; while participants were mostly consistent in how they answered the new task, their treatment of yod did not align with how they answered the rhyme judgment task. Further investigation is necessary to determine if the administration of the task is flawed, or if rhyme judgments and onset/rhyme perception happen slightly differently, contrary to our belief.

Faculty Mentor: Dr.Bill Haddican
Research Area: Linguistics

David Young

Collective Behavior of Daphnia

Authors and Affiliations

David Young [1], **Oleg Kogan** [1], **Sebastian Alvarado** [2]

[1] Queens College Physics Department, [2] Queens College Biology Department

Abstract

Collective behavior is a widespread phenomenon in the animal kingdom, influencing how animal groups respond to environmental changes. This study utilizes the model organism *Daphnia magna* to explore the emergence of collective motor behavioral patterns. Daphnia in a petri dish executes what appears to be random motion. In this study we investigated properties of this random motion and sought to understand deviations from random motion of a Brownian particle (such as dust particles suspended in liquid). Using TRex animal-tracking software, we recorded and analyzed the movement of daphnia under various boundary conditions. The position data were processed with Python and further analyzed in MATLAB to quantify average displacement from an initial position. The average over many daphnia of this displacement as a function of time was analyzed. Boundaries significantly impacted the behavior of daphnia.

Because of this, we were not yet able to definitively establish the difference between the random motion of daphnia with that of a Brownian particle. This suggests the necessity for a larger experimental apparatus to accurately determine how daphnia's motion deviates from Brownian dynamics. We also examined the effect of colored light on daphnia's motion. Although these results are not yet conclusive, ongoing research aims to investigate this variable in greater detail, considering its ecological relevance in natural freshwater environments. This study offers valuable insights into the factors influencing daphnia's collective behavior, contributing to a deeper understanding of their motion patterns and the mechanisms underlying their collective dynamics.

Faculty Mentor: Dr. Oleg Kogan

Research Area: Biophysics

Elijah Singh

Numerical Estimation Task Comparison

Authors and Affiliations

Elijah Singh[1], Amanda Kenepp[1,2], Tatyana Adayev[3], Anne Glickman[3], Nicole Tortora[3], Emily Graves Allen[4], Lisa Shubeck[4], Jessica Ezzell Hunter[5], & Veronica J Hinton[1,2]

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Abstract

Objective: Children's performance on two timed tests of math reasoning, Naming Speed Quantity (NSQ) and Symbolic Magnitude Judgment (SMJ), was examined to determine if age, sex, IQ and the fragile X premutation (PM) (defined as 55-200 expanded CGG repeats in the X-linked *FMR1* gene) influence performance. This work is part of a larger study investigating cognition in children with a PM. Previous studies demonstrated that adults with the PM have a minor yet significant weakness in math reasoning skills.

Participants & Methods: Children aged 8-13 with the PM allele (n = 59; 59% female) and controls (n = 71, 51% female) were recruited. Measures included NSQ (participants quickly and accurately count sets of 1-5 squares – time to completion), SMJ (participants are presented with two numbers and asked to quickly and accurately judge which is larger - median RT and RT/accuracy) and IQ (WASI-II FSIQ-2). Pearson's correlation and independent t-test analyses were run. Alpha was set at .01.

Results: NSQ and SMJ RT variables were positively correlated [SMJ Median RT ($r = 0.515$ $p < 0.001$), SMJ Speed/Accuracy ($r = 0.512$ $p < 0.001$)]. There was a significant negative correlation between age and NSQ and all SMJ variables [NSQ Total Raw Score ($r = -0.494$, $p < 0.001$), SMJ Median RT ($r = 0.202$, $p < 0.001$)], and SMJ Speed/Accuracy ($r = -0.460$, $p < 0.001$). IQ was not significantly correlated with any measure ($p > .01$). There were no significant between-group differences related to sex or PM status ($p > .01$).

Conclusion: Results indicate that participants performed similarly on both tasks, each potentially capturing their math reasoning skills. IQ, sex and PM status did not contribute. In contrast, as age increased, performance improved significantly. This demonstrates that even across a relatively narrow age range these tasks capture developmental changes of math skill learning.

Faculty Mentor: Veronica J Hinton

Research Area: Psychology

Eva Taub

The Effect of Prenatal Depressive and Anxiety Symptoms on the Stress Hormones of Offspring in Early Childhood

Authors and Affiliations
Eva Taub, The Leffell School
Dr. Yoko Nomura, Psychology Department, Queens College

Abstract
Approximately 13% of women develop various prenatal anxiety and mood disorders due to sudden hormonal changes that lead to the dysregulation of the HPA axis. Previous studies have discussed prenatal anxiety and depression relating to abnormal neurological anatomy including a reduced cerebral cerebellar gray matter volume, increased cerebral cortical gyrification, altered amygdala and hippocampal volumes, disturbed brain microstructure and a decrease in functional connectivity in newborns. Other studies have shown that even moderate levels of anxiety and various mood disorders prenatally is correlated with a higher prevalence of mental illness, behavioral problems and lack of cognitive capabilities in offspring during later adolescents. This has been shown to correlate with the excess amount of cortisol produced by the mother when pregnant. High levels of blood cortisol can cause the 11β-HSD2 enzyme to be dysregulated. This particular enzyme helps regulate the amount of cortisol that affects the baby and helps convert it into cortisone which is its less reactive state. So, when exposed to an abnormally high cortisol level, the enzyme will decrease in function and cause the fetus to be exposed to an unhealthy amount of cortisol. This cortisol will desensitize fetal glucocorticoid receptors; therefore, inducing hyperactivity of the offspring HPA axis in the fetus long term. The HPA axis will then produce an unhealthy amount of the Cortisol, DHEA, Cortisone, Metabolon and Progesterone which all help regulate stress. Yet, there is no research observing the correlation between prenatal anxiety and depression and the extent of hormone dysfunction in young children. So, this study utilizes SPSS in order to observe the correlation between maternal anxiety and depression scores, as scored on the State Trait Anxiety Inventory (STAI) and the Edinburgh Postnatal Depression Scale (EPDS), and child stress levels, as observed through various stress related hormones.

Faculty Mentor: Yoko Nomura
Research Area: Psychology

Evelyn Chimbo

Iodine Catalyzed Preparation of Dihydrofurans from Benzylacetonitrile and Styrene

Authors and Affiliations
Evelyn Chiimbo, Department of Chemistry and Biochemistry, Queens College
Dr. Yu chen, Department of Chemistry and Biochemistry, Queens College

Abstract
Iodine catalyzed preparation of dihydrofurans from benzyl acetonitrile and styrene were synthesized via a single electron transfer mechanism that leaf to good (80%) from poor (20%) yields. Through systematic experimentation and analysis, we aim to gain insights into the reactivity of Iodine and persulfate as reagents and their influence on the overall reaction pathway, utilizing Iodine as the oxidant and electrophile. The current best percent yield is 80% when utilizing ammonium persulfate (NH4)2S2O8 and acetonitrile solvent. Analysis such as TLC and NMR are used to justify the presence of the dihydrofurans, and the percent yields.
Product mechanism study and reaction optimization are currently ongoing.

Faculty Mentor: Dr. Yu chen
Research Area: Organic Chemistry

Gabriela Sedano

Investigating Sleep and Awake Activity Among Infants at High and Low Risk for Autism Spectrum Disorder

Authors and Affiliations
Gabriela Sedano, Queens College, CUNY
Dr. Kristina Denisova, Queens College, CUNY

Abstract
The goal of this extended research is to identify the correlations between sleep and awake periods and gross motor movements in infants with and without the risk of autism spectrum disorder (ASD). Accelerometers, actigraphy devices, non-invasive electrodes, and SpO2 monitors are used to track brain activity and physical activity of infants during both sleep and wake time. The participants consisted of high-risk infants, particularly infants with a family history of ASD, and low-risk subjects without any history of ASD. Data collection and analysis are being conducted to determine the different motor activity patterns correlated with sleep and wakefulness in high-risk and low-risk groups.

Faculty Mentor: Dr. Kristina Denisova
Research Area: Psychology

Grace Park

Discovery of Selective Inhibitors of CK1δ and CK1ε with a Tetra-substituted Pyrazole Scaffold

Authors and Affiliations
Grace Park, Department of Chemistry and Biochemistry, Queens College, CUNY
Jun Yong Choi, Department of Chemistry and Biochemistry, Queens College, CUNY

Abstract
Casein kinase 1 (CK1) is a family of protein kinases that regulate signal transduction pathways, such as Wnt signaling, circadian rhythm regulation, CNS-related disorders, and tumorigenesis in most eukaryotic cell types. Thus, they are a lucrative target for therapeutic agents in combating these types of disorders. The purpose of this study is to synthesize highly selective inhibitors of CK1δ and CK1ε. Small molecule analogs having a tetra-substituted pyrazole scaffold have been synthesized via multi-step organic reactions, which were monitored by thin layer chromatography and analytical liquid chromatography (LC). The final products were purified by high performance LC and characterized by NMR and Mass Spectrometry. The ADP-Glo biochemical assays show that JC-1025, JC-1031 and JC-1033 inhibit CK1δ in a low nanomolar range, while they are not active against CK1ε at 1 μM. Presently, new analogs are being synthesized and tested and will provide insight into the types of effective therapeutic agents in the treatment of cancers.

Faculty Mentor: Jun Yong Choi
Research Area: Chemistry

Jiaming Li

Efficient synthesis of poly-substituted asymmetric Cyclooctatetraene via Palladium-Catalyzed Cascade Reaction with Ynone O-Methyl Oximes and DMAD

Authors and Affiliations
Jiaming Li, Chemistry department, Queens College, CUNY
Dr. Yu Chen, Chemistry department, Queens College, CUNY

Abstract
Cyclooctatetraene (COT) is a multifunctional molecule known for its role as an important block and metal ligand in organic synthesis. However, the synthesis of poly-substituted asymmetric Cyclooctatetraene has been challenging because the well-known method generates symmetry-dominated and low selectivity. This study explores the palladium-catalyzed cascade reaction of ynone O-methyl oximes (1-substituted-3-(3-thienyl)-2-alkyl-1-one O-methyl oximes) and dimethyl acetylene dicarboxylates (DMAD) to synthesize poly-substituted asymmetric Cyclooctatetraene. The optimal conditions were using $CuBr_2$ (Copper (II) bromide) as a catalyst, DMF (Dimethylformamide) as a polar solvent, and 2 equivalents of DMAD, the yield of cyclooctatetraene is 82%.

Faculty Mentor Name: Dr. Yu Chen
Research Area: Organic Chemistry

Jonnathan Saavedra

Automation In the Laboratory

Authors and Affiliations

Jonnathan Saavedra[1], Biology Department, Queens College of The City University of New York

John Dennehy[1,3]

[1]Biology Department, Queens College of The City University of New York [2]Life Sciences Department, Long Island University Post [3]The Graduate Center of The City University of New York

Abstract

In scientific laboratories, automation enhances quality, efficiency, and safety. This research utilizes the affordable and versatile Opentrons OT-2 robot for automating serial dilution processes and simulating pathogen distribution across hospital surfaces. By employing the Opentrons API and Python programming, we demonstrate the robot's capability to improve precision and reproducibility in microbiological experiments, while reducing human error.

The automated serial dilutions streamline experimental protocols, increasing productivity. Concurrently, our hospital simulation script uses probabilistic models to simulate pathogen spread within healthcare environments, providing insights into critical points for infection control. This innovative approach aims to inform better sterilization practices and public health policies, potentially contributing to safer hospital environments and reduced transmission of infectious diseases. This interdisciplinary research exemplifies the synergy between microbiology, robotics, and computer science, showcasing technology's potential to address complex biological and health-related challenges.

Faculty Mentos: Dr. John Dennehy, Dr. Fabrizio Spagnolo

Research Area: Computer Science, Automation

Kanaka Sharon Vemu

The Association Between Sympathetic: Vagal Ratio and Internalizing and Atypical Behaviors in 5-Year-Olds

Authors and Affiliations
K. Sharon Vemu, Psychology, Queens College, CUNY
Dr. Yoko Nomura, Psychology, Queens College, CUNY

Abstract:
Introduction. Heart rate variability (HRV) is the variation in time between heartbeats and reflects the activity of the autonomic nervous system (ANS), which controls involuntary functions like heart rate, blood pressure, and digestion. HRV can indicate an imbalance in the ANS, affecting stress and overall health. Prenatal anxiety in mothers is found to be linked to lower HRV frequencies in their children, indicating decreased parasympathetic activity and increased sympathetic dominance, which may be linked to increased stress and anxiety levels in the children. The baseline heart rate ratio is a comprehensive indicator of autonomic functioning as it measures the balance between the parasympathetic and sympathetic systems. This ratio compares sympathetic and parasympathetic activities, where a high ratio points to stress and a low ratio indicates a calmer state, allowing an understanding of sympathetic dominance or parasympathetic predominance. Therefore, a higher ratio, reflecting sympathetic dominance over parasympathetic activity, may indicate higher stress levels and anxiety in the child. Analyzing this association can help understand the long-term effects of prenatal anxiety on a child's stress and emotional regulation.
Methodology. Prenatal anxiety in pregnant individuals was measured through self-reported questionnaire State-Trait Anxiety Inventory (STAI) in a sample of __ individuals. The heart rate baseline ratio was collected through ECG monitoring to capture heart rate intervals. This data was analyzed via (software) to determine the power within the low-frequency (LF) and high-frequency (HF) bands, and then compute the ratio by dividing LF power by HF power. Descriptive statistics were performed to derive the mean, standard deviation, and range for both variables.
Conclusions. A high sympathetic ratio in kids is linked to an increased risk of mental health disorders, indicating symptoms of anxiety and poor emotional regulation, while a balanced ratio shows a good balance between responding to stress and recovering, which is crucial for overall health and emotional well-being. Understanding the impact of prenatal psychosocial stress such as anxiety and its effect on the child's autonomic system functioning provides insight into possible long-term health outcomes and guides the development of early interventions to promote better autonomic regulation and emotional health.

Faculty Mentor Name: Dr. Yoko Nomura
Research Area: Neuropsychology

Lara Althawadi

Understanding The neural circuits underlying Motivation and Cue-Driven Behavior in Oxycodone Addiction: A Mice Model Study

Authors and Affiliations

Lara Althawadi[1], Eddy Barrera[2], Jeff Beeler[1,2]

[1]*Department of Psychology, Queens College, CUNY, NY* [2]*Department of Biology, CUNY Graduate Center, NY*

Abstract

This experiment that I'm working on to verify the oral oxycodone self-administration model in mice by examining the effects of different concentrations of the drug on motivation and cue-driven drug-seeking behavior. The primary objectives are to assess whether the mice can form a cue association with liquid oxycodone and if this association can drive future drug-seeking behaviors. Additionally, the study evaluates the level of effort the mice are willing to exert to obtain oxycodone at varying concentrations, utilizing a progressive ratio task. This task incrementally increases the number of lever presses required for each subsequent reward, allowing for the determination of a "breakpoint," where the animal ceases to work for the drug. We hypothesize that a higher dosing of oxycodone will result in a higher breakpoint, indicating a dose-dependent elevation of drug-motivation. Ultimately, this research seeks to clarify changes in glutamate neurotransmission across different phases of oxycodone self-administration, contributing to a better understanding of addiction mechanisms and potential therapeutic targets.

Faculty Mentor: Jeff Beeler
Research Area: Biology, Psychology

Kevin Bedoya

Computational modeling of intracellular transport using Python

Authors and Affiliations:
Kevin Bedoya, Department of Computer Science, Queens College, CUNY
Dr. Oleg Kogan, Department of Physics, Queens College, CUNY

Abstract:
Transport of cargo inside cells is a result of the interplay of motion of molecular motors on microtubules (MTs) and random diffusion in the cytoplasm. One type of MT morphology that occurs in cells involves multiple MTs converging at one location with the same polarity. Recently, one of us studied a one-dimensional model of this situation using both analytical techniques and Monte Carlo simulations, making several tantalizing predictions (Biophysical Reports 4(3), 100171 (2024)). Here we extend the analysis to more realistic two-dimensional geometries using numerical solutions of partial differential equations that describe the dynamics of probability densities of cargo. A computational approach to our study can be algorithmically done via discretization schemes, which can then be coded using Python. We consider a diffusion layer that represents the cytoplasm coupled to discrete MTs. Working in polar coordinates, the diffusion layer is sectioned into discrete rings and rays, with probability density at each point stored into multi-dimensional arrays in code. MTs are likewise discretized into segments. Partial differential equations are turned into finite difference equations, which the code implements to evolve probability densities in each layer in time at each grid location. We leverage this model to calculate particle density in both layers, rates of mass loss from the domain, and mean first passage times as functions of physical parameters.

Faculty: Dr. Oleg Kogan
Research Area: Theoretical Biophysics, Computer Science

Manha Bulbul

Isolation and Purification of Bacteriophages for Anaerobic and Aerobic Bacteria

Authors and Affiliations
Manha Bulbul, Biology, Queens College, CUNY
Monica Trujillo, Biology, Queensborough Community College, CUNY
John Dennehy, Biology, Queens College, CUNY

Abstract:
Antibiotic resistance is an increasingly important issue, as in many cases of bacterial infections, antibiotics do not properly eradicate the disease. Because of this, many scientists are looking towards using bacteriophages, a specialized virus that infects its corresponding bacteria, as a method of controlling and eradicating diseases.

In this experiment, we have isolated and purified phages for anaerobic and aerobic bacteria from hospital wastewater sources. The anaerobic bacteria used in this experiment are: B. Uniformis (BU), B. Vulgaris (BV) and B. Ovilus (BO). These bacteria are found in the human gut. Aerobic bacteria used in this experiment is Pseudomonas, which is a genus for a common pathogenic bacteria, Pseudomonas aeruginosa, known to infect and weaken the human immune system.

Faculty Mentor: John Dennehy, Biology, Queens College, CUNY
Research Area: Microbiology

Melanie Mejia

Impact of IQ, age, sex, and Mutation status on reaction time and accuracy on Attention Network Test

Authors and Affiliations

Melanie Mejia[1], Sonia Seehra[1,2], Shira Russell-Giller[1,2], Elijah Singh[1], Natalia Mejia[1], Deianeira Rodriguez[1], Phoebe Macdowell[1,2], Shayna Herszage-Feldan[1], Declan Sung[1], Veronica J Hinton[1,2]

1. Department of Psychology, Queens College, City University of New York
2. Department of Psychology, The Graduate Center, City University of New York, New York

Abstract

Objective: The goal of this study is to examine performance on the Attention Network Test (ANT) and determine whether factors such as sex, IQ, age and the fragile X premutation (PM) (defined as 55-200 expanded CGG repeats in the X-linked *FMR1* gene) may selectively impact on reaction time (RT) and accuracy.

Method: The ANT is a computer-administered measure of executive attention, orienting, and alerting. RT refers to how long it takes the participant to respond to the trial, and accuracy refers to the number of correct responses obtained. These measures emphasize different aspects of individual performance. In the sample of 141 child participants, ranging from ages 8-13 with the PM allele (n= 67, 44.8% female) and controls (n= 74,51.4%), the ANT was administered remotely as part of a larger study protocol that examines cognition in children identified prenatally with molecular markers and controls. Data were processed to yield measures to RT, total # correct and the ratio of the two variables. Regression and between group analyses examined ANT outcomes with participant's age, sex, estimated IQ and PM status. Independent t-test analyses and Pearson's correlation were run. Alpha was set at .01.

Results: Age and RT were negatively correlated (r= -.499, p<.001). Age and accuracy were positively correlated (r=.222, p< .01). Age and RT/accuracy were negatively correlated (r=-.498,p<.001). IQ and accuracy were positively correlated (r= .309, p<.001). IQ and RT/accuracy were negatively correlated (r= -.276, p=.001). There were no differences in the group related to either sex or PM status (p >.01).

Conclusion: Performance on the ANT test is sensitive to both age and IQ. Across a relatively narrow age range (8 to 13), RT and accuracy both improved as age increased. Similarly, overall performance improved with increases in IQ. Neither sex nor the PM had impact on performance.

Mentor: Veronica J. Hinton

Research Area: Psychology

Moshe Fried

Basins of Attraction of Kuramoto Oscillators on a Ring

Authors and Affiliations
Moshe Fried, Queens College, CUNY
Dr. Oleg Kogan,Queens College, CUNY

Abstract
The Kuramoto Model is a simple, yet paradigmatic toy model of interacting nonlinear oscillators. The model describes the dynamics of phases of coupled nonlinear oscillators that affect each other's instantaneous frequencies in a way that allows the formation of coherent synchronized collective states. In this project we are studying nearest-neighbor coupled Kuramoto oscillators on a ring. In such a topology, the model admits many stable states, each characterized by a different winding number. We are working on understanding the structure of basins of attractions of various stable states, as well as boundaries between these basins. A basin of attraction is a region of phase space surrounding a stable state such that if an oscillator was to be placed anywhere within that basin, it will move towards that stable state. An oscillator placed outside the basin of attraction of a given stable state will move towards some other stable state. Understanding the structure of basins of attraction of stable states of this system, as well as dynamical features that form basin boundaries, will be helpful in predicting the response of this system to perturbations, including additive noise - which can give rise to noise-induced transitions between stable states.

Faculty: Dr. Oleg Kogan
Research Area: Physics

Roberto Bailey & Samreen Randhawa

A Structural Equation Modeling Approach to Assessing the Impact of Prenatal Cannabis Exposure on Psychophysiological Responses: The Mediating Role of Autonomic Functioning Gene Expressions

Authors and Affiliations
Roberto Bailey, Hunter College High School;Queens College, CUNY
Samreen Randhawa, Simon Fraser University, Canada;Queens College, CUNY
Yoko Nomura, Queens College

Abstract
Previous review papers suggest that cannabis use among pregnant women is on the rise, though prevalence estimates vary widely from 2% to 36% depending on detection methods and populations studied. Nonetheless, prenatal cannabis exposure can have substantial effects on children's stress regulation measured through psychophysiological responses. Prior research from the Stress in Pregnancy Study found maternal cannabis use during pregnancy to be associated with reduced normalized heart rate variability (HRV), referring to the interval beat-to-beat changes in heart rate. However, the potential impact of prenatal exposure to cannabis on respiratory sinus arrhythmia, natural variation in heart rate that occurs during the breathing cycle, has not been explored to our knowledge.

Placenta biopsies were acquired and processed as described in the Stress in Pregnancy Study Cohort Profile and RNA sequencing was performed to extract gene expression data. Gene expression clusters were formed using results from bivariate correlations and factor analysis alongside information available from the National Institute of Health gene database. Vagal tone, a proportional ratio of HRV with respect to parasympathetic autonomic activity, and RSA were measured in response to a repeated startle paradigm.

Structural equation modeling (SEM) is a statistical technique that evaluates complex relationships between observed and latent variables. The proposed model would examine how self-reported cannabis exposure influences psychophysiological responses, with gene expressions clustered into two groups—neurotransmission and neurodevelopment—serving as mediators. The model will measure both direct and indirect effects of cannabis exposure on cardiorespiratory autonomic regulation, focusing on vagal tone and RSA. Significant findings could suggest that maternal cannabis use during pregnancy significantly impacts these autonomic regulatory functions.

Faculty Mentor: Yoko Nomura
Research Area: Developmental Neuroscience

Sara Lifshitz

α/β-Tubulin as a 'Toggle Switch' in Human Breast Cancer

Authors and Affiliations
Sara Lifshitz, Dr. Susan Rotenberg
Department of Chemistry and Biochemistry, Queens College, CUNY

Abstract
The laboratory with which I am affiliated has demonstrated that protein kinase C (PKC) phosphorylates Ser165 of alpha-tubulin increases the rate of polymerization of microtubules (MTs) in human breast cells, leading to their increased motility and decreased proliferation. Observations from Fourest-Lieuvin et al. (2006) demonstrated that in ovarian cancer cells, phosphorylation of Ser172 of beta-tubulin by cyclin-dependent kinase-1 (cdk-1) produces the opposite effects on MTs and cell proliferation. These findings suggest that PKC and cdk-1 promote opposing effects on MTs in breast cells. The idea is that alternating phosphorylation states of alpha/beta-tubulin defines a "toggle switch" that provides a novel means to direct the breast cell phenotypes of motility and proliferation and to predict the metastatic potential of a breast tumor. This study explores the intracellular and phenotypic effects of a phospho-mimetic mutant of beta-tubulin (S172D) in human breast cells (MCF-10A). This was done through the transfection of selectively mutated plasmids and the analysis of the expression of epithelial–mesenchymal transition (EMT) biomarkers by Western Blot.

Faculty Mentor: Dr. Susan Rotenberg
Research Area: Chemistry, Biochemistry

Selassie Mawuko

Brain Extracellular Matrix Plasticity Following Peripheral Neuropathy

Authors and Affiliations
Selassie Mawuko 1, Maral Tajerian 1,2
1Queens College, CUNY; 2The graduate center, CUNY

Abstract
Neuropathic pain, caused by nerve injury, leads to significant changes in the extracellular matrix (ECM) around glial cells in the hippocampus. This project explores how these changes contribute to chronic pain. The ECM's structure alters, becoming less rigid and affecting the function of glial cells like microglia and astrocytes.

After nerve injury, microglia activate quickly, releasing inflammatory molecules that start pain signals. Although this activation decreases over time, astrocytes remain reactive, continuing to support chronic pain. This prolonged astrocyte activity is marked by increased levels of certain proteins and changes in cell shape.

Research shows that modifying ECM components can reduce pain and memory problems. For example, lowering specific enzymes in the ECM can alleviate pain behaviors and improve cognitive functions. Understanding these interactions provides potential targets for new pain treatments.

Faculty Mentor: Dr. Maral Tajerian
Research Area: Biology

Shaunakay Palmer & William Park

Development of Nek4 Biosensors for Monitoring Cellular Activity

Authors and Affiliations
Shaunakay Palmer, William Park, (Department of Chemistry and Biochemistry)
Dr. Sanjai Kumar Pathak (Department of Biochemistry)
Queens College, CUNY

Abstract
Development of Nek4 Biosensors for Monitoring Cellular Activity
Protein kinases have shown to be a viable target for pharmaceutical research, with over eighty FDA-approved drugs targeting nearly thirty kinases. Unfortunately, 90% of the 538-member family of the kinase remain underexplored, and among the kinases Nek4 remains one of the least studied members of the NIMA family, yielding only about 50 papers on PubMed as opposed to around 500 for the family's most studied member, Nek2. In order to contribute to the long-term goal of annotating Nek4 function in living cells and laying the foundation for potential drug development involving this kinase, we aim to synthesize potential Nek4 biosensors using solid phase peptide synthesis protocols. Such biosensors would be able to detect Nek4 activity via fluorescent activity upon binding to the active site and triggering phosphorylation. Affinity to the activity site is determined through the creation of a 16-compound peptide library containing amino acid sequences that prior research indicates are likely to bind to Nek4. Purification of synthesized peptides are done using reverse-phase high performance liquid chromatography, and characterization accomplished with mass spectrometry. Future research upon completion of this library assesses the efficiency of sensing activities of the developed biosensor library using steady-state enzymology in both in vitro and in vivo study with enzyme assays.

Faculty Mentor: Dr. Sanjai Kumar Pathak
Research Area: Chemistry, Biochemistry

Sujal Kumar

Product Mix and the Markups of US Companies

Authors and Affiliations
Sujal Kumar, Stefan Pitschner
Queens College School of Business

Abstract
This paper explores the influence of product mix, alongside prices and costs, on company markups, challenging the traditional assumption that markups fluctuate only due to price and cost changes. Using advanced linguistic tools to analyze corporate filings, Prof. Pitschner identified product mix as a significant factor, accounting for 28% of markup variations—more than price changes (20%) but less than cost changes (52%). My work involved replicating Jan De Loecker's study by debugging and verifying their replication code, which resulted in accurate tables and regression models demonstrating the positive relationship between markups and margins. Additionally, I worked on Python scripts for automating article retrieval and supported the literature review

Faculty Mentor: Stefan Pitschner
Research Areas: Economics, Computer Science

Swan Yi Htet

Characterizing Crowdedness in TESS Images

Authors and Affiliations

Swan Yi Htet [1], **Keaton J. Bell** [1], **Isabel L. Colman** [2]

[1] Queens College Physics Dept. , [2] American Museum of Natural History Astrophysics Dept.

Abstract

NASA's Transiting Exoplanet Survey Satellite (TESS) captures light curves from its pixel images to detect exoplanets and study stellar variability. TESS images are composed of individual pixels that measure the brightness of stars over time, creating light curves used to identify transits and other variations. However, TESS's large plate scale of 21 arcseconds per pixel introduces a phenomenon known as crowding, where light from multiple stars blends together within a single pixel. This blending, or crowdedness, contaminates the light curves and affects their accuracy. For exoplanets, excess flux from crowding can reduce the apparent transit depth, leading to an underestimation of planet radii. This research aims to assess the precision of crowdedness corrections applied by the TESS pipeline, enabling the propagation of this uncertainty to measured system parameters.

To achieve this, we gather Target Pixel Files (TPF) and sky positions of nearby stars using data from observatories like GAIA. We then perform MCMC (Markov Chain Monte Carlo) analysis in parallel on the AMNH cluster to develop a model image of the star, evaluating the crowdedness value in the photometric aperture for each image in the TPF. By comparing the distribution of these values to those used by the TESS reduction pipeline, we determine the precision of the pipeline's corrections. Our modeling quantifies additional sources of systematic error, such as uncertainty in the background flux of the TPF and intrinsic variability of stars. Applying this technique to multiple TESS targets will further quantify the precision of the contamination corrections applied by the TESS pipeline, improving the accuracy of exoplanet and stellar variability studies.

Faculty Mentor: Dr. Keaton J. Bell

Research Area: Computational Astrophysics

Tam Nguyen

Modeling Spillovers in Credit Riskiness of Sovereigns

Authors and Affiliations
Tam Nguyen , Dr. Suleyman Taspinar
Economics Department, Queens College

Abstract
As different economies become increasingly interconnected through various channels, they are more likely to experience spillover effects in case of a credit event. Thus, policymakers are interested in understanding the co-movements across markets in different countries during periods of financial turmoil. One way to measure co-movements is by examining the impact of changes in one sovereign's credit default swap (CDS) spreads on other sovereigns' credit riskiness. because CDS spreads are the most commonly traded credit instruments and are widely used to assess the likelihood of a country experiencing a credit event. In this paper, we aim to quantify the co-movements of sovereign CDS spreads by using a spatial econometric model and a dataset consisting of 14 sovereigns from 2009 to 2022.

Faculty Mentor: Dr. Suleyman Taspinar
Research Area: Economics

Tao Wu

Auto-classification of arXiv Articles Via Neural Networks

Authors and Affiliations
Primary Author: Tao Wu, the Department of Mathematics, Queens College, CUNY
Project Collaborator: FangFang Lu, the Department of Computer Science, Queens College, CUNY
Project Collaborator: Kathy He, the Department of Computer Science, Queens College, CUNY

Abstract
Centering on text embedding practices in natural language processing and challenges inherent in the process, this research project seeks to explore the machine learning pipeline of building a predictive model for the classification of arXiv research articles into predefined primary categories. Effective auto-classification of documents enables streamlining processes within organizations, helps to derive useful knowledge, and informs better decision-making to drive growth for entities with complex data sets. Our utilization of modern embedding techniques, as an indispensable component in our ML pipeline, involves doc2vec and MPNet, both of which can generate high-dimensional vector representations/embeddings after having been trained on the full text of labeled arXiv articles. These computed embeddings are then used for the training of a fine-tuned artificial neural network model designed for classification. The out-of-sample performances of the proposed model, trained and evaluated on a distributionally balanced dataset, are 52.041% ± 0.167 and 72.440% ± 0.568 overall accuracies with doc2vec and MPNet deployed respectively. Both outperform the baseline method, FB Abs, with identical datasets and in the case of MPNet, its performance metric is on par with those of state-of-the-art embedding methods such as Longformer and SciBERT. This study demonstrates the competitive edge of using MPNet as an embedding layer that converts unstructured text into structural vector representations from which a customized ANN model learns for downstream classification tasks as well as enhances the scientific argument that large language models fine-tuned on in-domain data for the adaption of specific tasks should, in principle, provide superior performance. Future work will focus on training and evaluating a distributionally imbalanced dataset similar to the distribution of real-world arXiv submissions, further exploring MPNet's capability as an end-to-end classification model, investigating models with encoder-only transformer-based architecture like BERT, and applying them to other classification tasks in different domains.

Faculty Mentor: Dr. Nicholas Vlamis, Department of Mathematics, Queens College, CUNY
Research Area: Concentration in and around mapping class groups, hyperbolic geometry, and Teichmüller theory.

Poster Session and Assignments

Poster Session 1

Student Name	Poster Board #
Abid Fahim	1
Antonella Chiriboga	2
Brittany Pompey	3
Cynthia Gan	4
Elijah Singh	5
Eva Chloe Taub	6
Evelyn Chimbo	7
Jiaming Li	8
Kanaka Sharon Vemu	9
Melanie Mejia	10
Roberto Bailey & Samreen Randhawa	11
Sara Lifshitz	12
Shauna-Kay Palmer & William Park	13
Sujal Kumar	14
Tam Nguyen	15

Poster Session 2

Student Name	Poster Board #
Alan Cantos	1
Avraham Zion Kuighadush	2
Brian Limbu	3
David Young	4
Gabriela Sedano	5
Grace Park	6
Jonnathan Saavedra	7
Kevin Bedoya	8
Lara Althawadi	9
Manha Bulbul	10
Moshe Fried	11
Selassie Mawuko	12
Swan Yi Htet	13
Tao Wu	14
Rose Felix	15