Harrison Science Research Presents:

The 23rd Annual

HARRISON HIGH SCHOOL

SCIENCE SYMPOSIUM





Monday, June 2, 2025
6:30 PM - 9:00 PM
HHS Student Union

Scientific presentations of original research projects by Harrison High School Students

Overview of the Program

The Harrison Science Research program invites all students to participate in authentic and original scientific research. It is designed to provide participants with an understanding of research methodologies in the natural and social sciences, with an emphasis on both laboratory and data-driven research. We encourage students to work with research scientists and professionals within their chosen area of interest so that they may develop a commitment to long-term focused research. Students may conduct independent research in mathematics, life science, physical science, psychology, or the social sciences and are required to use technology to organize research (presentation software and data management systems). Students maintain a portfolio of their work, which provides the basis for assessment. Students prepare to enter local, regional, national, and international scientific competitions. Students involved in the program demonstrate initiative, perseverance, and creativity, in an atmosphere where independent work habits are developed and fostered.

Acknowledgments

Our program could not sustain itself without the support received. We owe a special thanks to the following:

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Science Research Teachers

Allison Blunt
Mary Blount

Science Teacher Aide

Helen Hluskho

Internal Review Board Members

Dr. Christopher Tyler, Ph.D.
Ms. Stavroula Georgoulis, MA
Dr. Brian Ladewig, Ed.D.
Dr. Joan O'Keeffe, Ed.D.
Ms. Kim Beukema, Principal

We would also like to thank the High School Faculty, Secretarial, and Custodial Staff for supporting our program throughout the year.

Order of Events

6:30-6:50 **Science Research Orientation for 9th Grade (& other 1st Year Parents)**

6:30-7:00 **Open House & Refreshments in the Student Union**

- Students & Parents are invited to informally visit posters.

7:00-7:45 **Poster Presentation Session in the Student Union**

- This session will include students from the Science Research program. Parents and other attendees will be asked to interview Symposium participants. In addition to allowing students to present their work, this will help them prepare for future science fairs.

7:45-9:00 **Program Honoring the Work of Our Students**

- **Montage**
- **Opening remarks** - Ms. Kimberly Beukema, Principal HHS
- **Highlights of the HHS Program** -Allison Blunt & Mary Blount
- **Guest Presenter** - Tasha Garayo, HHS Alumnus & 4th Year Medical Student, Drexel University College of Medicine
- **Student Presenter:** Ryo Ide
- **Senior Recognition**
- **Closing Remarks & Group Photo**

In the following pages of our Symposium Booklet you will find:

Senior Research Bio Pages, Abstracts, and Mini-Posters

Junior Abstracts

Sophomore Abstracts

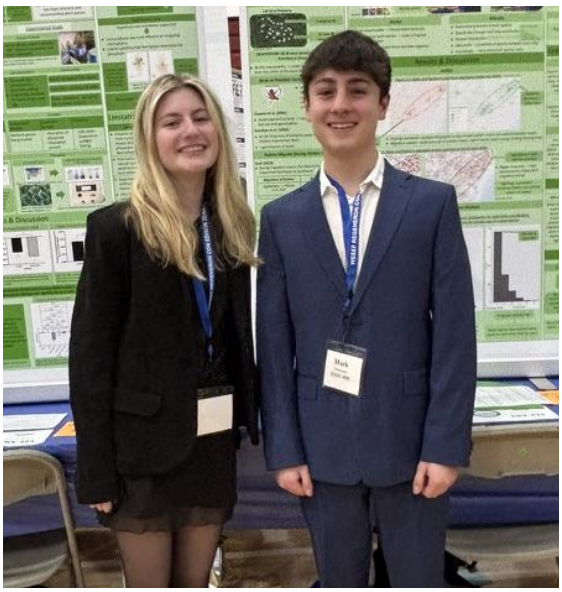
Science Research Seniors

















Remi Badner

The Effects of Active Usage of Social Media on the Reported Frequency of Cognitive Distortions



Location of Research:
Harrison High School

Mentor:
Ms. Allison Blunt

Will be Attending:
University of Pennsylvania

Intended Major:
Philosophy, Politics, and Economics

Fairs & Awards:
WESEF 2025 - Participant
Regeneron STS - Applicant
WESEF 2024 - United State Air Force Award
Somers 2023 - Participant
HHS Symposium - 2023, 2024, 2025

Active usage of social media is defined as the behavioral pattern of actively creating content or interacting with others online through dedicated platforms (eg., Instagram, Snapchat, and Facebook). It is a way of connecting with other users and building social networks. Active usage has been reported to promote an individual's positive well-being. Cognitive distortions are irrational patterns of thinking that inaccurately alter one's perception of reality and lead to negative emotions. These negative thought patterns often lead to anxiety, depression, lowered self-esteem, and overall poor mental well-being. This study aimed to test two hypotheses. One hypothesis was that as active usage on social media increases, the reported frequency of cognitive distortions will decrease. The other hypothesis was that people on social media will experience the same type of cognitive distortions as people in social situations as reported by Covin (2011). 109 adolescents were surveyed using an original scale for active use of social media which included specific behaviors such as frequency of posting updates and photos, sharing personal information, meeting new people online, and participating in group chats. Covin's (2011) Types of Thinking Scale was adapted for social media use. The hypothesis was not supported as findings demonstrated that as active usage on social media increased, the reported frequency of cognitive distortions significantly increased ($p<.01$). Furthermore, active usage significantly correlated with increased time spent on social media ($p<.01$), and increased time spent on social media was significantly associated with an increased reported frequency of cognitive distortions ($p<.05$). Results suggest that as adolescents spend more time on social media, even if they are actively engaging with others, it may have a negative impact on their mental health.

The Effects of Active Usage of Social Media on the Reported Frequency of Cognitive Distortions

Introduction

Tik Tok Ban Reversed: Is this good?
Haidt & Rausch (2025)

- TikTok encourages "addictive, compulsive, and problematic use" among its younger users
- Exposes them to sexual & violent content, and increases levels of anxiety, depression and other mental health issues."

- Social Media = Addictive
  - Teenagers report spending over 5 hours/day on social media platforms (Real Research Media, 2022)
- Depression & Anxiety Tied to Cognitive Distortions
- **Purpose:** To determine whether active usage on social media decreases the reported frequency of cognitive distortions.

Methodology

Participants: 109 adolescents from U.S.

Variables:

- ➔ Independent - active usage of social media
- ➔ Dependent - reported frequency of cognitive distortions
- ➔ Controlled → All participants were adolescents, All participants have at least one of the following social media accounts: Instagram, Tik Tok, Snapchat, Facebook, All took the same survey instrument via a google form

Types of Thinking Survey:

- ➔ Part 1: Demographic Information
- ➔ Part 2: Social Media Usage
- ➔ Part 3: *Types of Thinking Scale*

Results & Analysis

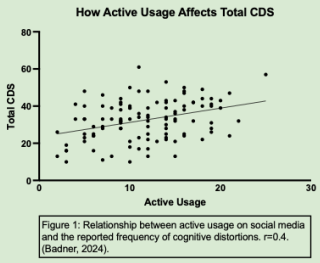


Figure 1: Relationship between active usage on social media and the reported frequency of cognitive distortions. r=0.4. (Badner, 2024).

Unexpected Result: As active usage increased, the total reported frequency of cognitive distortions increased –Significant relationship → p<.01

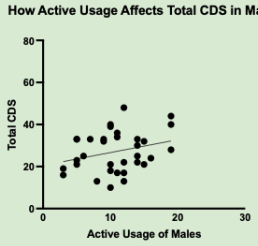


Figure 2: Relationship between active usage on social media and the reported frequency of cognitive distortions for males. r=0.3. (Badner, 2024).

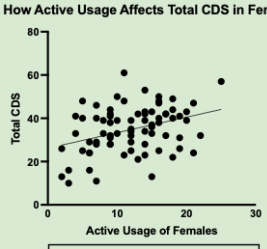


Figure 3: Relationship between active usage on social media and the reported frequency of cognitive distortions for females r=0.4. (Badner, 2024).

Moderate positive relationship → not significant (p>.05)

Significant relationship (p<.01)

Conclusion & Future Research

Hypothesis = Rejected

Aim: To determine whether active usage of social media decreases the reported frequency of cognitive distortions

Results: As active usage on social media increased, the reported frequency of cognitive distortions increased

Importance: Highlights the fact that all types of usage on social media (no matter if it is active or passive) increases the reported frequency of cognitive distortions



https://amuedge.com/bad-habit-slimdown-week-37-poor-social-media-representation/



https://therapymantra.co/negative-feelings/cognitive-distortions/

Future Research

- More diverse sample geographically, ethnically, and gender wise
- Collect non anonymous data that will later be de-identified
- Use pre-existing identification code to evaluate people's comments on social media posts

Julianna Blackman

Examining the Interplay of Socioeconomic Status and Hearing Loss on Neurocognition in Pediatric Cancer Survivors



Location of Research:
Children's Hospital Los Angeles
Harrison High School

Mentor:
Dr. Melissa Balderrama

Will be Attending:
University of Pennsylvania

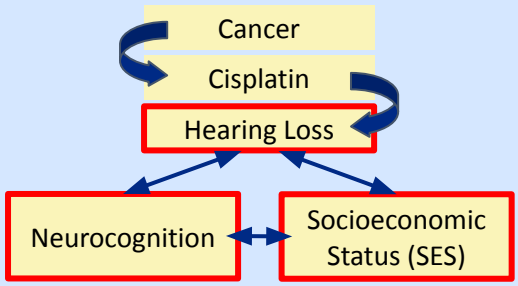
Intended Major:
Neuroscience

Fairs & Awards:
WESEF 2025 - 3rd Place Medicine and Health
WESEF 2024 - 2nd Place Medicine and Health
NYSSEF 2024 - 4th Place Behavioral Science
Somers 2023 - Participant
HHS Symposium - 2023, 2024, 2025

There are many factors that can influence a pediatric cancer survivor's quality of life following remission. For instance, cisplatin–a type of chemotherapy used to treat cancer–has been found to cause hearing loss in cancer survivors. Furthermore, a 2024 study found that low socioeconomic status (SES) was associated with worse neurocognitive outcomes in patients, including low crystalized verbal intelligence scores. Due to these adverse effects and dangers to neurodevelopment, this study aimed to examine the interplay of SES and hearing loss on neurocognition in pediatric cancer survivors. SES was determined by whether the participant used public or private health insurance, hearing loss was determined by whether the participant was recommended hearing aids, and neurocognition was determined using crystalized verbal intelligence and functional communication scores. Additionally, the amount of craniospinal irradiation received (centigrays) and the age at initial cancer diagnosis (months) were controlled for during the analysis. Following IRB exemption, data was extracted from 105 medical records from participants receiving care at the same pediatric hospital. Data analysis was then conducted on de-identified data with One-Way Analyses of Covariance (ANCOVAs), Two-Way ANCOVAs, and a Chi-Square Test for Independence. The results showed that insurance type had a significant impact on crystalized verbal intelligence (p = .001), and a relationship approaching significance with functional communication (p = .053). However, when hearing loss was added as an independent variable, there was a non-significant effect on neurocognition. This indicated that SES was a stronger predictor than hearing loss of neurocognition. There was also a non-significant relationship between the patient's insurance type and their likelihood of being recommended hearing aids. Thus, SES had a greater impact on patients' neurocognition than their hearing. Overall, this study can raise awareness of the negative effects that lack of equity in the medical field has on patients.

Examining the Interplay of Socioeconomic Status and Hearing Loss on Neurocognition in Pediatric Cancer Survivors

Introduction



Ototoxicity - Damage to the ear from a medication
Crystallized Verbal Intelligence (CVI) - Comprehension of concepts using written and/or spoken words
Functional Communication (FC) - Effective communication of feelings and basic needs

Purpose: Uncover a relationship between SES, hearing loss, and neurocognition in pediatric cancer survivors

Hypothesis: Public insurance/hearing loss participants will have worse CVI and FC t-scores when compared to private insurance/average hearing peers

Methodology

Independent	Dependent
Insurance type; Hearing status	CVI score; FC score

Covariates

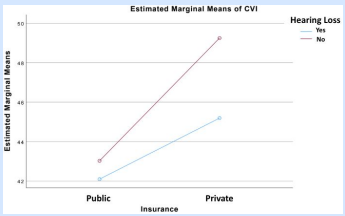
1) Craniospinal irradiation (centigrays)
2) Age at initial cancer diagnosis (months)

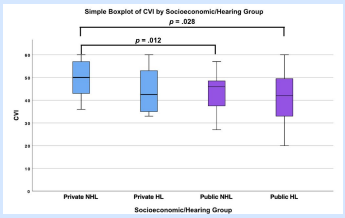
Data Analysis

1. One-Way Analysis of Covariance (ANCOVA)
-Effect of insurance on CVI and FC
-Effect of SES/hearing combined variable on CVI and FC
2. Two-Way ANCOVA
-Effect of insurance and hearing on CVI and FC
3. Chi-Square Test for Independence
-Relationship between insurance and hearing
4. Box Plot
-Spread of CVI or FC for insurance/hearing groups

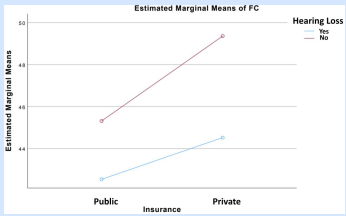
Results & Analysis

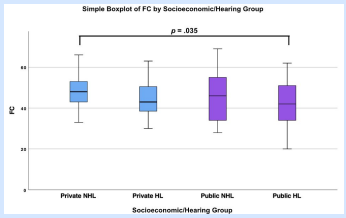
Verbal Intelligence





Functional Communication





Key Takeaways

1. Public insurance = **lower CVI and FC t-scores**
2. Hearing loss = **lower CVI and FC t-scores**
3. For CVI and FC, private insurance/without hearing loss = **highest** estimated mean score; public insurance/ hearing loss = **lowest** estimated mean score

Conclusion & Future Research

Discussion

Hypothesis was somewhat supported

High SES = High CVI
High SES ≠ High FC → Not statistically significant

Added hearing loss

Implications

- **Interdisciplinary approach**
- Beneficial to future of cancer survivorship care
- Highlights necessity for **equity in healthcare**

Conclusion

Neurocognitive disparities in cancer survivors, specifically low CVI scores, may result from low SES

Increase advocacy for patients

Inspire future research

Sophia Bondikov

The Extent to Which Anthocyanins from Tart Cherries Improve Performance and Decrease Inflammation in *Drosophila melanogaster*



Location of Research:
Harrison High School

Mentor:
Ms. Allison Blunt

Will be Attending:
Binghamton University

Intended Major:
Biology

Fairs & Awards:
WESEF 2025 - 2nd Place Medicine and Health
Upstate JSHS 2025 -NY Upstate Poster Finalist
Regeneron STS - Applicant
Somers 2023 - 3rd Place Medicine and Health
HHS Symposium - 2023, 2024, 2025

Many athletes are turning to natural supplements, such as tart cherries, as alternatives for banned substances. During prolonged periods of exercise, pro-inflammatory cytokines are produced, increasing oxidative stress and inflammation levels in the body. Anthocyanins, pigments abundant in tart cherries, block cytokine production which may be responsible for ameliorating inflammation. The purpose of this study was to determine if the mechanism that anthocyanins in tart cherry supplements improve performance is by decreasing inflammation. It was hypothesized that the higher the anthocyanin concentration, the less inflammation, which will result in improved performance. To test this hypothesis, the mutant Drosophila melanogaster which expresses Green Fluorescent Protein (GFP) in the presence of inflammation was used. A dose-response study was conducted by substituting 0, 5, 50, 500, and 1000 μM anthocyanin concentrations for water in the homemade cornmeal food following the BDSC recipe. Flies raised on the different concentrations underwent two hours of continuous exercise in an adapted version of Tinkerhess' (2012) power tower assay. A negative geotaxis assay was conducted before and after the power tower to determine change in performance. The NIGHTSEA fluorescence adaptation to a stereo microscope was used to view GFP expression in the flies, which was then quantified using the software program ImageJ. Results showed flies fed 50, and 500 μM performed significantly better than the 0 μM and exhibited significantly less inflammation ($p<.0001$). However, the 1000 μM performed significantly worse and had significantly more inflammation than the 500 μM ($p<.05$), so the threshold for optimal performance was between 50 and 500 μM. This study has implications potentially in the field of sports nutrition, offering a natural performance enhancer and potential alternative for synthetic anti inflammatory substances.

The Extent to Which Anthocyanins from Tart Cherries Improve Performance and Decrease Inflammation in *Drosophila melanogaster*

Introduction



→Tart cherries (TCs) = high in **anti-inflammatory properties**

→ Anthocyanins= pigment, most abundant anti- inflammatory compound



1. Prolonged exercise→ free radical (FR) buildup
2. FR buildup→ oxidative stress (OS)
3. OS→ inflammation



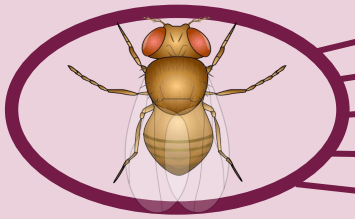
***Drosophila melanogaster* (fruit fly)**
→ Similar inflammatory pathways as humans
→ Inflammation based on cytokines

Purpose: Determine if anthocyanins in TCs are responsible for improving performance by decreasing inflammation

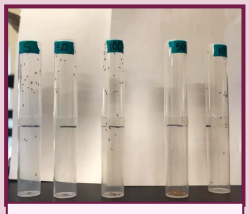
Hypothesis: Higher anthocyanin concentration→ less inflammation→ improved performance

Methodology

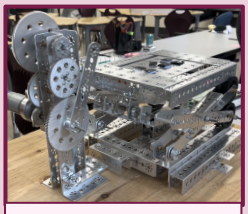
IV	**DVs**	**CVs**
Anthocyanin concentration	→ Performance → GFP	21°C, 12 hr light/12 dark



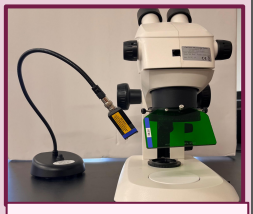
0 µM
5 µM
50 µM
500 µM
1000 µM



Part 1: Negative Geotaxis Assay -Tests for Performance

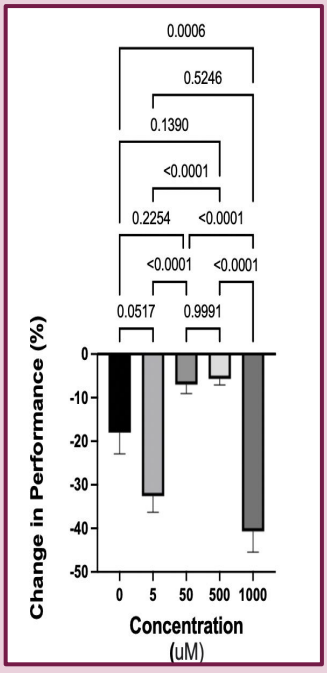


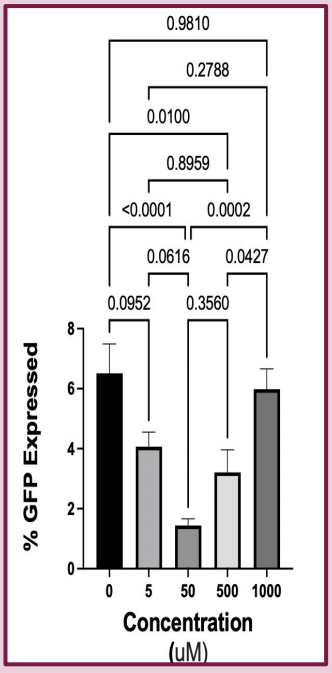
Part 2: Power Tower Assay -Induces Inflammation



Part 3: GFP Analysis -View and quantify inflammation

Results & Analysis





→ After 2 hours in PT, 50 and 500µM performed more similarly to pre PT than 0, 5, and 1000µM
→ GFP expressed reinforces trends from change in performance

Conclusion & Future Research

Hypothesis= Somewhat supported

- Improvement in performance only in 50 and 500uM
- **Range** of optimal performance instead of linear relationship
- Too much = toxic, unproductive

Future Research

1: Isolate anthocyanins

Limit presence of other substances present in TCs

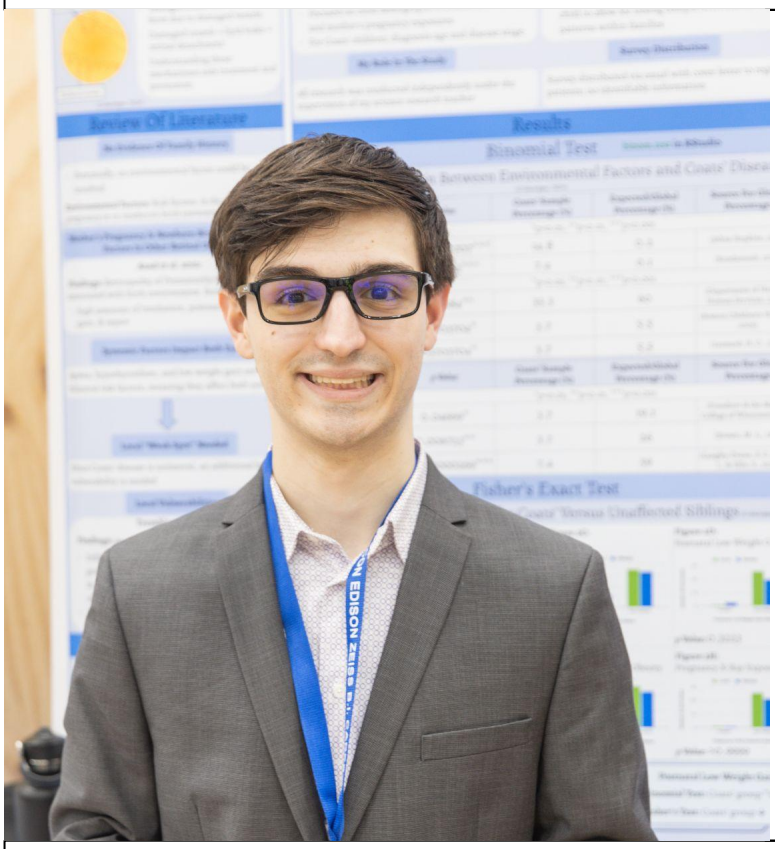
Inflammation related diseases: arthritis, coronary issues, certain cancers

2: Immunohistochemical study

See what is happening on the inside of the fly, how inflammation is arising on a systemic level

John Colacioppo

Assessing Environmental Factors Related to the Onset of Coats' Disease



Location of Research:
Harrison High School

Mentor:
Ms. Allison Blunt

Will be Attending:
University of Connecticut

Intended Major:
Mechanical Engineering & Aerospace

Fairs & Awards:
WESEF 2025 - Participant
Regeneron STS - Applicant
JSHS 2025 - Applicant
Somers 2023 - Participant
HHS Symposium - 2023, 2024, 2025

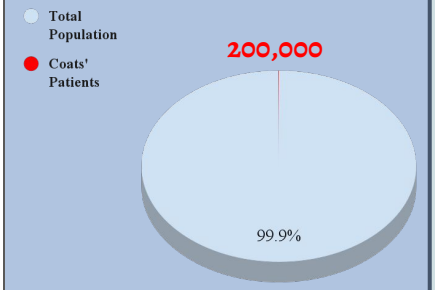
Coats' disease is a rare retinal condition affecting fewer than 200,000 people in the U.S. It causes exudation, which is the slow escape of liquids from blood vessels through pores in the cell membrane; and telangiectasia, which is an abnormal widening of small blood vessels in the retina. It can result in blindness if left untreated. Retinopathy of Prematurity (ROP) is a disease that presents similarly in the early stages except it does not involve telangiectasia or significant exudation. ROP has been associated with factors in the birth environment such as number of days of intubation, postnatal low weight gain, and sepsis, all of which may contribute to the breakdown of the blood-retinal barrier in addition to the abnormal development and/or leaking of blood vessels. Since genetic causes of this disease have yielded conflicting results, it can be thought that an environmental factor may be related to the onset of Coats' disease. Since few studies have explored a possible link between an environmental factor and the onset of Coats' disease and since Coats' disease and ROP are similar, the purpose of this study was to determine if there is an environmental factor, specifically in the mother's pregnancy or the child's birth environment that potentially contributes to the onset of Coats' disease. The hypothesis was that similar patterns in environmental exposures, especially in the birth environment, will be identified among Coats' patients. After IRB was obtained, 27 mothers who gave birth to at least one child with Coats' disease were surveyed through a Coats' Foundation registry using the HIPAA compliant platform Invitae. A two-sided binomial test found that compared to the global population, the Coats' group showed significantly higher rates of apnea and hypothyroidism ($p < 0.001$), and postnatal low weight gain was significantly lower in the Coats' population ($p<0.05$). Similar trends, although not significant, were found between the Coats' patients and their siblings ($p>0.05$). Although the findings were not significant in the study population, they suggest that further research could be warranted to determine whether these identified factors are linked to the disease pathogenesis.

Assessing Environmental Factors Related to the Onset of Coats' Disease

John Colacioppo

Introduction

Prevalence of Coats' Disease in the U.S. Population



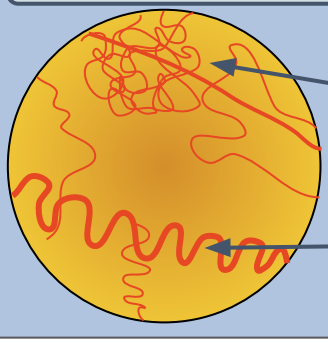
Retinal damage →blindness

Affects young children, primarily males; no known cause

Typically presents unilaterally (One Eye) → key feature of the disease

Coats' Disease

Retina: location of disease progression



Telangiectasia: Web-like veins form due to damaged vessels

Thickened Vessels: Damaged vessels → lipid leaks → retinal detachment

Methodology

Survey Participants, Construction, & Distribution

Participants: 27 Coats', 23 Siblings

Contacted through National Foundation Registry

Sections: Consent & Eligibility

Mother's Demographics

Biological Children

Distribution: Emailed to registry patients

No identifiable information collected

Variables

IV: Coats' Disease presence
DV: # of children exposed to environmental factor
CVs: Only mothers of a child with Coats' disease participated, same survey instrument

Role

All research was conducted independently under the supervision of my science research teacher

Results & Analysis

Hypothesis Partially Supported

✓ ↑ Apnea & hypothyroidism in Coats' patients
✓ Postnatal low weight gain may be a protective factor
X Not universal to all Coats' patients

Potential Mechanisms

Apnea:	Hypothyroidism	Postnatal Low Weight Gain:
Breathing stops	Swelling	Slower growth
Retina dilates	Retinal pressure	Less mutations
Adrenaline release	Fluid leakage	Reduced risk of abnormal vascularization
Retinal detachment		

Conclusion & Future Research

First Step In Identifying Potential Avenues For Research On Coats' Disease

Application & Importance

Increased awareness + Early intervention & screening + Effective monitoring

=



Wellbeing

Future Research

Expanded Data Collection:
- Larger sample size
- Targeted questions

Animal Studies: Induce factors & investigate effects on retinal vascularization using a model organism

Mark Colacioppo

Analyzing the Role of Birds on the Spread of the Invasive Japanese Barberry in a Rural Town in Upstate New York



Location of Research:
Harrison High School

Mentor:
Ms. Ana Hiraldo-Gomez, ArcGIS
Mr. Matthew Aiello-Lammens
Pace University

Will be Attending:
University of Delaware

Intended Major:
Nursing

Fairs & Awards:
WESEF 2025 - Participant
Regeneron STS -Applicant
JSHS 2025 - Applicant
Somers 2023 - Participant
HHS Symposium - 2023, 2024, 2025

Invasive species have no natural predators in an area and crowd out native species which disrupts ecosystems. Specifically, the Japanese barberry doesn't require much sunlight and can grow almost anywhere the seeds are dropped which then overshadows light-dependent plants, effectively decreasing their population. This leads to less biodiversity and upsets the food chain for native plants and animals in the area. A 130 acre property in Downsville, New York, motivated this study. In 2017, there were 5 Japanese Barberry Bushes planted close to a house in a line. In July 2024, the property was systematically mapped to determine the locations of new Japanese Barberry growth; 23 new bushes were observed. All newer bushes were located along the treeline and not in an open field and 23 out of the 23 were located directly under aerial branches; perfect perches for birds. In addition, Hamilton et al. (1943) found an 81.5% frequency of barberry seeds in American Robin feces. During the migratory season for birds in the Northeast, Birds consume berries to prepare for their travel to a warmer climate and the Japanese Barberry berries ripen from early September to October. It was hypothesized that migrating birds feed on the fruit of Japanese Barberry, spreading their seeds during their migratory journeys. Recorded sightings of Japanese Barberry and the migratory American Robin were downloaded from iNaturalist, a public crowdsourcing species identification system and an organism occurrence recording tool. The command rdist.earth was used on RStudio to determine the proximity of the American Robin and Japanese Barberry to each other. A poisson distribution showed that the species were a median of 4 km away from each other. When examining a specific user's ID who logged both species, the poisson distribution showed a median of .02 km. Given the proximity of the barberry to the birds along their migratory route, it is possible for the birds to be an important vector of spread for this invasive plant species. Understanding the mechanism of spread could help future researchers produce technologies to limit the spread of these invasive plant species.

Analyzing the Role of Birds on the Spread of the Invasive Japanese Barberry in a Rural Town in Upstate New York

Introduction

Japanese Barberry (JB): Highly Invasive

- JB Introduced to US in 1875 as ornamental substitute for common barberry → host for black stem rust
- **Doan (2013):** ↓ biodiversity & outcompetes natives; hosts 12x lyme ticks



Ward and Williams (2011)

- Shade tolerant, perennial, grows on infertile soil
- Takes advantage of limited light & displaces other species

Systematic Property Mapping, Upstate NY

130 Acre Property



5 original JB

22 new JB since 2017

OBSERVATION: All JB were directly under aerial tree branches or phone lines

- All the new growths → under aerial branches ~4.45 m from the center of the bush to the branch

Methodology

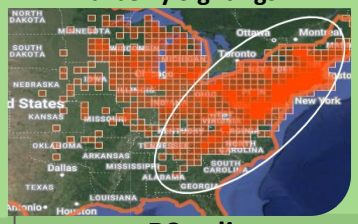
IV	DV	CV
-Migratory sightings of the American Robin -Lat/long of sightings on iNaturalist	-Overlap w/ JB sightings → hotspot densities -Proximity between American Robin & JB	-Eastern US -2020-2022 -Crowdsourced sightings

iNaturalist

Bird Sightings



Barberry Sightings



ArcGis

-Maps downloaded → interpretable by ArcGis
-Aggregate for both species → areas of highest densities revealed
-Overlay tool calculated these densities together

$$P(X=x) = ((\lambda^x)(e^{-\lambda}))/x!$$
$x = 0,1,2,3,...$
λ = mean number of occurrences in the interval

RStudio

-Determine proximity of both species
-Specifically through Lat/Long coordinates
-Poisson Distribution
-rdist.earth → proximity of species between each other
-Accordingly → how close both species were

Results & Analysis

ArcGis

Figure 1-2: Robin and Barberry individual aggregate graphs on ArcGis

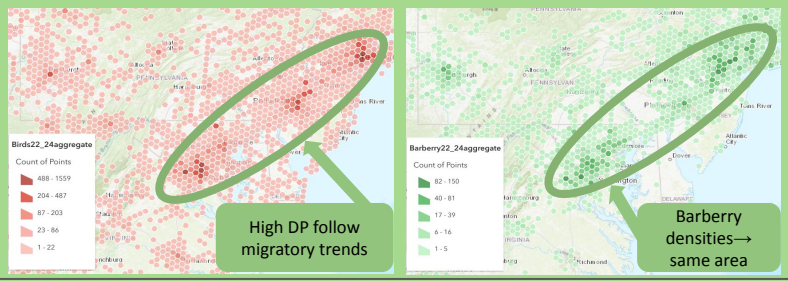
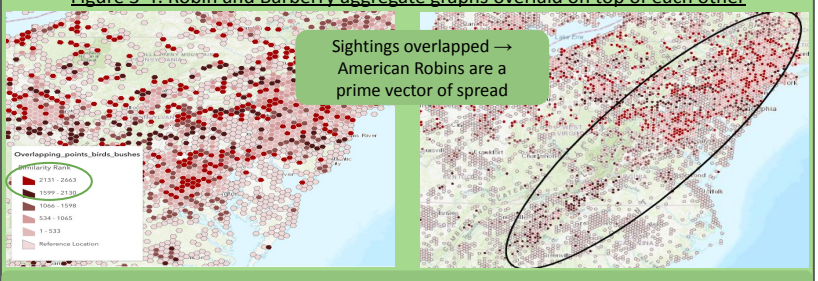
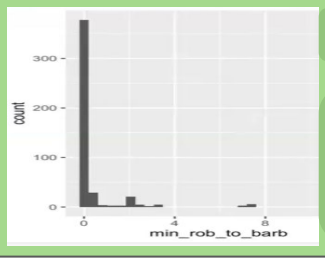


Figure 3-4: Robin and Barberry aggregate graphs overlaid on top of each other



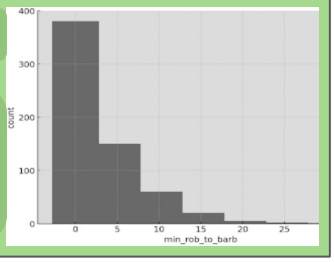
RStudio - Nearest Neighbor Analysis

Poisson distribution for total Robin and Barberry observations for a single user ID's observations



All graphs skewed right

More species observations were closer to each other than far apart



Conclusion

Hypothesis = Supported

- ✓ High population densities of the American Robin during migratory season overlapped with JB sightings
- ✓ All RStudio graphs were skewed right, demonstrating that most species observations were close together
- ✓ Crowdsourced data observations either directly overlapped or were median of .02m apart

Limitations and Future Research

Nearly impossible to verify crowdsourced data→thousands of observers from many states	Only looked at correlation, not causation	Study isn't longitudinal→didn't follow the same bird/trees over the set time
Put multiple cameras near JB plants → how many birds eat from it → calculate seed shadow and monitor new JB growths	Monitor JB plant growth after seeds pass through the digestive system of the American Robin	Tag birds to directly follow migration patterns and track correlations with new JB growth

Applications

Essential for effective ecosystem management

By identifying American Robins as possible vectors for barberry seed dispersal → Targeted strategies can be developed to mitigate the spread→ preserves biodiversity and ecosystem health

Isabel Cross

The Effect of the Gene AMPdeam on Athletic Performance in Drosophila melanogaster: Implications of Genetic Testing on Specialized Training and Injury Susceptibility



Location of Research:
Harrison High School

Mentor:
Dr. Cale Whitworth
Bloomington Drosophila Stock Center

Will be Attending:
University of South Florida

Intended Major:
Biomedical Engineering

Fairs & Awards:
WESEF 2025 - Visionary Engineering Award
Regeneron STS - Applicant
Genius Olympiad 2024 - Finalist
WESEF 2024 - 2nd place, Genius Olympiad
Somers 2023 - 3rd Place Animal Science
HHS Symposium - 2023, 2024, 2025

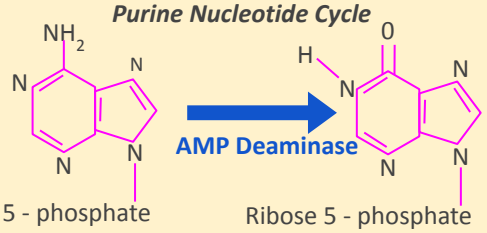
It is unknown whether environmental or genetic factors determine athleticism, and whether certain genes provide an advantage in athletic performance. AMPD gene family codes for the enzyme, Adenosine Monophosphate Deaminase in the purine nucleotide cycle that provides quick bursts of energy to the muscles during exercise and may provide an advantage in endurance athletes engaging in continuous exercise. Mutations in this gene family may cause skeletal muscle pain or weakness after prolonged physical activity. Drosophila melanogaster was studied because of the homologous ortholog for the AMPD gene family named AMPdeam. The purpose of this study was twofold: 1. To determine the extent the fly gene AMPdeam plays a role in short-term and continuous exercise. 2. To determine the extent a human gene insertion of AMPD2 can rescue the deficient fly gene. To test the effect of the mutated AMPdeam gene, a Negative Geotaxis Assay was used to test short-term exercise. An adaptive version of The Power Tower by Piazza (2009) was constructed from TETRIX robotics materials, to test continuous exercise. Results showed that AMPdeam knockdown performed significantly worse than the wild type in short-term exercise and continuous exercise ($p < .01$) meaning that the deficiency could have been responsible for the poor performance. In addition, the rescue performed similarly to the wild type and better than the deficient in continuous exercise although the results were approaching significance ($p < .11$) meaning the deficiency was rescued by the human gene AMPD2 supporting that *Drosophila melanogaster could* be a valid model for AMPD gene family deficiencies. Implications include further research that may be warranted to determine whether the AMPD gene family provides an advantage to athletes in continuous exercise. In addition, knowing the role of the AMPD gene family in exercise may help tailor specialized training programs to maximize performance and minimize injury risk.

The Effect of the Gene AMPdeam on Athletic Performance in Drosophila melanogaster: Implications of Genetic Testing on Specialized Training and Injury Susceptibility

Introduction

It is unknown whether genetic or environmental factors are responsible for athletic performance

Purine Nucleotide Cycle

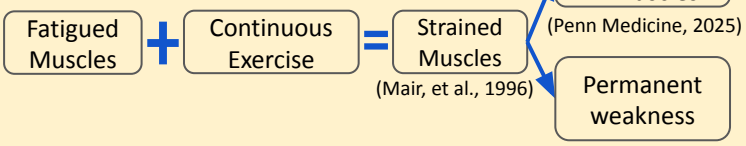


(Cross, 2025)

- **AMPD:** Adenosine monophosphate deaminase, a gene family that codes for the enzyme AMP deaminase.Mutations related to AMPD genes possibly lead to pain or weakness in muscles during long periods of exercise.

(National Library of Medicine, 2025)

Injury Susceptibility



(Mair, et al., 1996)

(Penn Medicine, 2025)

(Florida Pain Muscle, 2025)

Purpose

To determine:

1. Role of fly gene AMPdeam in exercise.
2. If human gene AMPD2 can rescue the deficient fly gene.

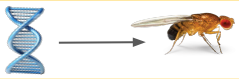
Methodology

Model Organism

Drosophila melanogaster

Variables

Independent



Dependent

% of success in performance assays

Control

23°C 12h 12h

Fly Stocks

Wild Type | Muscle GAL4

UAS-RNAi AMPdeam +UAS-hAMPD2

Genetic Crosses

Deficient flies:		
GAL4	✕	UAS-RNAi AMPdeam
Rescue flies:		
GAL4	✕	UAS-RNAi AMPdeam + UAS-hAMPD2

Performance Assays

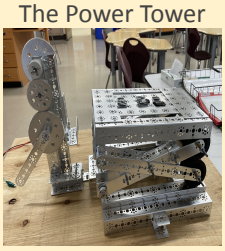
Negative Geotaxis



Short-term exercise assay

(Cross, 2024)

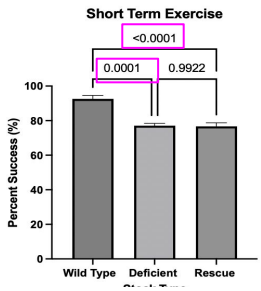
The Power Tower



Continuous exercise assay

(Cross, 2024)

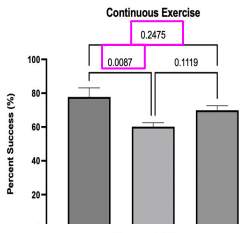
Results & Analysis



Short-Term Exercise Assay

Deficient & Rescue performed significantly compared to WT. ($P < 0.001$)

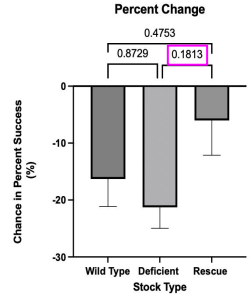
AMPdeam deficiency negatively affected short-term performance.



Continuous Exercise Assay

Deficient flies performed significantly worse than WT. ($P < 0.01$)
No significant difference between Rescue and WT. ($P > 0.05$)

Rescue successful in performing similar to WT.



Percent Change

Rescue flies had the smallest percent change in success. ($p \rightarrow 0.05$)

Smallest change in performance out of all fly stocks.

Conclusion & Future Research

Hypothesis Supported ☑

Drosophila melanogaster = Valid model organism for Human AMPD genes

Likely Mechanism

IMP → AMP = Insufficient energy

Genetics could affect athletic performance

Further research waned to understand the relationship between genetics and athletics.

Genetic Testing & Specialized Training

Deficient	*Non-Deficient*
May pursue short-term exercise sports such as; sprinting, weight-lifting, shot put…etc	May pursue either short-term or continuous exercise sports

May prevent future injuries and maximize athletic performance in deficient athletes.

Caua Barofaldi

Work Volume Responses to Resistive Exercise Improve with Periodic Heat Extraction from the Palm



Location of Research:
Harrison High School

Mentor:
Mr. Christopher Grippo

Will be Attending:
Kelley School of Business
Indiana University

Intended Major:
Finance

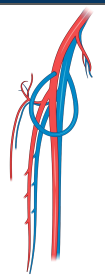
Fairs & Awards:
WESEF 2025 - Participant
Regeneron STS -Applicant
JSHS 2025 - Applicant
Somers 2023 - Participant
HHS Symposium - 2023, 2024, 2025

Muscle fatigue is an enduring issue for athletes, as it inhibits them from attaining maximum performance. This condition is due to the allosteric thermoregulating mechanism of the human body. Palm cooling therapy is a type of intervention that involves cooling the palms to a range of 0-15°C, aimed at reducing core body temperature, consequently resulting in peripheral vasoconstriction, which lowers the metabolic outflow from exercise and reduces nerve conduction in the active muscle, leading to reduced muscle inflammation. It has been shown to be an effective tool at aiding performance intra-workout. In the study, palm cooling is investigated to determine how it impacts performance resistance training. It was hypothesized that muscle inflammation will be reduced by the cooling intervention and the participants will be able to complete more repetitions. The participants included High School-aged Varsity Football players who were tasked with a standardized warmup and resistance training protocol. The experimental and control groups were rotated weekly when administered a Palm Cooling Device (PCD), ensuring that the participants receiving the cooling intervention changes each week. During their designed rest intervals between the 2nd and 3rd sets of dumbbell incline press. The cooling intervention sought to explore the effect of palm cooling in reducing inflammation, which can be statistically measured through an assessment of the average number of repetitions completed, where it was hypothesized that the group receiving the cooling intervention in their last two sets would perform a higher average number of repetitions than the control group. The quantitative analysis of the data elicited a p-value of 0.0325, which is significant at a threshold of 0.05, suggesting that there was a positive correlation between the variables. Moreover, an estimation plot was performed where the consistent positive slopes suggest a uniform stimulus for the application of the cooling intervention , inducing participants to exert a higher average number of repetitions. This was reinforced by the statistical analysis, which returned a Pearson Correlation Coefficient (r-value) of -0.2516, which represents a negative correlation between the variables, and this translated to a higher mean number of repetitions for the PCD group, hence supporting our hypothesis. The findings suggest that athletes may benefit from the cooling intervention to increase their endurance levels and hence performance in weight training and possibly other training settings.

Breaking the Ice: Thermoregulating Palm Cooling Device in Resistive Training

Caua Barofaldi

Introduction



Arteriovenous Anastomoses (AVA)
Body's own radiator →flushes out temperature → Core body temperature becomes a central indicator for muscle function

Disturbance in ideal temperature range worsen enzyme performance, which in turn **decreases one's maximal work volume capacity**

Enzyme seeks protection! → Heat will denature the enzyme in periods of high metabolic activity → Restoring ideal temperature becomes pivotal

Palm Cooling: allows to restore one's ideal core body temperature which is expected to enhance maximal contractile ability

Purpose: Determine the effects of altering core body temperature for muscle fatigue intra-workout

Methodology

Participants	Design	Warm-Up
16 subjects	3 week trial	10 min period
Split equally	Controlled	15 jumps
Varsity Football Athletes	Randomized & Crossover	World's best Stretch & Lunges

Protocol	Specifics
3 sets	Verbal support
8 reps baseline	Experienced lifters
Dumbbell Incline Press (DIP)	Eccentric & concentric tempos



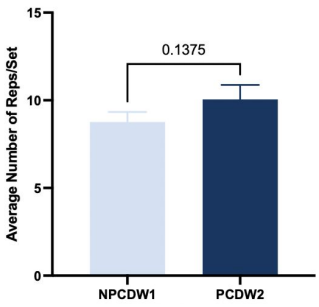
Palm Cooling Device (PCD)

Independent	Dependent
Palm Cooling Intervention	Core-body temperature → (MRC)

- PCD & Zone both thermoneutral
- Athletic experience

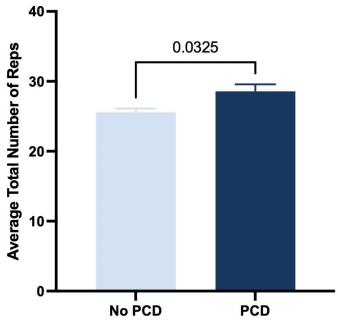
Controlled

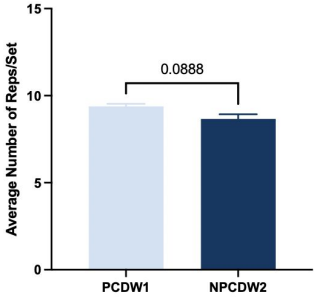
Results & Analysis



Average Number of Repetition/Set. PCD totaled a higher MRC once received the treatment W2. (p>.05). (Error Bars = SEM).

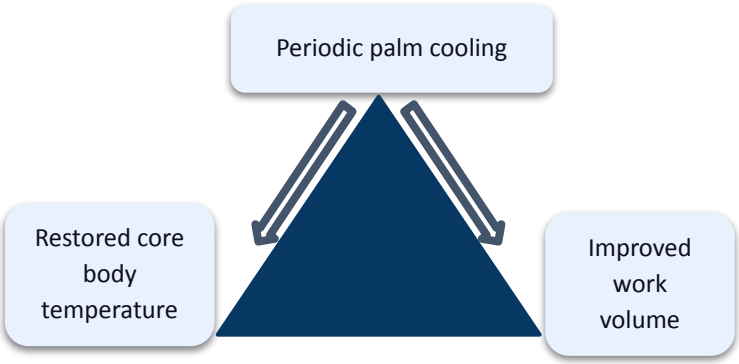
Average Total Number of Repetitions. PCD totaled a higher number in all trials vs. NPCD (p<.05)





Average Number of Repetition/Set. PCD totaled a higher MRC prior to becoming a control W1. (p>.05). (Error Bars = SEM).

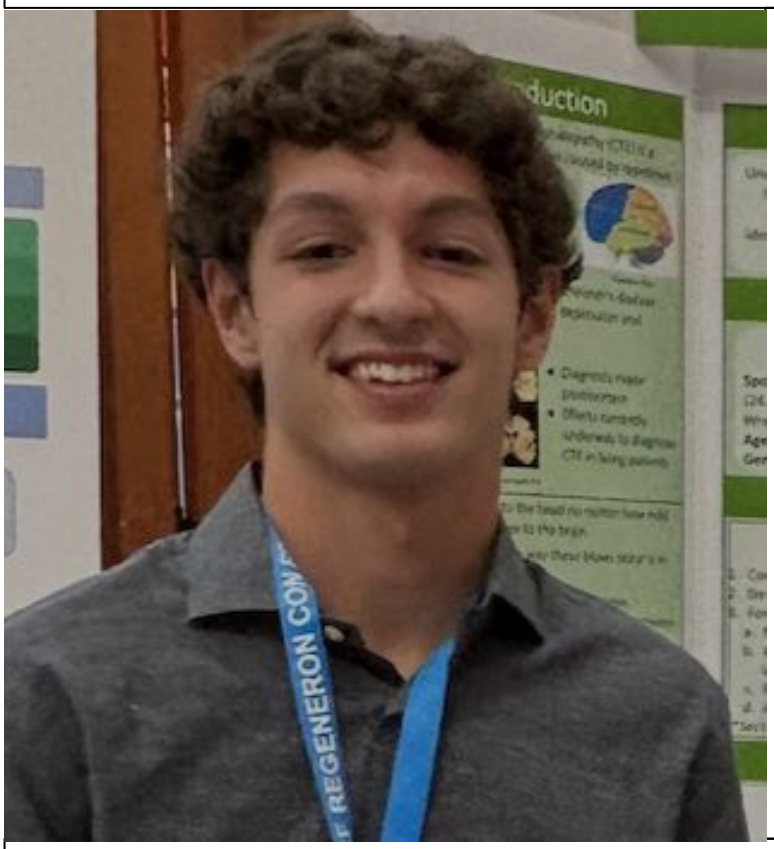
Conclusion & Future Research



1. **Athletic use**
   - ➢ Increased work capacity and volume
   - ➢ Comparable to PED-aided performance
   - ➢ Effective training strategy
2. **Rehabilitation & PT**
   - ➢ Promotes recovery and exercise tolerance

Dean Edwards

Evaluating the Risk of Head Injury in Athletes Who Play High School Contact Sports



Location of Research:
Harrison High School

Mentor:
Dr. Julian Bailes

Will be Attending:
University of California at San Diego

Intended Major:
Neurobiology

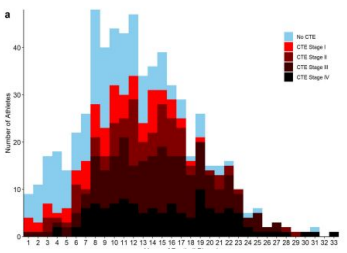
Fairs & Awards:
WESEF 2024 - Participant
Somers 2023 - Participant
HHS Symposium - 2023, 2024, 2025

Chronic traumatic encephalopathy (CTE) is a degenerative brain disease that is caused by repetitive hits to the head and is typically seen in athletes. When CTE is studied, it is generally in higher profile and professional athletes, so looking at high school athletes will give a better understanding of their risk of head injury. A survey was constructed for high school student athletes who played contact sports to understand which contact sports put high school athletes most at risk for a head injury. Results showed male football and wrestlers experienced significantly more hits per game and per practice than basketball, lacrosse, soccer, and hockey ($p<.05$). There was also a strong relationship between the number of head injuries and the severity of those head injuries. Understanding that these sports have the highest incidences of head injury can lead to further steps to prevent these head injuries, and potentially prevent CTE.

Evaluating the Risk of Head Injury in Athletes Who Play High School Contact Sports

Introduction

Chronic Traumatic Encephalopathy (CTE) is a degenerative brain disease caused by repetitive hits to the head



Graph shows increase in presence of CTE

- The disease mostly affects athletes who play contact sports since they are subject to the most head trauma
- 345/376 ex-NFL Players diagnosed with CTE (McKee A, 2023)

Methodology

Goal : Understand which contact sport puts high school athletes at the greatest risk for a head injury
Contact Sports: Football, Basketball, Hockey, Wrestling, Soccer, Lacrosse

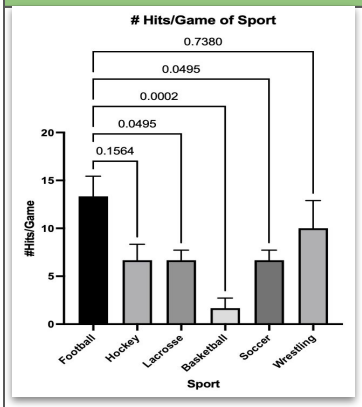
Survey was distributed to athletes who played contact sports

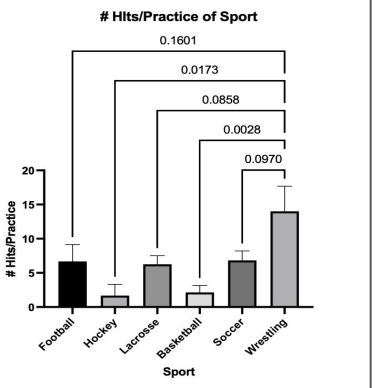
Example Questions

- Have you had a head injury?
- If so how many?
- Symptoms of the injury?

Repeated for up to 3 sports (3 seasons)

Results & Analysis





Football has the highest hits to the head per game / Lacrosse has the highest hits to the head per practice

Conclusions

- Higher risk of head injury in youth contact sports than originally believed
- Understanding which sports have the highest incidences of head injury can lead to further steps in prevention
- Increased understanding of which contact sports may put youth athletes at a higher risk of head injury and potentially CTE

Future Research

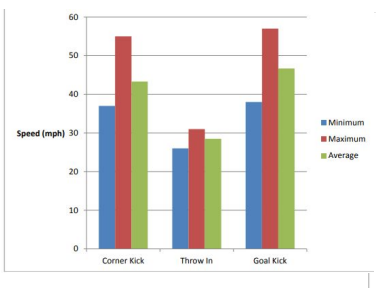
Understand environmental factors of the sports chosen: hits to the head during practice / intensity of practice, equipment worn, repetitions taken

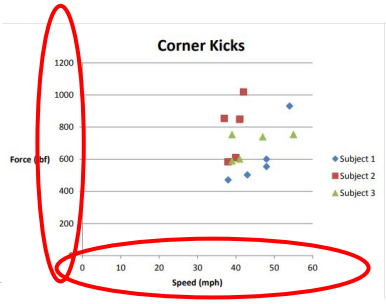
Year 3 / Study 2

In Soccer heading the ball is the most common contact to the head

- Head absorbs the force of the ball and snaps back
- Force is transferred to inside the head and the brain moves around in the head

Review of Literature





Comparison of force of impact between 3 variations

Methodology

- Players head the ball from varying distances (x5)
- Force will be measured with force sensor in headband
- 20 participants: Varsity - 10 Boys and 10 Girls

Predicted Results

Farther Distance - More Speed - Greater Force of Impact - Greater Risk of Head Injury

Ongoing Questions

- In order to reduce inter-rater variability: Only one person will kick the ball
- Less variability in data
- Needed a definitive way to measure mass of the head

Taylor Hackett

Reversing the Effects of the *For* Gene Inactivation on Learning and Memory Processes using Vitamin E in *Drosophila Melanogaster*



Location of Research:
Harrison High School

Mentor:
Dr. Christopher Tyler, Harrison High School
Dr. Sara Clark, Tulane University

Will be Attending:
Tulane University

Intended Major:
Neuroscience

Fairs & Awards:
WESEF 2025 - Participant
Tri-County Science Fair 2025 - Participant
Somers 2023 - 3rd place Behavioral Science
HHS Symposium - 2023, 2024, 2025

Post Traumatic Stress Disorder, or PTSD, is a result subsequently following exposure to an individual or series of traumatic events. In the United States, 1 in every 13 adults is likely to develop PTSD, with 10% being female and 4% being male. A significant majority of PTSD cases are impacted by impaired declarative memory and underlying learning abilities. PTSD is a result of neurological alterations in the hippocampus and amygdala resulting from emotionally negative stimuli. There is a potential risk of PTSD as a result of genetic implications caused by the inactivation of a variety of genes, possibly the PRKG1 gene, which encodes Protein Kinase G and is a mediator of the cGMP signaling pathway. This study aims to determine whether the PRKG1 gene inactivation is a viable risk factor for memory and learning dysfunction in Drosophila melanogaster. It is hypothesized that PRKG1 will impair learning abilities within the Drosophila. Therefore, this study will determine the impact of the PRKG1 gene inactivation on basic neurological functioning. The methodology will consist of two fly variants - one with the gene knocked down and the other being Wild Type. This study requires a T-maze to determine the effectiveness of memory processes, and the flies will be supplemented with the antioxidant Vitamin E to determine the final results. It is hypothesized that the PRKG1 knockdown will inhibit the fly's memory recollection and will furthermore be re-facilitated by the higher doses of Vitamin E. This experiment may potentially be applied in further research regarding the genetic implications of PTSD and memory inhibition, as Drosophila will be used as a provisional model for expected PTSD patients.

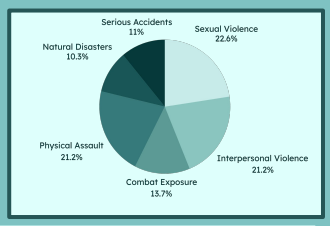
Reversing the Effects of the *For* Gene Inactivation on Learning and Memory Processes using Vitamin E in *Drosophila Melanogaster*

Introduction

Post Traumatic Stress Disorder (PTSD)

Psychiatric disorder that may occur in people who experienced and/or witnessed a traumatic event

- Every 5 out of 100 adults (5%) of the US have been diagnosed with PTSD
- Patients may experience impaired short-term & directional memory



PRKG1 gene inactivation

- Involved in synaptic plasticity, learning, & memory in neurological disorders (PTSD)

D. Melanogaster ortholog: *for* gene

- 12/14 forward & reverse score for PRKG1
- Shares 75% of genes found in human diseases

Purpose: to determine the extent to which Vitamin E can rescue learning and memory deficits attributed to the *for* gene inactivation

Methodology

for gene	#31698
GAL-4	#458
Wild Type	#3605

	TRiP/TM3	TRiP, Ser [1]
elav-GAL4 / +	TRiP-TM3/elav	TRiP/elav
elav-GAL4 / +	TRiP-TM3/elav	TRiP/elav

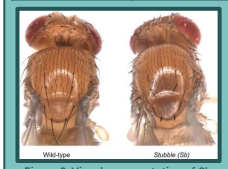


Figure 2: Visual representation of Sb phenotype compared to Wild-type bristles on D. Melanogaster (Vincent, 2015).

- 50% of offspring have Sb phenotype
- Vitamin E flies have *for* knockdown
- Compared to Wild Type stocks
- TM3 allele is expressed and removed

- T-maze to assess memory and learning differences
- Switches color for test to assess reversal learning ability

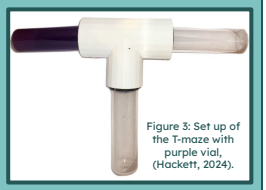


Figure 3: Set up of the T-maze with purple vial, (Hackett, 2024).

- Heightened sensitivity to shorter wavelengths
- 3 conditioning trials & 3 test trials per supplement
- 1 minute between conditioning, 5 minutes between tests

Cross fly stocks → Raise on supplement → Condition offspring → Test & change assay → Assess & Prism 10

Results & Analysis

0 µg supplement

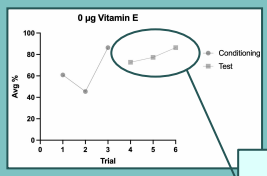


Figure 4: 0µg paired T-test graph (Error Bars=SEM) (created by Hackett, 2024).

0µg was unable to detect a change in the food's location

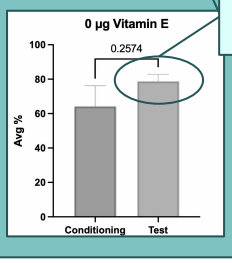


Figure 5: 0µg paired T-test graph (Error Bars=SEM) (created by Hackett, 2024).

2000 µg supplement

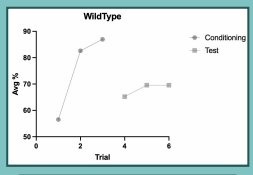


Figure 10: 0µg paired T-test graph (Error Bars=SEM) (created by Hackett, 2024).

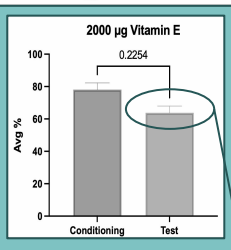


Figure 11: 0µg paired T-test graph (Error Bars=SEM) (created by Hackett, 2024).

2000µg and WT showed similar reversal learning skills

WildType

Capacity to recall the location of the food

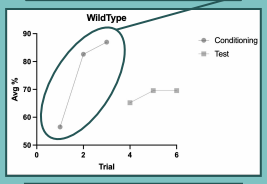


Figure 12: 0µg paired T-test graph (Error Bars=SEM) (created by Hackett, 2024).

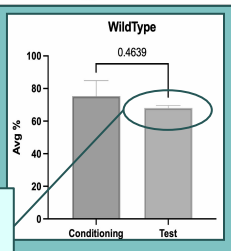


Figure 13: 0µg paired T-test graph (Error Bars=SEM) (created by Hackett, 2024).

Discussion & Limitations

Reversal learning — Affirms hypothesis

For gene impaired reversal learning abilities

Reversed the effects of the gene inactivation

Implications & Future Research

CASGEVY™ CRISPR/cas9 gene-editing therapy

- Could lead to further research of how CASGEVY™ to be used to edit PRKG1 to prevent PTSD learning dysfunction

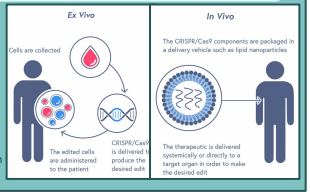


Figure 16: Ex Vivo vs. In Vivo gene editing Illustration (CRISPR Therapeutics, n.d.).

Sara Hanna

Determining How the Proximity of Smartphones Influences Adolescents' Sleep Procrastination Habits



Location of Research:
Harrison High School

Mentor:
Ms. Allison Blunt

Will be Attending:
Sacred Heart University
Lake Erie College of Osteopathic Medicine

Intended Major:
BS/DO Program
(Biology/Doctor of Osteopathic Medicine)

Fairs & Awards:
WESEF 2025 - Participant
STS 2025 - Applicant
JSHS 2025 - Applicant
Somers 2023 - Participant
HHS Symposium - 2023, 2024, 2025

Revenge Sleep Procrastination is a phenomenon where adolescents tend to delay their sleep in favor of leisure activities, especially when their schedule is stressful and lacking in free time. Later bedtimes can result in sleep deprivation which can have serious negative physical and emotional consequences. Taking steps to avoid stimulants such as access to a smartphone before bedtime may be necessary to ensure sufficient sleep. Therefore, the purpose of this study was to determine whether the proximity of a smartphone, a known stimulant, affects adolescent sleep procrastination habits on school nights. 15 teens were tested over a series of 9 school nights. Every 3 nights, participants were asked to move the position of their phone from arm's length, to across the room, and to another room. Participants wore a smart watch to record their time spent asleep each night. They also kept a sleep journal recording the length and quality of their sleep each night. The results showed that when smartphone proximity increased, Delay to Sleep significantly decreased ($p<0.01$) and when smartphone proximity increased the reported Sleep Quality Rating significantly increased ($p<0.01$). Counterintuitively, a simple linear regression model showed that the relationship between reported free time and average delay to sleep was significantly non-zero ($p<0.05$). Implications include that smartphones may be a distractor to adolescents at bedtime, leading to sleep insufficiency and potentially compromised health outcomes.

Determining How the Proximity of Smartphones Influences Adolescents' Sleep Procrastination Habits

Introduction

Sleep Insufficiency

- Receiving an adequate amount of sleep is necessary for wakeful function (NIH, 2024).



Grind Culture: Individualistic cultures belief that a constant work flow leads to success

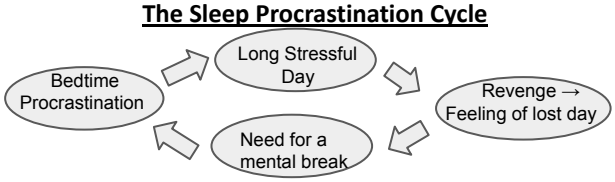
Smartphones

- 68% of adolescents report keeping their phone within reach at night (EdSource)
- Teenagers are more vulnerable to smartphone addiction

Sleep Procrastination Cycle

Sleep Procrastination: The act of delaying sleep knowingly (can occur inside or outside of bed)

The Sleep Procrastination Cycle



Revenge Bedtime Procrastination

- Phenomenon in which people put off sleep in favor of leisure activities (Verywell mind, 2023)

Purpose

- To evaluate whether the proximity of a smartphone at bedtime alters adolescents' sleep habits.

Methodology

Survey Construction
→ IRB approval attained
→ Participant extracurricular involvement and weekly average screen time
→ Rate your quality of sleep (1-5): each night
→ Include time you intended to fall asleep + time you actually fell asleep
→ Google Drive link for photo upload

Participant Confidentiality
No identifying information was collected. Only the researcher and her teacher have access to the data.

Participants were sent a Google Form to submit their results, recorded their sleep on a smartwatch

Participants recorded their sleep over a period of **9 school nights**

Participants moved the positioning of their phone **every set** of **3** school nights

They moved it to **within arm length**, **across the room** so they would have to get out of bed to interact with it, or **in another room**

After each night, participants self-rated the **quality of their sleep** and recorded their **delay to sleep**

Participants uploaded both their self reported data and screenshots from their smartwatch at the conclusion of the nine school nights

Results & Analysis

Average Delay to Sleep vs. Proximity of Smartphone

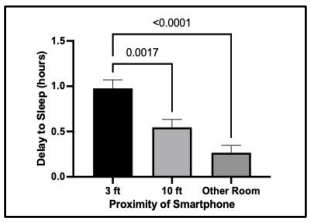


Figure 1A: As the proximity of the smartphone increased from 3ft, 10ft, to the other room, average delay to sleep significantly increased
Created by Hanna, 2024.

Average Sleep Quality Rating vs. Proximity of Smartphone

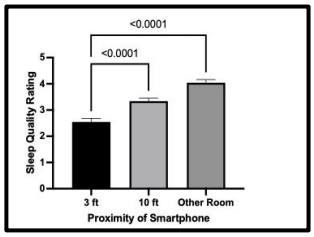


Figure 1B: As the proximity of the smartphone increased from 3ft, 10ft, to the other room, average delay to sleep significantly increased
Created by Hanna, 2024.

Total Minutes of Sleep vs. Proximity of Smartphone

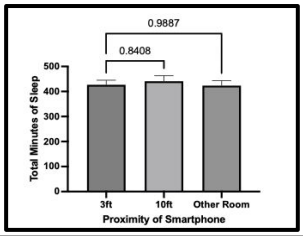


Figure 1C: As the proximity of the smartphone increased from 3ft, 10ft, to the other room, total minutes of sleep did not significantly increase
Created by Hanna, 2024.

Conclusion & Future Research

Hypothesis Supported: Delay to Sleep

- Illustrates that when adolescents are exposed to smartphones at a **closer proximity**, they tend to experience sleep procrastination at a **higher level**

Hypothesis Supported: Sleep Quality

- Illustrates that when adolescents are exposed to smartphones at an **closer proximity**, they tend to rate their overall sleep quality at a **lower level**
quality of sleep at a lower level

Future Research

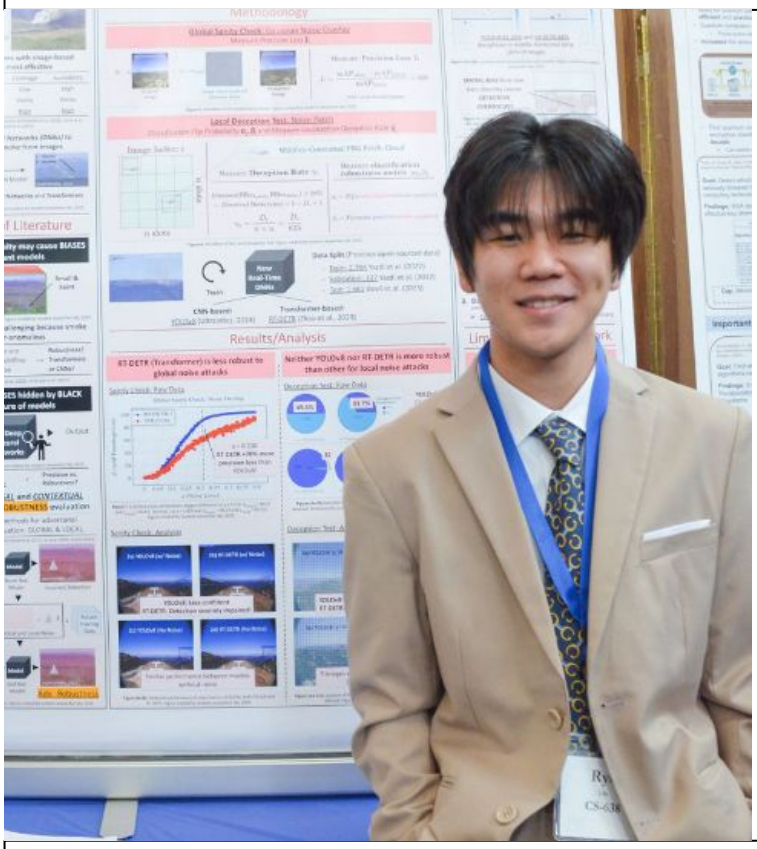
- To conduct a similar study in a controlled setting at a sleep lab
- To test the effects of sleep procrastination on productiveness in school

Conclusion

- Participants self-report **higher sleep quality ratings** and **lower levels of in-bed procrastination** during the other room condition
- Results of the study suggest that smartphones should be the furthest away from the adolescent to ensure quality sleep

Ryo Ide

A Burning Question: How Robust is Wildfire Detection with Deep Learning?



Location of Research:
Home

Mentor:
Dr. Lei Yang, University of Nevada, Reno

Will be Attending:
University of California at San Diego

Intended Major:
Computer Science/Physics

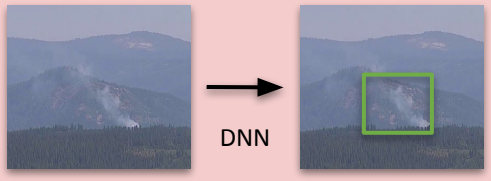
Fairs & Awards:
ISEF 2024 - Finalist
WESEF 2025 - Excellence in Computer Science/Mathematics Award
WESEF 2024 - 1st Place/Top 20 in Fair, Computer Science
NYSSEF 2024 - 3rd Place Robotics & Intelligent Machines
Somers Science Fair 2023 - 3rd Place
HHS Symposium - 2023, 2024, 2025

Rapidly growing wildfires have recently devastated societal assets, exposing a critical need for early warning systems to expedite relief efforts. Smoke detection using camera-based Deep Neural Networks (DNNs) offers a promising solution for wildfire prediction. However, the rarity of smoke across time and space limits training data, raising model overfitting and bias concerns. Current DNNs, primarily Convolutional Neural Networks (CNNs) and transformers, complicate robustness evaluation due to architectural differences. To address these challenges, we introduce WARP (Wildfire Adversarial Robustness Procedure), the first model-agnostic framework for evaluating wildfire detection models' adversarial robustness. WARP addresses inherent limitations in data diversity by generating adversarial examples through image-global and -local perturbations. Global and local attacks superimpose Gaussian noise and PNG patches onto image inputs, respectively; this suits both CNNs and transformers while generating realistic adversarial scenarios. Using WARP, we assessed real-time CNNs and Transformers, uncovering key vulnerabilities. At times, transformers exhibited over 70% precision degradation under global attacks, while both models generally struggled to differentiate cloud-like PNG patches from real smoke during local attacks. To enhance model robustness, we proposed four wildfire-oriented data augmentation techniques based on WARP's methodology and results, which diversify smoke image data and improve model precision and robustness. These advancements represent a substantial step toward developing a reliable early wildfire warning system, which may be our first safeguard against wildfire destruction.

A Burning Question: How Robust is Wildfire Detection with Deep Learning? | Ryo Ide

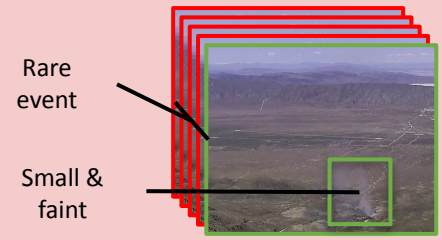
Introduction

Camera Surveillance + Deep Neural Networks (DNN)
Promising for early wildfire detection
Images from (ALERTWildfire, 2023)



Two types: Conv. Neural Networks and Transformers

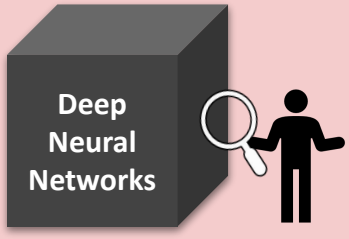
Wildfire smoke have inherent data limitations problem
Images from (ALERTWildfire, 2023)



- Low sample size - Little diversity
→Possible bias

Smoke's spatio-temporal anomalous properties

When does it make mistakes?



Deep Neural Networks' "black box" nature

Are existing wildfire detection models robust & safe enough for practical use?

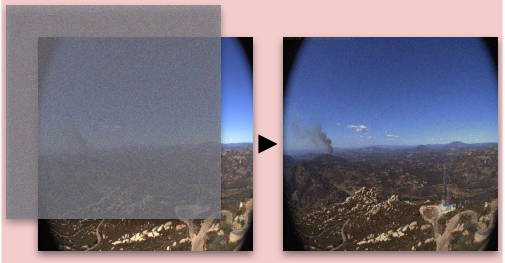
Methodology

Proposing Wildfire Adversarial Robustness Procedure (WARP):

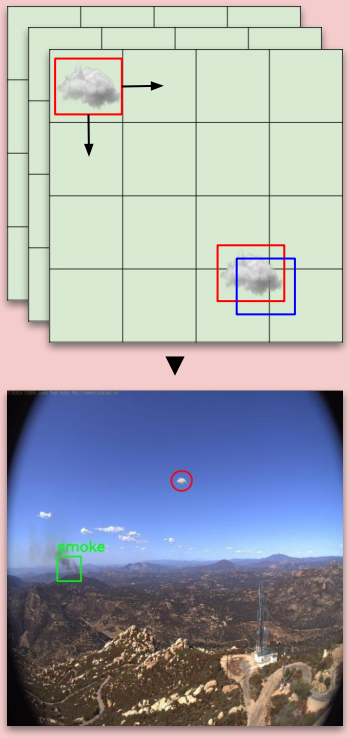
Model-agnostic robustness evaluation framework

Proposed two-part robustness evaluation approaches
Images from (HPWREN, 2023)

Overlay Noise *Globally*: measure *precision loss* under increasing noise overlay



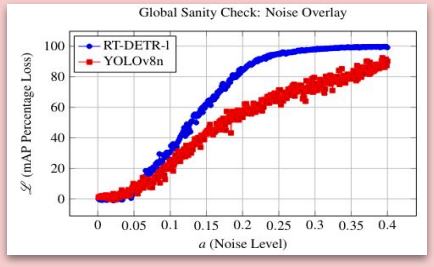
Overlay Noise *Locally*: measure *classification* and *localization robustness* under patch noise



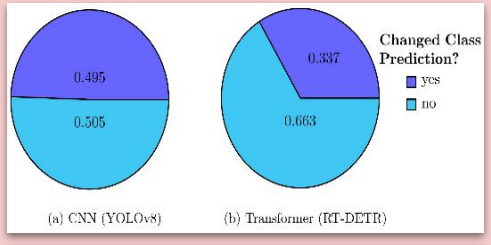
Results

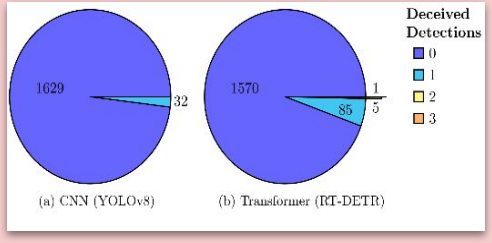
Unseen weaknesses revealed by WARP

Transformers models less robust than Convolutional Neural Networks (CNNs)



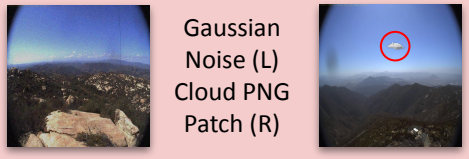
Speed-optimized Transformer's precision degrades faster than CNN under global noise

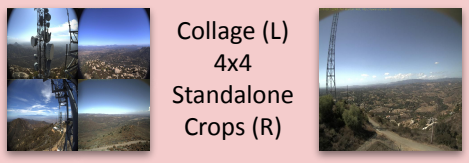




Transformer's bounding box is more vulnerable, CNN's smoke classification is more vulnerable

Nuanced robustness evaluation evolves data augmentation strategies
Images from (HPWREN, 2023)





Shun Ide

Spin the Roulette: Gambling for Luck to Detect Misalignment in AI Recommender Systems



Location of Research:
Home

Mentor:
Dr. Djallel Bouneffouf, IBM

Will be Attending:
Purdue University

Intended Major:
Computer Science

Fairs & Awards:
ACM KDD 2024: Presenter at
The First Workshop on AI Behavioral Science
WESEF 2025 - Participant
Regeneron STS -Applicant
WESEF 2024 - Participant
Somers 2023 - Participant
HHS Symposium - 2023, 2024, 2025

This work proposes a general approach to quantitatively assessing the risk and vulnerability of artificial intelligence (AI) systems to biased decisions. The guiding principle of the proposed approach is that any AI algorithm must outperform a random guesser. This may appear trivial, but empirical results from a simplistic sequential decision-making scenario involving roulette games show that sophisticated AI-based approaches often underperform the random guesser by a significant margin. This work highlights that the algorithms utilized in a modern recommender system may exhibit a similar tendency to favor overly low-risk options. These results may help to fill the lack of AI misalignment studies in sequential decision-making systems, as well as providing an important precedence for using random-influenced data to address the robustness of AI. It is proposed that this “random guesser test” can serve as a useful tool for evaluating the utility of AI actions, and also points towards increasing exploration as a potential improvement to such systems.

Spin the Roulette: Fixing AI Recommenders by Gambling for Luck

Shun Ide

Introduction

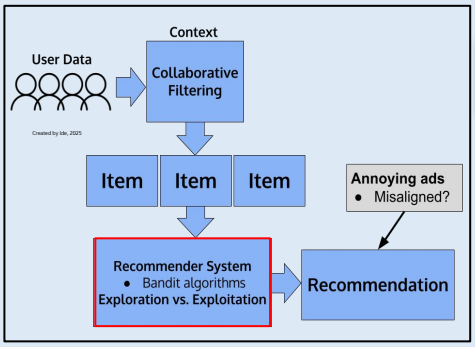
AI Misalignment in Recommenders

- ***Political Polarization***
- ***Misinformation*** (Bojic, 2024)

Commonly Used MAB Algorithms

- **Thompson sampling (TS) MAB**
- Epsilon-greedy (EG) MAB (ε = 0.1)
- Temporal difference RL (TD(λ) with λ = 0, 1)

Multi-Armed Bandits for Recommendation



How does AI (MAB) choose?

Exploit action
(Statistically determined)
VS.
Explore options
(Random decision, or sample model distribution)

Review of Lit. Reveals Risks of Current Algorithms

① Arnold et al. (2017)	Old algorithms & **New applications**
② Zhuang and Hadfield-Menell (2020)	**Harms content diversity**
③ Bouneffouf et al. (2017)	Forgetful algorithm = **Better performance?**

Concerning!

Current metrics don't work for recommenders

Explainable AI (XAI) | Data Lineage | AI fairness & Adversarial Robustness

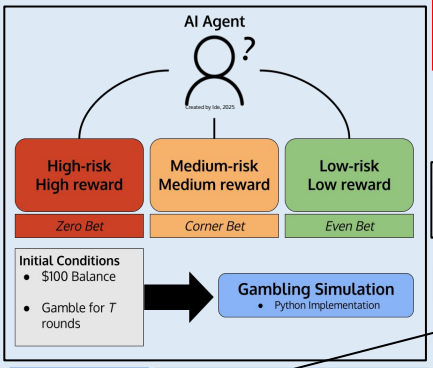
Molnar, 2023; Dwivedi et al, 2023, Voigt et al, 2017, Awad et al., 2022, John-Mathews et al., 2022

- **Too specific**
- **Wrong focus**
- **Independent, not sequential**

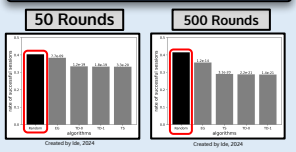
Methodology

Need new misalignment metric for sequential decision-making
Example of SDM task?

Testing AI Decision-Making Using Roulette Gambling



Previous AI + Roulette Experiment

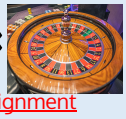


Unexpected success of random guesser
→**Sign of misalignment?**

Gambling = similar decision-making to recommenders

bet type	θ_i (fair)	θ_i (skewed)	r_i	expected value (fair)
Zero	1/37	2/37	36	−0.027
Corner	4/37	4/37	8	−0.027
Even	18/37	18/37	1	−0.027

Recommender System ≈



If random guesser outperform, misalignment

AI bad gambler → AI bad decision-maker → **AI bad recommender**

Previous Work	Experiment 2	Experiment 3
Short-term/Long-term	Performance over time	Nonstationary scenario
Gamble **50/500 rounds, compare performance**	Gamble **until bankruptcy, compare performance**	Introduce **trends within data, compare performance**

Results

2 Metrics to Evaluate Success

Rate of Successful Sessions
- *Ended with a profit?*

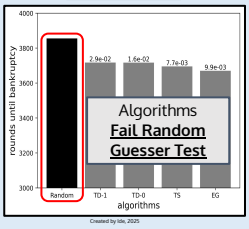
Rounds until Bankruptcy
- *Reliable over time?*

Compare against random guesser

Experiment 2

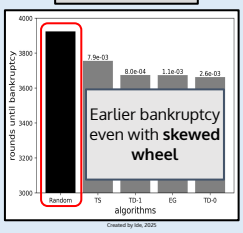
Rounds Until Bankruptcy
Compare between *fair* & *skewed*

Fair Wheel



ALL INSTANCES Random guesser **significantly outperforms** ($p<0.0001$)

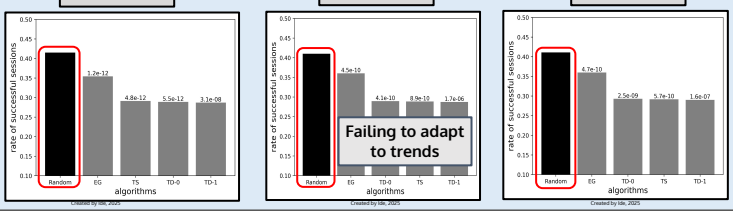
Skewed Wheel



Experiment 3

Rate of successful sessions
Nonstationary Scenario

0<t<100 | 100<t<200 | 200<t<300



Discussion & Conclusions

Hypothesis Supported!
Random Guesser outperformed
= AI Algorithms Misaligned

Novel misalignment test for sequential decision-making systems

1. **Short/Long-term:** Little Improvement
2. **Adaptability:** Unreliable over time
3. **Nonstationary:** Cannot adapt to trends

Current algorithms Too conservative → *Explore more!*

Q. Actual Systems use Contextualized Algorithms?
A. **Most demographic data used in collaborative filtering**
→Little impact on results

Should implement increased-exploration algorithms for user feedback

Impacts/Applications?

Increase exploration for recommenders → More balanced selections → **Less User Harm** Polarization, etc.

Kurato Inaba

The Effect of Distributed Propulsion on the Aerodynamic Efficiency of Eppler's E169 Airfoil



Location of Research:
Harrison High School, NY

Mentor:
Mr. Randy Gunnell

Will be Attending:
Cornell University

Intended Major:
Engineering Physics

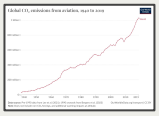
Fairs & Awards:
WESEF 2025 - 3rd Place Engineering, Creative Approach to Research Award
Regeneron STS - Applicant
JSHS 2025 - Applicant
HHS Symposium - 2025

Distributed propulsion is an aviation design concept in which multiple smaller propellers are distributed across aircraft. This concept can offer greater efficiency and performance for aircraft flights by optimizing lift-to-drag ratios. Thrust refers to the force that moves the aircraft forward. Flight vehicles equipped with high-lift propellers may pose benefits in efficiency and flight performance when optimized for low-speed performance during approach and landing, and impact gas emissions. This study aimed to test how the integration of electrically powered distributed propulsion can affect the lift performance of an airfoil at different angles of attack(AoA). Four separate replicas of Eppler's E169 airfoil were replicated by 3D modeling and printing using a polycarbonate filament, each with a different angle of attack, 0°, 5°, 10°, and 15°. Experiments were conducted in a home-designed and engineered wind tunnel using an industrial fan and a concrete form tube. Data measurements and electrically powered propulsors were operated using PASCO devices. Results showed that the 15°(AoA) airfoil experienced significantly more lift than 0°, 5°, and 10°($p<0.001$). A propeller mounted on the leading edge of the 15° airfoil design with a speed of 15000 rpm depicted significantly greater lift performance than 8000 rpm and 12000 rpm($p<0.05$). This means that distribution propulsion devices may improve aerodynamic efficiency by increasing the lift performance of aircraft through electricity. Advancements in electric devices support hybrid-electric aviation that may reduce gas emissions and energy usage. These results show promise for future aircraft designs with electric-powered systems.

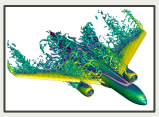
The Effect of Distributed Propulsion on the Aerodynamic Efficiency of Eppler's E169 Airfoil

Introduction

Energy Efficiency Challenges



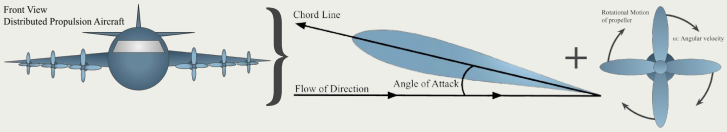
Aviation emits **one billion** tonnes of CO_2 annually (Ritchie, 2020).



Modern aircrafts experience **high turbulence/drag** & consumes greater fuel (Sivaraj et al., 2018).

Distributed Propulsion

Multiple **smaller engines & propellers** placed on body



* <u>Higher Velocity</u> → <u>Lower Pressure</u> *

↑ **Pressure difference** (Upper & lower wing surface)

Rotational motion → Thrust: ↑ **airflow acceleration**

<u>Bernoulli's Principle</u> & <u>Lift Equation</u>

$$P_1 - P_2 = \frac{1}{2}\rho(v_2^2 - v_1^2) \qquad L = \frac{1}{2}\rho v^2 S C_L$$

$$\Delta P \propto L$$

<u>Potential Improvements</u>

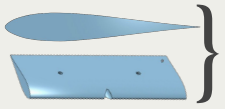
- **Thrust redistribution** across wing structure
- Effective **airflow management**
- **Enhance lift & reduce drag**

Engineering Methodology

Airfoil Design

*Designed on AutoCAD **OnShape 1.189***

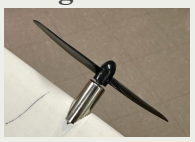
Eppler's E169
UIUC Airfoil Coordinates Database





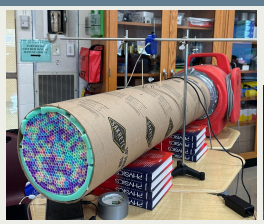
Propeller Integration

Motor Housing
Sourced from Hobbypower

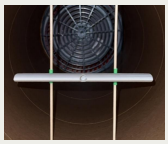


Wind-Tunnel Construction

Industrial Fan
Airflow generator
Concrete Form Tube
Enclosed test area
Custom Straw Bundle
Airflow straightener

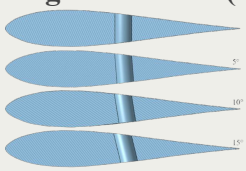


Test-Section Area



Independent Variables (2-Part)

Angle of Attack (AoA)



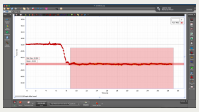
Rotations per Minute (RPM)

RPM = 0, 8000, 12000, 15000

V=IR I = 0.15A



Data Collection

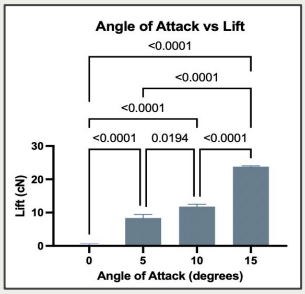


PASCO Capstone v.2.8.9
PASCO PS-2189
PASCO 550 Universal Interface



Results & Analysis

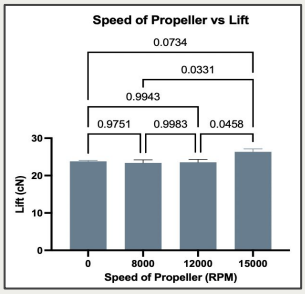
Angle of Attack v. Lift



* **E169 AoA:15 produced most significant lift** *

Chosen to test lift w/ **propeller integration** →
Thought to see the greatest lift change.

Speed of Propeller v. Lift



* **E169 15000 RPM produced most significant lift** *

Significantly more lift v. 8000 ($p<0.05$)
Approaching significantly more lift v. 0 & 12000 ($p=0.07$)

Conclusion & Future Research

Hypothesis: Somewhat Supported

Highest RPM produced most lift ($p=0.07$)

Potential Mechanisms

↑ SA lamination + ↑ P distribution → $\Delta P \propto L$ Bernoulli's Principle

Aim: Understand how <u>propellers on the leading edge</u> will <u>reveal the effect of DP</u>
Conc.: Eppler's E169, <u>15000 RPM</u> @ <u>15 AoA</u> produced the <u>most lift</u>

Limitation: Wind tunnel & Model Scaling
Low-cost → inconsistencies, low wind-speeds, small scale, reduced real-world applicability

Future Research

<u>Full-sized lab wind tunnel</u> ↓ airflow inconsistencies, turbulence, & increased realistic environments

Sophia Jonisch

Evaluating Barriers Faced by Wheelchair Patients when Accessing Healthcare Services in a New York City Hospital Outpatient Setting



Location of Research:
New York Presbyterian Hospital in Queens

Mentor:
Dr. Ari Jonisch

Will be Attending:
Cornell University

Intended Major:
Hospitality

Fairs & Awards:
WESEF 2025 - American Psychological Association Award
Regeneron STS -Applicant
Somers 2024 - 1st Place Behavioral Science
HHS Symposium - 2024, 2025

Health equity means the attainment of the highest level of health for all people. Relative to the general population, people with disabilities are more likely to be sedentary and to have more health problems, and are therefore more likely to spend time in a hospital setting. Given that 15% of the global population (over 1,000,000,000 people) live with a physical disability, it is important to understand their experiences. This study investigated the barriers faced by physically disabled patients when accessing healthcare services in a New York City hospital outpatient setting and their satisfaction with the care they received. Centers for Medicare and Medicaid Services (CMS) patient satisfaction surveys which included questions from HCAHPS and CG-CAHPS, and original questions focused on accessibility, were randomly distributed by front desk employees to 50 wheelchair users and 156 non-wheelchair users who were scheduled for outpatient care. Conclusions drawn based on these surveys impact hospital reimbursements. The results of the chi-squared test of independence showed non-wheelchair users were significantly more satisfied overall than wheelchair users X^2 (1, N = 206) = 40.4883, p = .00001. Other important findings included that when wheelchair users were dropped off at the lobby rather than being wheeled from the parking lot, their overall satisfaction was significantly higher X^2(1, N = 206) = 10.8997, p = .000016. And, when wheelchair users were offered assistance, their overall satisfaction was significantly higher X^2(1, N = 206) = 18.6145, p = .000963. Major takeaways include that hospitals should advise wheelchair users to be dropped off so they can strategically avoid the trip from the parking lot to the lobby, and hospitals should ask wheelchair users if they need assistance upon leaving. By acknowledging the lower satisfaction scores and the reasons for them, policymakers can implement interventions to enhance quality of care for this marginalized group.

Evaluating Barriers Faced by Wheelchair Patients when Accessing Healthcare Services in a New York City Hospital Outpatient Setting

Introduction

Physical Disability: a condition that limits one's physical activities in life

Equity in Healthcare

Physically disabled is a large population

Relative to the general population, people with disabilities more likely to be sedentary & to have more health problems→Important not to overlook

HCAHPS and CG-CAHPS:

Surveys that the government sends to patients (inpatients who are discharged and outpatients at clinics) in an effort to identify patient satisfaction. Results of these surveys impact reimbursement

Purpose is to investigate barriers faced by physically disabled patients when accessing healthcare services in a NYC hospital outpatient setting and assess their satisfaction with the care they receive

Methodology

Participants

- IRB Exemption because no personal demographic information was provided
- 206 patients, 50 of whom were wheelchair users and 156 that were non-wheelchair users
- University affiliated hospital that serves as a community hospital: provides comprehensive care to diverse population of a New York City buero-

Survey constriction

- **Three sections**
- Informed consent
- Questions from gov. surveys
- Original questions for wheelchair users

Distribution + Analysis

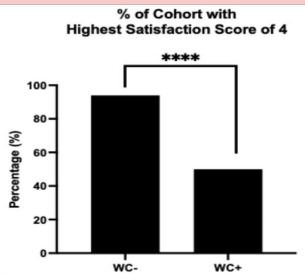
- IRB exemption
- Front desk disturbed surveys
- Handed coded responses
- Chi square test

Results & Analysis

	Score of 4	Score less than 4
WC negative	122(109.23)(1.49)	8(20.77)(7.95)
WC positive	20(32.77)(4.98)	19(6.23)(26.17)

Supports non wheelchair users are more satisfied than wheelchair users .00001<.05 The chi square test significance was 40.4883.

Figure created by Sophia Jonisch,2025



	Asked about assistance when leaving	Not asked about assistance when leaving
WC+ score of 4	14(7.50)(5.63)	5(11.50)(3.67)
WC+ < 4	1(7.50)(5.63)	18(11.50)(3.67)

Supports wheelchair users were asked about assistance when exiting, they were more satisfied 000963<.05. The chi square statistic is 18.6145.

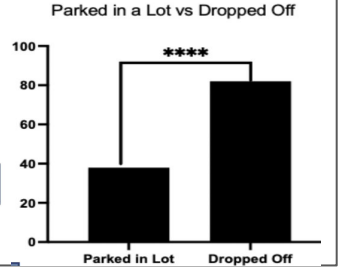
Figure created by Sophia Jonisch,2025



	Parked	Dropped off
WC+ score of 4	6(11.05)(2.31)	14(8.95)(2.85)
WC+ < 4	15(9.95)(2.57)	3(8.05)(3.17)

Wheelchair users were more satisfied when dropped off at lobby .000016<.05, The chi square statistic was 10.8997.

Figure created by Sophia Jonisch,2025



Conclusion & Future Research

Hypothesis = Supported

✔Overall satisfaction was lower for patients who used wheelchairs (p**<.05)**

✔Wheelchair users were significantly more satisfied when dropped off at the lobby instead of when they parked in the lot. (p**<.05)**

✔When wheelchair users were asked about assistance when leaving, their overall satisfaction rates were significantly higher (p**<.05)**ure that your research is well represented and visually appealing. Look at last year's book for inspiration.

Lower satisfaction ratings within the wheelchair users have financial implications for hospital

These findings suggest that wheelchair users face different challenges that are not adequately addressed by the hospital, leading to lower levels of satisfaction and a reduced quality of care

Elias MacMillan

Plants May Reveal Where a Corpse is Buried: How the Stages of Decomposition of Pork Affect the Growth Rate of *Papaver somniferum*



Location of Research:
Harrison High School

Mentor:
Dr. Christopher Tyler

Will be Attending:
John Jay College of Criminal Justice

Intended Major:
Forensic Science

Fairs & Awards:
WESEF 2025 - NASA Earth System Science Award
Regeneron STS -Applicant
Somers 2023 - Participant
HHS Symposium 2023, 2024, 2025

Many murder cases go cold, meaning that the case has been opened and unsolved for 3+ years. Forensic botany uses plants as evidence to reconstruct a crime. Cholewaa *et al.* (2022) found that decomposed pig limbs increased vegetation of *Begonia semperflorens*. However, few known studies have looked at how different decomposition stages affect the growth rate of plants. Therefore, the purpose of this study was to determine the relationship between pork at various decomposition stages and the growth rate of poppies (*Papaver somniferum)*. Pork was chosen because it is the closest meat to humans. It was hypothesized that the pork in the putrefaction (5 days) would increase the growth rate of poppies because the nutrients in the pork will be absorbed into the soil faster. Terrariums were used to create an artificial environment that mimicked that of a real crime scene. The pork was decayed in 4 stages (no decay, putrefaction, butyric fermentation, and dry decay) with one terrarium housing no meat as control. Germination rate, number of leaves, and the approximate height were recorded every 5 days until 20 days when final measurements were taken. Results showed that the poppies grown with no meat were significantly taller than the other groups ($p<.05$). However, in the soil with the plants grown with meat decayed for 5 days (putrefaction stage), there were significantly more leaves than almost all of the other groups ($p<.05$), and while not significant, more roots and root nodules. This indicates that plant growth is different when meat is decayed at different stages before burial, and that it may be possible to find bodies buried during different stages of decay based plant growth. Implications are that technologies could be created to identify changes in plant life that could help locate murder victims.

Plants May Reveal Where a Corpse is Buried: How the Stages of Decomposition of Pork Affect the Growth Rate of *Papaver somniferum*

Elias MacMillan

Introduction

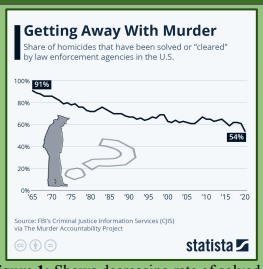


Figure 1: Shows decreasing rate of solved cases in America since 1965-2020

% of solved homicide cases decreasing in the U.S.

Multitude of reasons for occurance (dismemberment, buried, etc.)

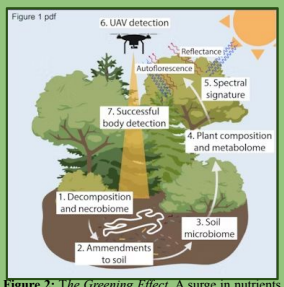


Figure 2: *The Greening Effect.* A surge in nutrients in the surrounding area where a body is buried causes the leaves of the plants to become greener which can be detected by Unmanned Aerial Vehicle technology (Pullano, 2020).

Forensic Science: The usage of the scientific method and technology to help aid and solve crime

Forensic Botany: The usage of plant science to aid and solve crime.

The **purpose** of this study was to examine how organic material in diff stages of decomposition affects plant growth.

Hypothesis: Plants grown with pork in the putrefaction stage will have the most growth because it still retains most of the nutrients from the piece of pork.

Methodology

IV: Decomposition Stages
DV: Growth of Plant
CVs: Amount of water, amount of soil, amount of seeds, size of terrarium, growth environment

Plant Choice: *Papaver somniferum*
Meat Choice: *Pork*

Growth Conditions:
Plants grown for 20 days under UV light
UV light cycles between day and night
10 seeds per terrarium
2 terrariums per condition
Seeds placed on surface off the soil
Meat buried 10 cm from surface



MacMillan, 2024

Decay Conditions:

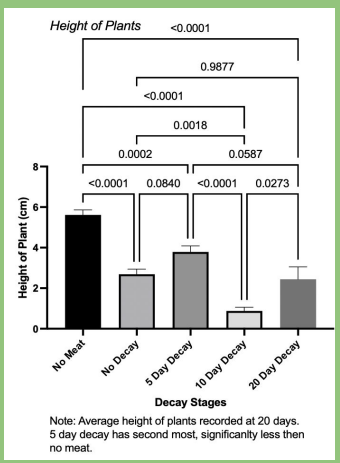
No Decay (0):
Fresh, decomposition is starting to begin

Putrefaction (5):
Bacteria begins the breakdown of the organic matter

Butyric Ferm (10):
Flesh is removed, body dries out.

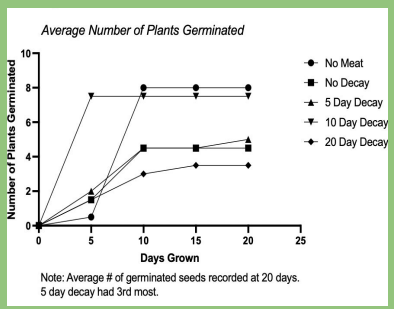
Dry Decay (20):
Body dries, continues decomposition at slower rate

Results & Analysis



Note: Average height of plants recorded at 20 days. 5 day decay has second most, significanlty less then no meat.

Putrefaction: Most average leaf growth (sig = No Decay + Butyric Fermentation), 2nd highest height + overall length (sig = Byutric Ferm.)
No Meat: Highest height + overall growth (sig when compared to all other conditions), 2nd highest average # of leaves



Note: Average # of germinated seeds recorded at 20 days. 5 day decay had 3rd most.

Putrefaction: Highest average root average + root node (not sig), 3rd highest germination rate
No Meat: Highest ave. germination, 2nd highest average root and root nodes (not sig)

Conclusion & Future Research

Hypothesis was **partially** supported
No meat had sig more growth in height and a larger germination rate, Put. = sig more growth in roots and leaves

Pork had both positive and negative effects
Increased branching, less germination + height
Control = sig more height but less leaves + branching
No specific trend based on decomp stage and plant growth

Putrefaction: 5 Day Decay
Rapid decomposition has just begun, increase in tissue
More decomposition occurred in soil
Less time to begin decomposition → nitrogen reaching plants faster
Release of decomposition enzymes →increased plant stimulation + growth

Grow plants in an outdoor setting
Observe difference b/w flowering in each stage
Observe the change in color in plant growth when influenced by an external source.

Can save time in scenes for time sensitive evidence
More research → more technology → decrease in cold cases
Ex: AI could be used to compare coloration of plants grown in the presence of a corpse vs. normally

Martina Marcinkevicius

A Two-Mediator Serial Mediation Chain of the Association Between Family Affluence and the Outcome Variables of Oral Health and Oral Hygiene



Location of Research:
Harrison High School

Mentor:
Dr. Anouk Geraets, Université du Luxembourg

Will be Attending:
Tulane University

Intended Major:
Biological Chemistry (Pre-Dental Track)

Fairs & Awards:
WESEF 2025 - 4th Place Medicine and Health
NYSSEF 2025 - Participant
WESEF 2024 - 3rd Place Medicine and Health
Regeneron STS - Applicant
HHS Symposium - 2023, 2024, 2025

Oral health is a vital aspect of overall wellness, encompassing the condition of the mouth and its structures — teeth, gums, tongue, and other tissues. It significantly influences whole-body health; issues relating to dental and gum health can lead to severe complications, including high blood pressure, high cholesterol, and an increased risk of heart disease and strokes. Meanwhile, oral hygiene, refers to practices that ensure the oral cavity is clean and disease-free, primarily through regular tooth brushing. Numerous studies have established the relationship between lower family affluence and poorer oral health and hygiene. Research has also indicated that adolescents with diminished mental well-being are less likely to brush their teeth. This study aimed to determine whether mental well-being (MWB) and decision-making (DM) will act as serial mediators in the relationship between family affluence (FA) and the outcome variables of oral health (OHLT), and oral hygiene (OHYG). A total of 126 adolescents from the Northeastern US were surveyed using the Family Affluence Scale, Warwick-Edinburgh Mental Well-Being Scale, Decision Style Scale, and two self-developed measures to rank Oral Health and Oral Hygiene. The strongest mediation pathway for oral health (FA → MWB → OHLT) demonstrated a total complementary effect of -0.2822 **(**24.6%) ($p < 0.001$), highlighting the critical role of mental well-being. In contrast, the serial mediation pathway (FA → MWB → DM → OHYG) exhibited the most substantial complementary total effect of 0.4033 (69.6%) ($p < 0.001$), emphasizing the importance of positive mental well-being and effective decision-making skills to enhance oral hygiene outcomes, particularly among adolescents from lower affluence backgrounds. These results suggest that limited access to mental health care for less affluent individuals may lead to inadequate oral care, underlining the need for interventions that foster mental well-being and decision-making skills to improve health and hygiene outcomes in vulnerable adolescents.

A Two-Mediator Serial Mediation Chain of the Association Between Family Affluence and the Outcome Variables of Oral Health and Oral Hygiene

Introduction

Non Communicable Disease: Disease that **can not** be spread from person to person → caused by unhealthy behaviors.

Oral Disease (Periodontal and Gingivitis)

** 3.5 billion people affected, ¾ coming from **low to middle income families.**

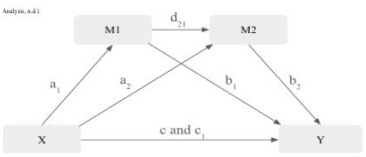
1 Singh 2019: Meta-analysis verifying **low** household income → **adverse** oral health outcomes.

2 CNBC 2022: 42% of Americans admitted that money is **negatively** affecting their mental health.

3 Gearets 2022: Adolescents **less likely** to brush their teeth if reported **higher levels of stress**, and more psychological complaints.

4 Tiwari *et al*. (2022) **poor** mental health symptoms (**lack of motivation**), can **negatively** impact oral hygiene.

Serial Mediation Analysis



Statistical method that examines **how one variable affects another through a chain of mediators** (like a domino effect).

Purpose: Determine whether the relationship between family affluence and oral hygiene, or health, is **serially mediated** by mental wellbeing and decision making.

Methodology

Variables

Independent Variable	Family Affluence
Dependent Variable	Oral Hygiene / Oral Health
1st Mediating Variable	Mental Wellbeing
2nd Mediating Variable	Decision Making

Participants

126 High School Students

50% male, 50% female

Procedure

IRB Approval and Consent Collected

Survey Construction: 4 Sections

- Demographic Information
  - Gender, Race, Ethnicity, Background, etc.
- Approximate Family Affluence Rank
  - Included Family Affluence Scale
- Mental WellBeing Rank
  - Included "The Warwick–Edinburgh Mental Wellbeing Scale"
- Decision Style Rank
  - Included "Decision Style Scale"
- Oral Hygiene / Oral Health Rank
  - Included Self Developed Scale

After data collected, data analysis was performed.

Data Analysis:

CVC File → SPSS | PROCESS Macro, Model 6

(5000 bootstrap samples)

Strongest Indirect Effect = Strongest Pathway

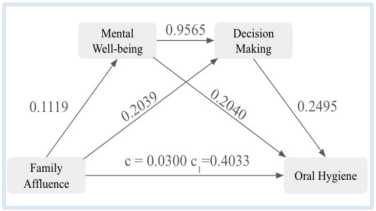
Indirect / Total Effect = % that the relationship is explained by serial mediation

*confidence intervals do not include zero

Results & Analysis

Outcome Variable of Oral Hygiene

Figure 1 created by Student Researcher Martina Marcinkevicius using Google Slides, 2024



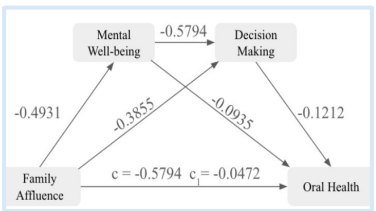
Relationship	Total Effect	Direct Effect	Indirect Effect	Confidence Interval Lower Bound	Confidence Interval Upper Bound
Total (FA → OHYG)	*0.9865*	*0.9565*	*0.0300*	0.8993	1.0738
Ind1 FA → MWB → OHYG			0.3484	0.1119	0.2040
Ind 2 FA → DM → OHYG			0.2151	0.2039	0.2495
Ind 3 FA → MWB → DM → OHYG			0.4033	0.2370	0.4373

Figure 1: **Total** Effect (0.9865) / **Indirect** Effect
Ind 3:FA → MWB → DM → OHYG **(69.6%)**
Ind 1: FA → MWB → OHYG **(60.1%)**
Ind 2: FA → DM → OHYG **(37.1%)**

**CONFIRMED
All confidence intervals **do not include zero.**

Outcome Variable of Oral Health

Figure 1 created by Student Researcher Martina Marcinkevicius using Google Slides, 2024



Relationship	Total Effect	Direct Effect	Indirect Effect	Confidence Interval Lower Bound	Confidence Interval Upper Bound
Total (FA → OHLT)	*-1.1496*	*-0.5703*	*-0.5794*	-1.2503	-1.0490
Ind1 FA → MWB → OHLT			-0.2822	-0.4631	-0.0935
Ind 2 FA → DM → OHLT			-0.2499	-0.3855	-0.1212
Ind 3 FA → MWB → DM → OHLT			-0.0472	-0.1119	-0.0165

Figure 4: **Total** Effect (-1.1496) / **Indirect** Effect
Ind 1: FA → MWB → OHLT **(24.6%)**
Ind 2: FA → DM → OHLT **(21.7%)**
Ind 3: FA → MWB → DM → OHLT **(4.1%)**

**CONFIRMED
All confidence intervals **do not include zero.**

Conclusion & Future Research

Hypothesis **mainly** supported

FA → MWB → DM → OHYG **69.6 %**

FA → MWB → DM → OHLT **4.1 %**

Oral Hygiene VS Oral Health

Oral Hygiene makes sense as the "better" outcome variable because:

Oral Hygiene
* Day-to-day decisions
* Action-oriented
* Involve decision-making.

Oral Health
*Condition of the Mouth
*Long term
*Result of Oral Hygiene

Supports Why…

(Hodgkinson, 2017)
The conventional practice of most mental agencies **contribute** to the disparities in access to mental health care services.

Mental wellbeing and decision-making not only affect **psychological health** but also have **physical repercussions.**

Diana Marin

How Different Concentrations of Ibuprofen Affect Female and Male *Drosophila melanogaster*



Location of Research:
Harrison High School

Mentor:
Ms. Allison Blunt

Will be Attending:
University of Houston

Intended Major:
Biomedical Engineering

Fairs & Awards:
HHS Symposium - 2025

Dose recommendations for Ibuprofen and other over-the-counter medications are often calculated based on drug dose trials performed on males. Due to the lack of data, it is possible that labels on over-the-counter medications suggest inaccurate dosages for females. In addition, there is conflicting evidence as to whether ibuprofen is less effective in females or if females just perceive their pain differently because of hormonal differences, requiring increased doses of painkillers. Therefore, the purpose of this study was to assess whether male and female wild-type *Drosophila melanogaster* reacted similarly to the same doses of ibuprofen after consuming weed killer to induce inflammation. The hypothesis was that females will consume the same concentrations of Ibuprofen as males to reduce inflammation and rescue associated locomotor deficits. Methods included separating wild-type *Drosophila melanogaster* by sex and then feeding them a 1.4 mg/mL concentration of RoundUp weed killer for 4 hours to induce inflammation. Then, the flies were transferred onto food containing either 0, 0.5, or 1.0 mM concentration of ibuprofen. A negative geotaxis assay was used because inflammation would impair locomotor activity. Results revealed that male flies showed significant improvement in locomotor ability after being administered 0.5 mM of ibuprofen ($p<.001$), while female flies needed 1 mM of ibuprofen to show significant improvement ($p<.001$). In addition, the male flies showed significant improvement compared to the female flies at 0.5 mM ($p<.01$). Implications include that the amount of ibuprofen that females need to take may be much greater than males to feel the positive effects of the medication so labels may need to be clarified.

How Different Concentrations of Ibuprofen Affect Male and Female *Drosophila* melanogaster

Introduction

- Dose recommendations for Ibuprofen and other over-the-counter medications are often calculated based on drug dose trials performed on males (Zucker, 2020)
- Due to the lack of data, it is possible that labels on over-the-counter medications suggest inaccurate dosages for females
- There is conflicting evidence as to whether ibuprofen is less effective in females or if females just perceive their pain differently because of hormonal differences, requiring increased doses of painkillers (Sluka, 2008)

Purpose

To assess whether male and female wild type *Drosophila melanogaster* reacted similarly to the same doses of ibuprofen after consuming weed killer to induce inflammation.

Hypothesis

Females Drosophila will consume a higher concentration of Ibuprofen than males to reduce inflammation and rescue associated locomotor deficits.

Methodology

Independent

- Concentrations of Ibuprofen: 0 mM, 0.05 mM, and 1 mM
- Groups of Drosophila; separated into males and females

Part 1: Prepare weed killer/ibuprofen concentrations as substitutes for water in food recipe (BDSC)

Part 2: Separate Drosophila by sex, place the separated flies in weedkiller vials for 4 hrs

Part 3: After 4 hrs in weedkiller, perform neg geotaxis assay, transfer files to ibuprofen for 4 hrs and repeat neg geotaxis assay

Dependent

- Performance of the Drosophila during the negative geotaxis assay test

Controlled

- Concentration of RoundUp weedkiller: 1.4 mg/mL
- 4 hrs in weedkiller concentration/ 4 hrs in Ibuprofen concentration
- Room temp: 22℃

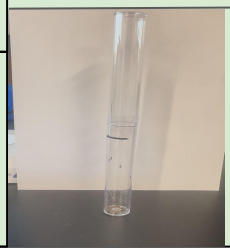


Figure 1: negative geotaxis assay test being done

Results & Analysis

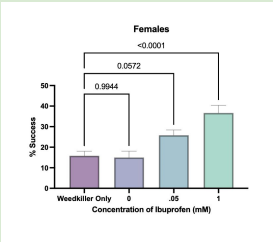


Figure 2: Females showed significant improvement after being given 1 mM of Ibuprofen ($p<.001$)

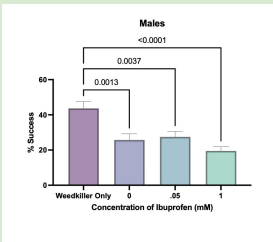


Figure 3: Males didn't show any improvement after being given Ibuprofen, as the success rate was highest after receiving weedkiller

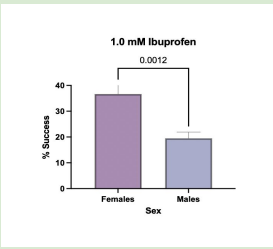


Figure 4: Compared to the males, the female flies had a significantly higher success rate after being given 1 mM of Ibuprofen ($p<.01$)

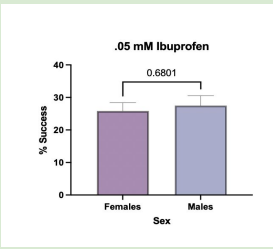


Figure 5: Compared to the females, males showed a slightly higher success rate than females after 0.5 mM of ibuprofen

Conclusion & Future Research

Conclusion

Hypothesis was supported
Females did significantly better than males, female success rate increased with each concentration of Ibuprofen

The male graph did not have a significant trend as the success rate was highest after only receiving weed killer, then decreased at 0 mM of Ibuprofen, and increased slightly for 0.05 mM

The significant trend of females locomotor ability increasing as the concentration of Ibuprofen increased was not seen for males

Future Research

Repeat on more complex animals that have similar systems to humans (mice, rats, monkeys)

Use immunohistochemistry to visualize how ibuprofen decreases inflammation in tissue

Adriana Marraccini

How Wearing Sporting Equipment Affects the Diversity of the Skin Microbiome of High School Athletes



Location of Research:
Harrison High School

Mentor:
Ms. Allison Blunt

Will be Attending:
Fairfield University

Intended Major:
Nursing

Fairs & Awards:
WESEF 2025 - Excellence in Medical Research Award
JSHS 2025- Applicant
Somer's 2023 - 3rd Place, Microbiology
HHS Symposium - 2023, 2024, 2025

Many athletes suffer from Atopic Dermatitis (AD), a condition that causes itchy, dry, and inflamed skin and is characterized by the overgrowth of pathogenic microbes and reduced skin microbial diversity. The skin microbiome consists of a diverse microbiota that fends off pathogens and aids in immune defenses. It is unclear what causes changes in the skin microbiota of athletes to cause AD. It is possible AD can be exacerbated in the places where skin touches sporting equipment, altering the microbial community. Therefore, the purpose of this study was to determine whether there is a change in the flora of the skin microbiome in the locations where sporting equipment touched the skin. The hypothesis was that the skin microbiome will be less diverse in areas where sports equipment is touched because other materials can change the skin microbiota. The methodology involved two parts. 1. Surveying participants to determine whether they have a history of itchy skin/AD. 2. Culturing swabs on the upper arm, where equipment touched the skin both before and after lacrosse practice on tryptic soy agar plates. Changes in colony shape, size, color (chromogenesis), texture, elevation, and opacity were measured every day over a 3-day period to determine whether the equipment affected the microbial growth. The hypothesis was not supported as there was an unexpected significant increase in the number and diversity of bacterial colonies from before to after practice ($p<.05$), although the number of *Staphylococcus aureus* bacterial colonies significantly increased ($p<.001$). This was interesting because *Staphylococcus aureus* is associated with AD, although the increase in biodiversity indicated that it did not seem to outcompete other bacteria. These results demonstrate that sporting equipment, which we use for protection, may actually be contributing to uncomfortable skin conditions but more research is still needed.

How Wearing Sporting Equipment Affects the Diversity of the Skin Microbiome of High School Athletes

Introduction

Atopic Dermatitis (AD) ⟶ skin disease that causes dry, itchy, and inflamed skin.

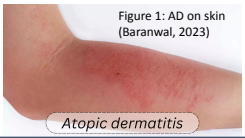


Figure 1: AD on skin (Baranwal, 2023)

AD = Common in Athletes

Skin Microbiome ⟶ Largest human organ
Colonized by beneficial microorganisms and serves as a physical barrier to prevent invasion of pathogens

Skin: S. Aureus = ⇧ **Pathogenic Bacteria = ⇩ innate immune responses & mucosal protection**

Skin: S. Epidermidis = ⇧**Commensal Bacteria = activation of innate immunity & prevention of allergic sensitization**

In athletes, atopic dermatitis can be exacerbated in the places where skin touches equipment

Elbow Pad Materials:

- Neoprene ⟶ soft spongy rubber material
- Lycra ⟶ an elastic polyurethane fiber or fabric

Purpose

To determine whether there is a change in flora of the skin microbiome in the locations where sporting equipment touches the skin that could potentially result in the development of AD

Methodology

Independent Variable: Area where equipment touches skin	**Dependent Variable:** Changes in skin microbiome	**Controlled Variable:** Swabs taken where the equipment touches the skin

Same brand sporting equipment (elbow pads), made of Lycra and neoprene used for all participants

Procedure

Part I: Survey Consent + Demographics: IRB Approval, Parental + Participant Consent

Safety Precautions: Gloves will be worn⟶ no cross-contamination, tape will be place around the edges

Part II: Evaluation

Swabbing skin before & after practice: on the same spot where the equipment touches the elbow using Nylon Swabs

Plate the swabs on tryptic soy agar plates: Carolina Biological agar plates ⟶ enhances bacteria growth

Culturing the bacteria: The plates will be left in an incubator at 37°C for 72 hours (bacteria

Count & Analyze the bacteria: based on shape, size, color, etc ⇨ used the clear acetate sheet

Results & Analysis

Total Growth With/Without Equipment

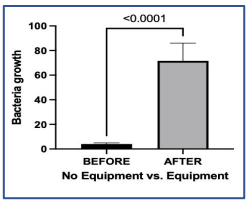


Figure 1: (p<.0001) (Error bars =SEM). Figure created by Marraccini, 2024.

***Staphylococcus aureus* Growth With/Without Equipment**

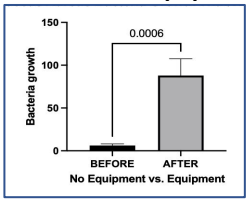


Figure 2: S. (p<.0006) (Error bars =SEM). Figure created by Marraccini, 2024.

***Halobacterium bacterial* Growth With/Without Equipment**

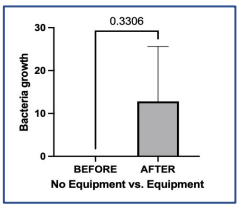


Figure 3: (p<.3306) (Error bars =SEM). Figure created by Marraccini, 2024.

***Staphylococcus epidermidis* Growth With/Without Equipment**

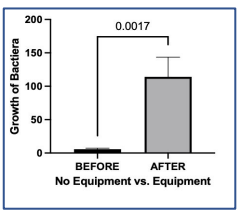


Figure 4: p<.0017)) (Error bars =SEM). Figure created by Marraccini, 2024.

Conclusion & Future Research

Hypothesis ⇨ NOT supported
➔ # *S.aureus* increased BUT the # colonies of other types of bacteria increased as well

S.aureus would out compete other bacterias so the # of other bacterias would decrease while *S.aureus* would increase

Limitations & Future Research

- Colonies could have grown on top of each other limiting their visibility and affecting the count
- PCR was not done ⟶ do not know the actual genetic makeup of the bacteria (only counted colonies)
- 1 type of sporting equipment material/one location on the body was studied

Conclusion

This study aimed to identify bacteria in the skin microbiome that is developing AD on athletes skin due to sporting equipment they wear

Overall, there was a more diverse microbiome after practice with more growth than before practice

Heidi Monke

Determining the Extent to which Lutein Has a Neuroprotective Effect in Alzheimer's Model *Drosophila melanogaster*: A Dose Response Study



Location of Research:
Harrison High School

Mentor:
Ms. Allison Blunt

Will be Attending:
Boston University

Intended Major:
Biochemistry and Molecular Biology

Fairs & Awards:
WESEF 2025 - 3rd place Medicine & Health
Somers Science Fair - Participant
HHS Symposium - 2023, 2024, 2025

According to the Alzheimer's Association, Alzheimer's disease affects over 6.7 million Americans over the age of 65. The prognosis of Alzheimer's disease is low with little success rate in treatment. The imbalance between the production of reactive oxygen species and antioxidant mechanisms causes a form of metabolic stress referred to as oxidative stress. Free radicals which are unstable atoms damage the mitochondria causing the production of toxic amyloid beta in AD. Consuming antioxidants through your diet in many different forms can reduce the damage of ROS and mitigate oxidative DNA damage. Lutein is a carotenoid that has been associated with neuroprotective effects yet, and has only been studied within observational studies. This study explores the effects of lutein on the validated Alzheimer model transgenic *Drosophila melanogaster* using a GAL4-UAS system expressing the human "Arctic" Aβ42 mutation to determine if lutein decreases AD-associated effects. A dose-response study will be conducted to determine if lutein improves neurological function in the Alzheimer model flies. It is hypothesized that as the concentration of lutein increases, the Arctic flies will experience longer lifespans and improved neurological function as measured through a negative geotaxis assay. The offspring then contained the gene for Alzheimer's disease in which they were fed different doses of lutein in a dose-response study which showed the overall function and effects of Alzheimer's disease which was most effective in the 100μM as tested by the negative geotaxis assay. Additionally, for the life span the effects were most successful in 10μM. Their improvement will be shown in their mobility and functions and how far they differ from the control group. Therefore the purpose of this was to evaluate the extent to which Lutein had a positive effect on both the health and life span of the UAS-Arctic model.

Determining the Extent to which Lutein has a Neuroprotective Effect in Alzheimer's Model *Drosophila melanogaster*: A Dose Response Study

Heidi Jolee Monke

Introduction

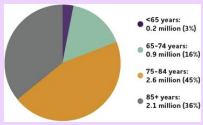
Alzheimer's Disease (AD)

Affects over 6 million people in America over the age of 65 (Alzheimer's Association, 2023)

Neurodegenerative disease that slowly affects the way the brain functions

(OmegaQuant, 2022)





(Alzheimer's Association, 2019)

Lutein

Carotenoid: beneficial antioxidant that helps protect humans from disease and enhances the immune system

***Drosophila melanogaster* = Valid AD Model**

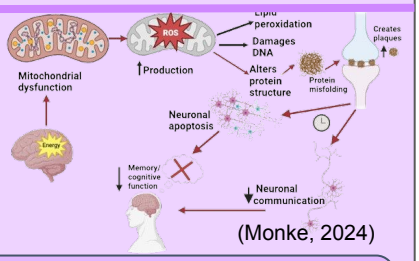
- Shares 75% of the same genes as humans

(Ugur et al., 2016)

- Small, reproduce quickly, and have a short lifespan to analyze the effects of the disease

Lutein Intercept in Process

-Can reduce oxidative damage
-Anti-inflammatory
-Formation of amyloid plaque
-Aid in protein misfolding



(Monke, 2024)

Purpose

If lutein decreases AD-associated effects on AD model transgenic Drosophila melanogaster using a GAL4-UAS system expressing the human "Arctic" Aβ42 mutation

Methodology

Variables

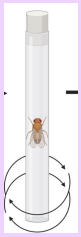
IV	DV	Control	Fly Type
Lutein; 0, 1, 100, 1,000, 10,000 (μM)	-Life Span -Locomotor ability	-12 hours of light -12 hours of darkness -22°C	-UAS "Arctic" Flies -GAL4 -Wildtype

Procedure

- "Artic"
- Gal4
- Wildtype

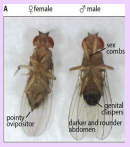
- gather virgin flies for Arctic and Gal 4 cross with one another

- 0, 1, 10, 100, 1,000, 10,000 (μM)
- eggs laid on concentrations



- Day 8,9,10
- Locomotor Ability = neurological function

- From D1 (hatched) to D20
- Number of flies alive counted



Results & Analysis

Fig 1: Negative Geotaxis Assay Alz

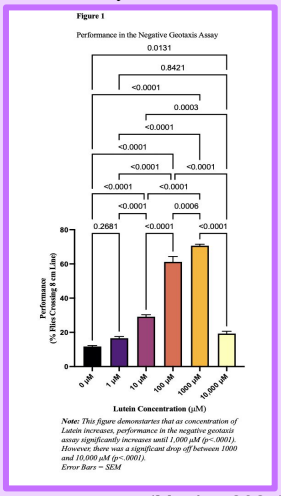
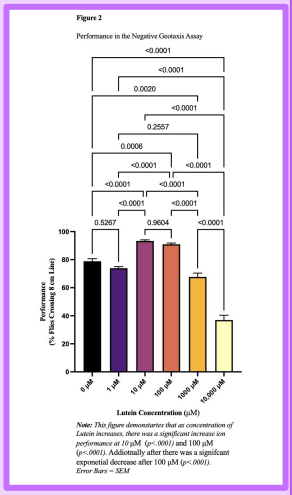


Fig 2: Negative Geotaxis Assay Control



(Monke, 2024)

Fig 1: Negative geotaxis for Alzheimer's flies showed 1000 μM to be the most successful

Fig 2: Negative geotaxis for control Lutein performed better than non Lutein flies.

Fig 3: Kaplan Meier Curve for Alz

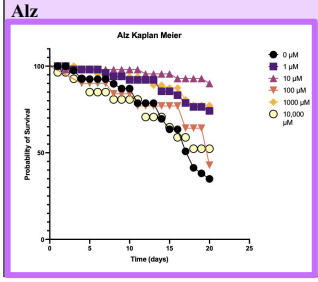
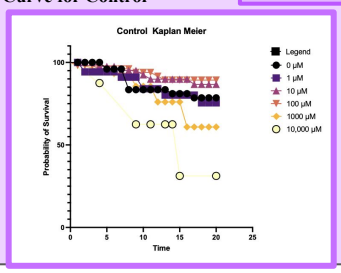


Fig 4: Kaplan Meier Curve for Control



Conclusion & Future Research

Experiment was overall successful

Negative Geotaxis Assay

A test that measure how many flies can climb past 8 cm mark in 10 secs

Purpose: assess motor function and potential neurodegenerative effects (Liu, 2015)

Figure 1&2:

As lutein ↑ locomotor ability ↑

Kaplan Meier Curves

Recorded lifespan from day 1-20

Purpose: allow researchers to record survival data

Figure 3 & 4:

As lutein ↑ lifespan ↑

Conclusion

-In both the Negative Geotaxis Assay and the Kaplan Meier curves lutein was successful in increasing the life and health span

-The experiment was overall successful meaning that further experiments would indicate using the results for further trials and on new models

Future Focus

-Human nervous system is more complex

-Study lutein in a molecular brain model

-Neurological function in a clinical dose response study on humans



(Queensland Brain Institute, 2024)

Yaseen Osman

Sensitivity and Dynamic Range Assessment of *in-vitro* Immunoassays to Determine a Suitable Platform to Screen Anti-Amyloid-β Antibodies



Location of Research:
Regeneron Pharmaceuticals

Mentor:
Dr. Ahmed Hassan

Will be Attending:
Georgia Institute of Technology

Intended Major:
Biochemistry

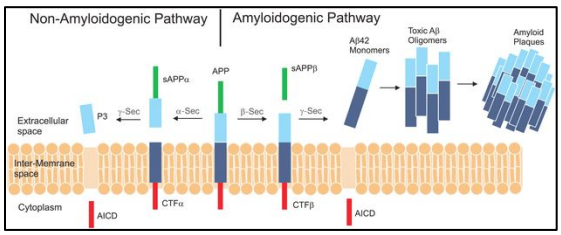
Fairs & Awards:
NYSSEF 2025 - 3rd Place Biomedical & Health
WESEF 2025 - 3rd Place Medicine & Health
JSHS 2025 - Applicant
Regeneron STS 2025 - Applicant
NYSSEF 2024 - 3rd Place Systems Software
WESEF 2024 - Participant
Somers 2023 - Participant
HHS Symposium - 2023, 2024, 2025

Alzheimer's Disease (AD) is a devastating neurodegenerative disorder that affects millions of people worldwide. The direct cause of AD remains unclear; however, it is highly associated with the aggregation and accumulation of the Amyloid Beta (Aβ) protein in the brain. Current antibody (Ab) therapeutics are clinically proven to remove Aβ plaques from the brain but fail at stopping the major symptoms of AD. Failures in the clinic highlight potential gaps in the understanding of the pharmacodynamic interactions of Aβ therapeutics. Reliable immunoassays are required to aid in the development and understanding of the mechanism of action of Aβ therapeutics. This study aimed to assess multiple *in-vitro* immunoassays—including Colorimetric and Chemiluminescence ELISA, Meso-Scale Discovery, and DOT Blot— to rank and characterize them based on sensitivity and dynamic range. The goal was to determine where these immunoassays fit into the anti-Aβ Ab screening process. Dose-response data was generated using various Aβ biologics against the monomeric, oligomeric, and fibrillar forms. It was found that the Colorimetric ELISA is best for the early stages of Aβ screening, where a highly sensitive and high-throughput assay is needed to select for Aβ specific binding Abs from thousands of samples. Chemiluminescence ELISA is best suited for the following stages of screening where specificity differentiation is needed to determine the target engagement and potency of Aβ Abs against different isoforms of Aβ. Application of the correct assays to the most suitable stage of screening can optimize the Aβ therapeutic screening process and accelerate the development of an effective biologic that can potentially treat millions of AD patients.

Sensitivity and Dynamic Range Assessment of *in-vitro* Immunoassays to Determine a Suitable Platform to Screen Anti-Amyloid-β Antibodies

Introduction

- Alzheimer's Disease (AD) affects 55 million worldwide and over 139 million expected by 2050.
- AD occurs when the Amyloid-β (Aβ) protein aggregates into larger oligomers, and fibrils and deposits on neurons as plaques, leading to neuronal cell death.
- Existing therapeutics remove plaques, but do not improve cognitive functions, highlighting the urgency to develop more efficient AD therapeutics.



Problem: Antibodies are characterized by different companies using varied formats, reagents, and instruments, leading to difficulty comparing performance of antibodies.

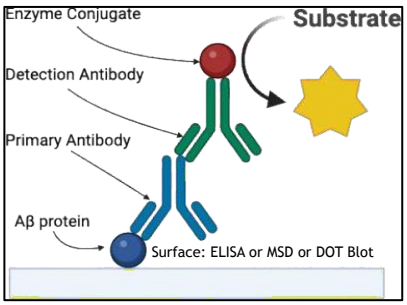
Goal: Find optimal assay to identify potent anti-Aβ antibodies.

Approach: Perform various immunoassays under standardized conditions to assess their characteristics.

Materials & Methods

Antibodies	Aβ protein targets		Immunoassays
Aducanumab	Aβ-42	Monomer	Colorimetric ELISA (C)
Solanezumab		Oligomer	
Donanemab		Fibril	Chemiluminescence ELISA (CL)
Lecanemab	Aβ pyroglutamate	Oligomer	
Bapineuzumab		Fibril	Meso-scale Discovery (MSD)
Gantenerumab	Aβ-40	Monomer	
Trontinemab		Fibril	DOT Blot

Format

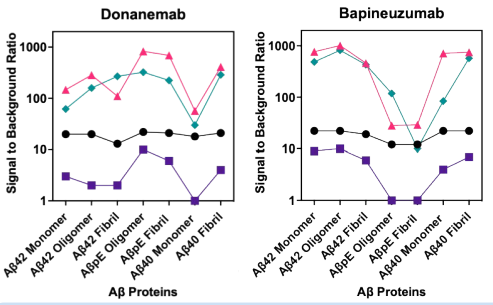


Dependent Variables

1. Assay Potency: Concentration required to get 50% of maximal binding effect

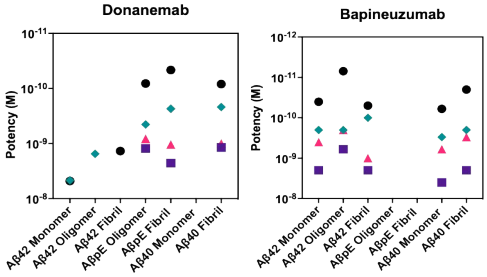
2. Dynamic Range: Highest signal measured

Results & Analysis



Dynamic Range Rankings:
1. ELISA (CL)
2. MSD
3. ELISA (C)
4. DOT Blot

- Dynamic range was calculated as the signal to background ratio.
- Varying dynamic ranges were observed depending on platform used, but with similar binding patterns.



Potency Rankings:
1. ELISA (C)
2. MSD
3. ELISA (CL)
4. DOT Blot

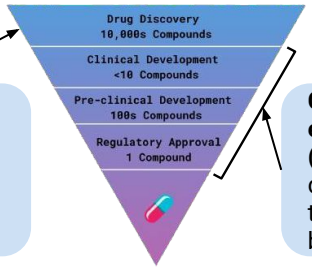
Potency was calculated from the dose-response fit of the binding signal.
Varying potencies were observed depending on platform used, but with similar binding patterns.

Conclusion & Future Research

Data generally aligned with published literature and revealed new binding interactions.

- **ELISA (C)** was the most potent
- **ELISA (CL)** had the highest dynamic range
- **MSD** ranked below the ELISA platforms
- **DOT Blot** ranked the lowest

Data highlights how different assay platforms can generate conflicting results, emphasizing the need to bridge the gap between orthogonal screening assay platforms.



Colorimetric ELISA (C): Potent and High-throughput to detect most binders.

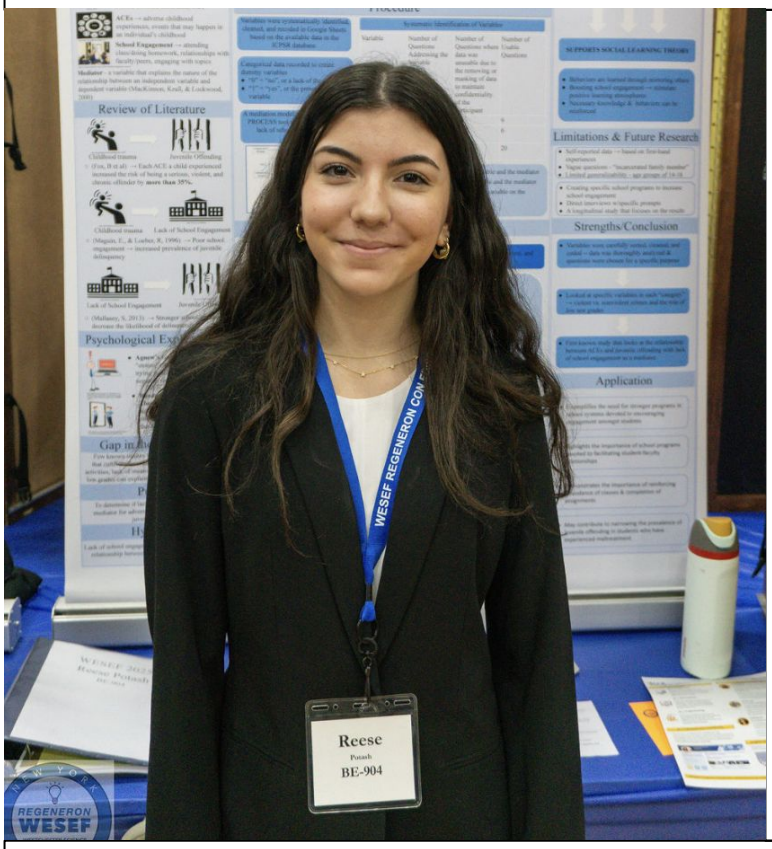
Chemiluminescence ELISA (CL): High dynamic range to differentiate binders.

Applications: This platform can potentially identify superior antibodies during the initial stages of antibody screening.

Future Research: Test more anti-Aβ antibodies and assays under this format, and include human derived Aβ plaques.

Reese Potash

Lack of School Engagement as a Mediator Between Adverse Childhood Experiences (ACEs) and Juvenile Offending



Location of Research:
Harrison High School

Mentor:
Ms. Allison Blunt

Will be Attending:
Duke University

Intended Major:
Political Science

Fairs & Awards:
STS Regeneron 2025 - Scholar
WESEF 2025 - 2nd Place Behavioral Sciences
Somers 2023 - 2nd place Behavioral Science
HHS Symposium - 2023, 2024, 2025

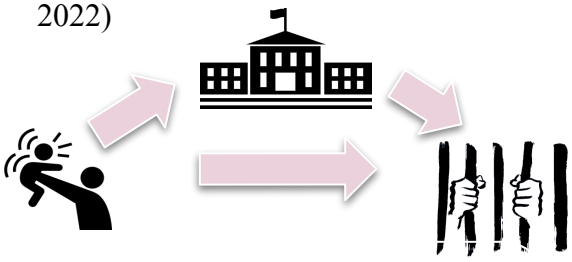
Adverse childhood experiences (ACEs) are traumatic events that occur during childhood, such as sexual abuse or emotional trauma, that can play a pivotal role in influencing criminal behavior. In the U.S., there are currently 60,000 youth incarcerated; by intervening early to decrease the rates of juvenile offending, the onset of adult criminal careers can be prevented. Social Learning Theory states that children often mirror the actions they observe in others. Since school is an academic place devoted to learning and developing meaningful relationships with faculty and peers, increasing school engagement may promote positive behaviors and deter criminality. This posits the potential for lack of school engagement, defined as an absence of interest in school activities, meaningful relationships with faculty, and high grades, to mediate the relationship between ACEs and juvenile offending. This study's hypothesis was that lack of school engagement will serve as a mediator in the relationship between ACEs and juvenile offending. Using the open-sourced, publicly available data on the University of Michigan's Inter-university Consortium for Political and Social Research (ICPSR) website, the Pathways to Desistance study, a longitudinal analysis of 1,354 serious juvenile offenders from their childhood to young adulthood, was examined. Variables were systematically identified based on the available data in the ICPSR database and re coded using IBM SPSS Statistics. Then, a linear regression through PROCESS was performed to determine the role of lack of school engagement as a mediating variable. The results provide support for Social Learning Theory, as lack of school engagement was a partial mediator for the relationship between ACEs and juvenile offending. This study exemplifies the need for stronger programs in schooling systems devoted to encouraging engagement amongst students. By facilitating student-faculty relationships, positively reinforcing attendance of classes and completion of assignments, and promoting easy access to extracurricular activities, critical steps to reduce criminality can be taken.

Lack of School Engagement as a Mediator Between Adverse Childhood Experiences (ACEs) and Juvenile Offending

Reese Potash

Introduction

- The **2 leading causes** of juvenile offending are failure in school and family problems (Legislative Analyst's Office, 1995)
- Each year **~250,000 children** are prosecuted in criminal courts subjected to criminal convictions (ACLU, 2025)
- **~97%** of prisoners have had at least one adverse childhood experience (Urban Institute, 2022)



- **Agnew's General Strain Theory** → "strains" or failures create negative emotional states → crime
- **Bandura's Social Learning Theory** → behaviors are mirrored from others & positive influences may deter crime



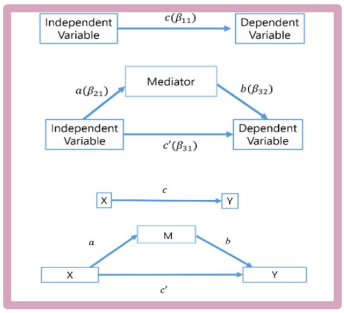
Methodology

Use of **open-sourced, publicly available** data set **Pathways to Desistance** on the **ICPSR website** (Inter-university Consortium for Political and Social Research)

Systematic Identification of Variables

Variable	Number of Questions Addressing the Variable	Number of Questions where data was unusable due to the removing or masking of data to maintain confidentiality of the participant	Number of Usable Questions
ACES	22	13	9
School Engagement	32	26	6
Juvenile Offending	116	96	20

Use of Google Sheets to **sort/code** variables based on available data.



A mediation model was run using Hayes PROCESS tool to determine whether lack of school engagement is a mediator.

Results & Analysis

Mediation between ACEs, Juvenile Offending, and Lack of School Engagement

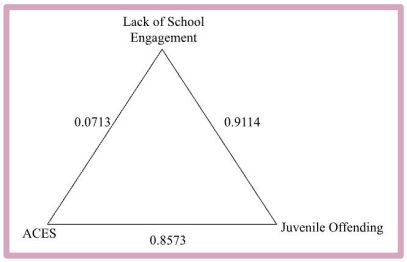
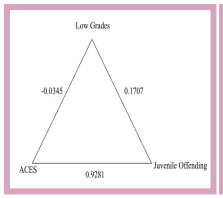


Figure A: Statistically significant *partial* mediation

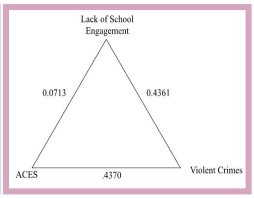
Overall Mediation

- **Significant (t=6.2043)** indirect effect
- **Significant (p<.001)** direct effect

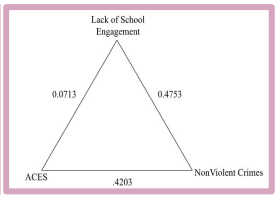
Specific Types of School Engagement & Juvenile Offending Mediations



Low Grades→ Figure B: Statistically insignificant mediation



Violent Crime → Figure C: Statistically significant *partial* mediation



Nonviolent Crime → Figure C: Statistically significant *partial* mediation

Conclusion & Future Research

Hypothesis supported → lack of school engagement interrupted the relationship between ACEs and juvenile offending

First known study that looks at the relationship between ACEs and juvenile offending with lack of school engagement as a mediator.

Future Research & Applications:

- Exemplifies the need for stronger programs in school systems devoted to encouraging engagement amongst students
- Supports Social Learning Theory → behaviors can be changed based on positive atmospheres
- May contribute to narrowing the prevalence of juvenile offending in students who have experienced maltreatment

Samantha Ramirez

Hypothalamic Perineuronal Nets in Caregiving Behavior



Location of Research:
Albert Einstein College of Medicine

Mentor:
Dr. Anita Autry,

Will be Attending:
University of Pennsylvania

Intended Major:
Bioengineering (Pre-Med)

Fairs & Awards:
NYSSEF 2025 - 3rd Place Cellular and Molecular Biology
WESEF 2025 - Innovations in Biomedical Research Award
Regeneron STS - Applicant
NYSSEF 2024 - Participant
WESEF 2024 - Society of Invitro Biology Award
Somers 2023 - Participant
HHS Symposium - 2023, 2024, 2025

Mothers begin adapting to caregiving during pregnancy and improve rapidly after birth. However, less is known about how caregiving develops fathers and babies. In recent work, the Autry lab found that hypothalamic expression of perineuronal nets (PNNs), extracellular matrix structures, and parvalbumin (PV), a protein, were correlated with caregiving states in male mice. PNNs regulate synaptic contacts, potentially sending signals that cause parents to exert certain behaviors onto their young. However, the actual role of the PNNs is unclear and whether PNNs or PV are enabling fathers to behave parentally. Additionally, prolactin is a hormone that reduces levels of testosterone and may alter gene expression in neurons that promote caregiving in males. Prolactin may also be regulating PNNs because it sends signals throughout connective tissue, a component of PNNs. Therefore, the purpose of this study was twofold: 1. to examine the role of hypothalamic PNNs on PV+ neurons in male mice regarding caregiving behaviors, 2. to determine if prolactin was regulating PNNs or PV expression. The methods involved conducting three ELISA assays to see if, between infanticidal males, alloparental males, alloparental females, fathers, and mothers, there were differences in the abundance of PV, aggrecan (a biomarker for PNNs), and prolactin. Results showed that, in the hypothalamus, the abundance of PV was significantly higher in alloparental mice than in infanticidal males ($p<0.001$), meaning that PV levels may contribute to expression of caregiving behaviors rather than reflect mating status. The abundance of both aggrecan and prolactin was significantly greater in alloparental females and parents ($p<0.001$), meaning that aggrecan and prolactin expression levels may be affected by mating status. The implications are that higher expression of PV in the hypothalamus, regardless of sex and mating status, promotes caregiving behavior, while a lack of PV could indicate aggressive behaviors.

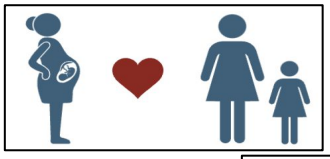
Hypothalamic Perineuronal Nets in Caregiving Behavior

Samantha Ramirez

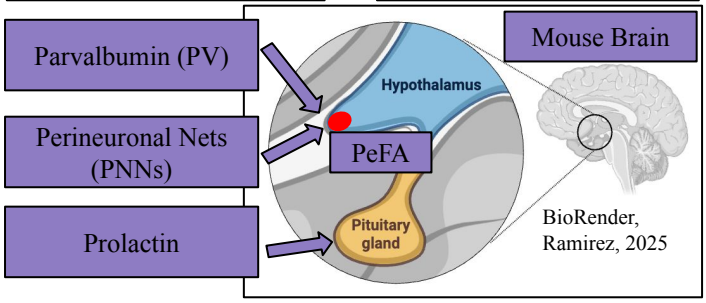
Introduction

Mother
= Biological Connection

Father
≠ Biological Connection







- Parvalbumin (PV) = calcium-binding protein in males
- Perineuronal nets (PNNS): Composed of proteoglycans (protein in connective tissue) (Carulli *et al.*, (2021))
- Previous localized the presence of PV+ neurons surrounded by PNNs in the anterior PeFA (Ramirez, 2023)

PURPOSE
1. To identify the role of hypothalamic PNNs on PV+ neurons in male mice in relation to caregiving behaviors
2. To determine if prolactin was regulating PNNs or PV expression

Methodology

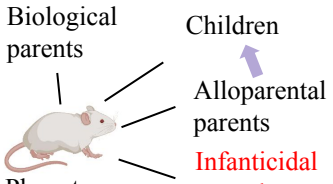
Hypothesis

1. PNNs → enable male caregiving behavior (Since PNN stabilizes synapses)

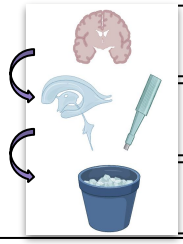
2. Males with low testosterone → act more paternally (Since PNNs may be correlated by prolactin)

Model Organism

35 C57 Wild Type Mus *musculus*



Tissue Preparation



Coronal sections

Ventricle punches

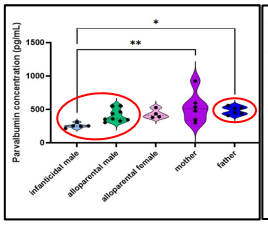
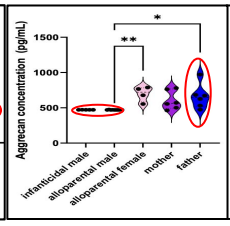
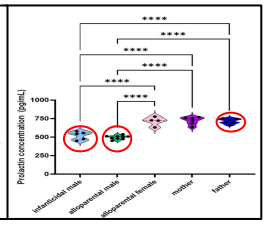
Frozen at -80 °C

Chosen Assay

ELISA (Sandwich Enzyme Linked Immunosorbent Assay)
→ Gold standard
→ Detects concentrations at the nanomolecular level

Independent	Dependent	Controlled
→ Phenotype	→ PV → Aggrecan → Prolactin	→ Genotype → ELISA → Environment

Results & Analysis

PV	Aggrecan (PNNs)	Prolactin
		
Fathers & alloparental male = levels of PV comparable to females & alloparental females → consistent with Autry lab findings	Fathers = level of Aggrecan comparable to females and alloparental females → same as PV	Fathers = level of prolactin comparable to females and alloparental females → same as PV & Aggrecan
High PV levels are associated with caregiving behaviors	**High Aggrecan levels are associated with mating status**	**High Prolactin levels are associated with mating status, potentially regulating Aggrecan**

Conclusion & Future Research

Hypothesis = Partially Supported

✓ Caregiving mice = High PV levels
✗ Only fathers = High Aggrecan levels
✓ Aggrecan & Prolactin = related to mating

Mated Mice (High levels of PV, PNNS & Prolactin) → **Caregiving behavior**

Alloparental Mice (High levels of PV) → **Caregiving behavior**

Limitation

ELISA cannot visualize prolactin; can't conclude causation

Further Research

- PNN Analysis
- Immunohistochemistry

Conclusion

Aim: Investigate neural mechanism of parental behavior
Findings: PV correlated to caregiving; PNN and Prolactin correlated to mating status
Conclusion: This means that factors driving infant-directed behaviors are likely determined based on mating status

Applications

- Likely a neurological component to parenting
- Broader understanding of social mammalian behaviors

→ **Lead to treatment for neglectful and abusive parents**

Massimo Reali

Using Drug Delivery Systems for Colon Cancer to Evaluate the Effectiveness of PLGA Based Nanoparticles Loaded with Folic Acid, Chitosan and Oxaliplatin on the Cytotoxicity of HCT116 and HT29 Cell Lines



Location of Research:
HHS, Stony Brook University

Mentor:
Dr. Justin Fang, Dr. Jennie Williams, Dr. Georgios Matthaiolampakis

Will be Attending:
Duke University

Intended Major:
Biomedical Engineering (Pre-Med)

Fairs & Awards:
NYSSEF 2025 - Honorable Mention Biomedical & Health Sciences
WESEF 2025 - 2nd Place Medicine & Health
Regeneron STS -Applicant
WESEF 2024 - 1st Place Medicine & Health, Future of Medicine Award
Somers 2023 - 2nd Place Medicine & Health
HHS Symposium - 2023, 2024, 2025

Colon cancer begins as the rapid growth of cells in the intestinal tract that metastasizes to lymphatic systems and key organs. Oxaliplatin is a platinum-based chemotherapy drug that is highly cytotoxic and effective, but it is not targeted, causing side-effects. Nanoparticles are a type of drug delivery system that encase chemotherapeutic drugs to facilitate passive targeting to cancer cells. Passive targeting can be induced by coating the particles with folic acid and chitosan to allow nanoparticles to latch onto receptors on the surface of cancer cells. This study explored an alternative drug delivery system to deliver oxaliplatin (OXA), folic acid (FA) and chitosan (CS) nanoparticles to targeted human colon cancer cell lines. Poly-lactide-co-glycolide (PLGA) nanoparticles were created and loaded with oxaliplatin, decorated with folic acid and chitosan, and tested using TGA and UV/Visible Spectroscopy to determine the amount of OXA, FA and CS in the nanoparticles. TGA showed that 5-6% of the mass of the nanoparticles was oxaliplatin. UV/Vis revealed that FA and CS absorb at overlapping wavelengths, so further testing is needed to differentiate their concentrations. However, SEM results depicted a significant difference between the size of experimental nanoparticles loaded with OXA, FA, CS and the control PLGA ($p<0.0001$). Cell viability was tested through an MTT Colorimetric Assay for 48 and 72 hours for four groups: PLGA, PLGA-OXA, PLGA-FA-CS, PLGA-OXA-FA-CS. Results showed that cells proliferate to 13% in PLGA-OXA-FA-CS compared to 99.6% in free-OXA. This illustrates that PLGA nanoparticles were not as effective as free-oxaliplatin in reducing proliferation. Implications include that there was OXA, CS and FA decorated onto the colon cancer cell lines from PLGA nanoparticles since the nanoparticles decreased in size when compared to the control and could potentially be administered in vivo, once appropriate concentrations can be determined.

Using Drug Delivery Systems for Colon Cancer to Evaluate the Effectiveness of PLGA Based Nanoparticles Loaded with Folic Acid, Chitosan and Oxaliplatin on the Cytotoxicity of HCT116 and HT29 Cell Lines

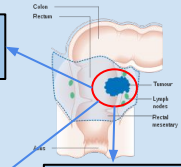
Introduction

Colon Cancer: Rapid division of cells around the colon

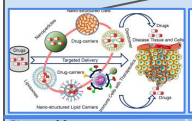
Internal Bleeding

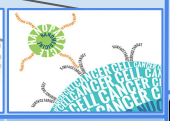
Irregular Bowel Movements

Prolonged Discomfort



Drug Delivery Systems & Nanoparticles

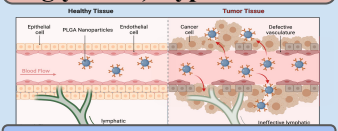




Small agents; encase drugs w/ antitumor ligands

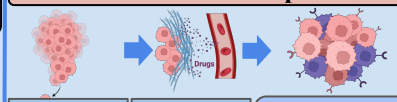
Ligands: bind to surface of cancer cells

PLGA (poly-lactide-co-glycolide): type of NP



Controlled Release Property

Current Chemotherapeutics



Metastasis | Apoptosis

Limit: Tumor Heterogeneity

Platinum Based Chemotherapeutics

Oxaliplatin: high pharmacokinetic & pharmacological properties



Alkylating Agents → DNA Cross Link → No Cell Growth

Folic Acid & Chitosan Decoration

(FA): latches onto folate receptors on cancer cells

(CS): positively charged ligand that balances (-) charged PLGA

Purpose, Gap & Hypothesis

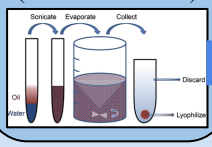
Current drug delivery systems remain ineffective because they are unable to encapsulate a high concentration of drug and directly target tumor cells.

Methodology

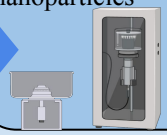
Part 1: Constructing Nanoparticles

Nanoemulsion Methods

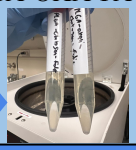
Single Emulsion Methods (w/o):
Oil: dissolved PLGA
Water: OXA & emulsifying agent (Vitamin E-TPGS)



Centrifugation: purifies nanoparticle solutions → only **binded contents**
Sonification: lowers surface tension of nanoparticles



Encapsulation & Decoration:
-PLGA, PLGA-OXA
PLGA-FA-CS,
PLGA-OXA-FA-CS

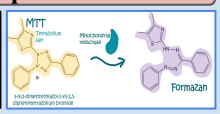


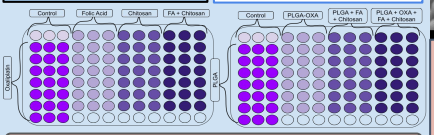
Precipitate

Part 2: Cell Viability Assays

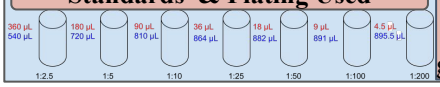
MTT Preparation

MTT: Measures Cell Viability with a color change

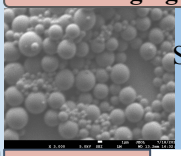




Standards & Plating Used

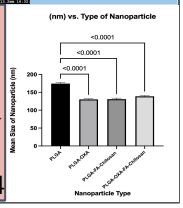


SEM Imaging & ANOVA



SEM: Smaller sizing → easier targeting

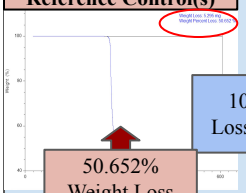
ANOVA: ($p<0.001$) PLGA → **significantly larger** than groups 2, 3, 4



Results & Analysis

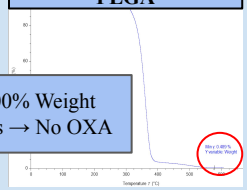
TGA ANALYSIS RESULTS

Reference Control(s)



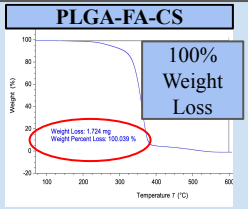
50.652% Weight Loss (Free-OXA)

PLGA



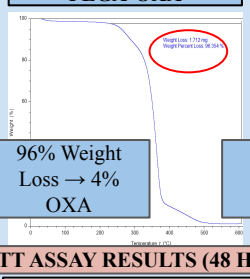
100% Weight Loss → No OXA

PLGA-FA-CS



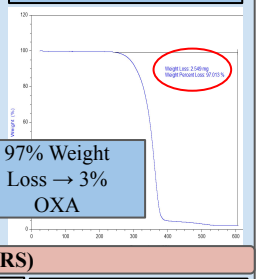
100% Weight Loss

PLGA-OXA



96% Weight Loss → 4% OXA

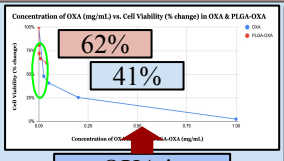
PLGA-OXA-FA-CS



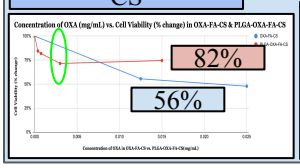
97% Weight Loss → 3% OXA

MTT ASSAY RESULTS (48 HRS)

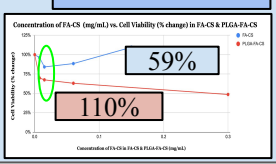
OXA-FA-CS is **26% more effective** than PLGA-OXA-FA-CS



FA-CS is **51% less effective** than PLGA-FA-CS



OXA is **21% more effective** than PLGA-OXA



Discussion

Hypothesis: **PARTIALLY SUPPORTED**

- ✓ **OXA quantified through TGA Analysis** → higher encapsulation rate than other studies
- ✓ **Significant Difference** between nanoparticle sizing
- ✓ **MTT Assay** = successfully calculated cytotoxicity
- ✗ Faulty estimations of Uv/Vis spectroscopy

Future Research, Conclusion & Applications

Finding a common solvent btw FA & CS	Reformulate nanoparticles at smaller size **(PLGA-PEG)**	Analyze cell lines of non-caucasian descent

Conduct a Western Blot / Flow Cytometry on FA → determine if there are different folate receptors

Nanoparticles: lower risk of spreading toxins/side effects

Treatment can be used at ↑ amounts and can be personalized (using FA & CS ligands)

Treat patients in **HIGHER STAGES** where colon cancer metastasizes quickly.

Teddie Stevens

Identifying the Most Productive Wetland Species in a Constructed Floating Wetland



Location of Research:
Teatown Environmental Science Academy

Mentor:
Ms. Eva Giorgi

Will be Attending:
Tufts University

Intended Major:
Environmental Science

Fairs & Awards:
WESEF 2025 - 2nd Place Environmental Science
WESEF 2024 - Teatown Young Environmentalist Award
Regeneron STS 2025 - Applicant
Somers 2023 - Participant
HHS Symposium - 2023, 2024, 2025

Constructed Floating Wetlands (CFWs) are artificial platforms that support aquatic emergent plants on a buoyant structure. Emergent refers to plants where the stems and leaves reside above the water surface, and extensive root systems develop below the wetland mat. CFWs are designed to absorb the nutrients associated with eutrophication and filter suspended particles, such as algae, improving the quality of water and ultimately the health of the ecosystem. The purpose of this study was twofold: 1. A pilot study to investigate the effectiveness of CFWs by analyzing nutrient uptake and changes in chlorophyll-a concentrations. 2. An experimental study to determine differences in effectiveness of 2 grasses: *Carex vulpinoidea*, *Juncus effusus* and 2 forbs: *Lobelia siphilitica*, *Hibiscus moscheutos* in promoting nutrient uptake and changes in chlorophyll-a concentrations. The pilot study entailed building 9 biodiverse CFW mats using Poly-Flo Biological Filter Media and placing them in 9 kiddie pools filled with local lake water; nitrate, phosphate, dissolved oxygen and chlorophyll-a concentrations were measured over a 14 day period. In the experimental study, individual plants planted on separate mats were placed in each of the 12 plastic water jugs containing local lake water; and the same measurements were taken. The pilot study results showed that there was a significant decrease in chlorophyll-a concentrations and nitrate levels between wetland mats and control groups ($p < 0.05$). The experimental study revealed that through a spectrophotometer at wavelength 665 nm *Hibiscus moscheutos* was the best mitigator for decreasing chlorophyll-a content. Testing for nutrients revealed that *Lobelia siphilitica* was the most effective at absorbing phosphate. Both *Hibiscus moscheutos* and *Lobelia siphilitica* are forbs, which have root systems that grow deeper in contrast to grasses, which may be important for mitigating nutrient overload in fresh water systems. Implications include that CFWs may be a sustainable and non-invasive system to decrease eutrophic water conditions.

Identifying the Most Productive Wetland Species for Use in a Constructed Floating Wetland

Introduction

Environmental Impacts of Algal Blooms

- Eutrophication is characterized by an abundance of nutrients accumulate in a water body (Schindler, 2006)

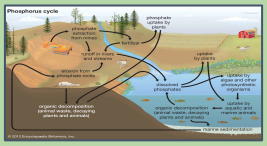


Figure 1. Schematic Diagram of Eutrophication Process (Britannica, 2025)

Constructed Floating Wetland

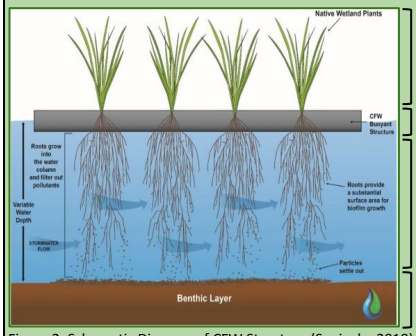


Figure 2. Schematic Diagram of CFW Structure (Sanicola, 2019)

- Plant Layer
- Biological Filter Material
- Layer of Roots
- Sediment Surface

Forbs



Figure 6. Forbs in the state of Utah (DWR, 2021)

Grasses



Figure 7. Switchgrass (Green Star Wetland Plant Farm, n.d.)

Purpose

To investigate the effectiveness of Constructed Floating Wetlands by analyzing nutrient uptake and changes in chlorophyll-a concentrations, and determine the role of forbs and grasses within the system.

Methodology

Pilot Study



Pilot study: Constructed Floating Wetland (Stevens, 2024)

Experimental Study



Experimental Study: Lobelia siphilitica and Juncus effusus (Stevens, 2024)

Poly-flo Biological Filter Media

Large Mat: 9 plants
Small Mat: 4 plants

Small Mats - holding one plant

Independent Variable: Number of wetland plants on a mat

Independent Variable: Wetland species being studied

Handheld Fluorometer



Nutrient Testing



Dissolved Oxygen



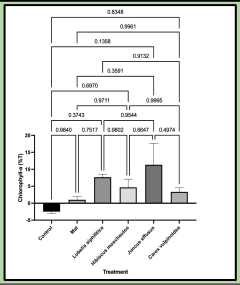
Results & Analysis

Pilot Study

Nitrate levels significantly decreased in Constructed Floating Wetland pools ($p < 0.05$); phosphate levels decreased although not significantly ($p > 0.05$)

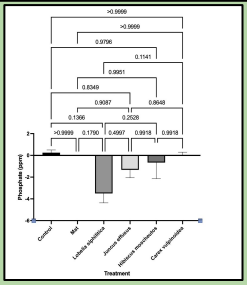
Experimental Study

Change in Chlorophyll (%T)



→ *Juncus effusus* most effective wetland species in filtering chlorophyll content compared to other wetland plants.

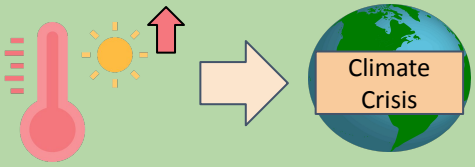
Change in Phosphate Levels (ppm)



→ *Lobelia siphilitica* most effective wetland species at absorbing phosphate compared to other wetland plants.

Conclusion & Future Research

- The application of CFWs can provide a solution to eutrophic water conditions that would not induce ecological harm with the inclusion of native species



Future Research

- Potentially use slow release fertilizers
- Conduct a similar study under grow lights in an enclosed area
- Confirm results by testing in natural conditions
- Plant tissue analysis to measure concentration of specific nutrients within the tissue
- Create an app/model to predict which plants would be most effective in mitigating specific nutrients given a certain size lake in a particular location

Jordyn Summer

How an Overload of Visual Stimuli Contributes to Anxious Behaviors



Location of Research:
Harrison HIgh School

Mentor:
Dr. Christopher Tyler

Will be Attending:
University of Georgia

Intended Major:
Biology

Fairs & Awards:
WESEF 2025-Medicine and Health
HHS Symposium - 2023, 2024, 2025

Social anxiety disorder (SAD) is a mental health condition where social interactions cause irrational anxiety. Phenomena associated with SAD, such as developing a fear of being watched and avoiding eye contact with others, suggests that SAD could stem from an overload of visual stimuli. The study aimed to determine whether vision served as a mechanism for inducing anxious-like behaviors in *Drosophila melanogaster*. Recently, *Drosophila melanogaster* has been used as a model organism to investigate anxiety. The present study aimed to determine whether blind mutant *norpA Drosophila* would demonstrate fewer anxious behaviors than sighted ones. The Wall-Following Assay was used to assess whether overcrowding, known to produce a stress response in flies, induced anxious-like wall following behaviors in an enclosed chamber. Results demonstrated that as overcrowding increased, a significant percentage of the mutant *norpA* exhibited less anxious behavior and traveled away from the walls of the petri dishes compared to the other stocks —Wild type, GAL4, and the stock containing the 5-HT2A gene which targets serotonin receptors and serves as a validated model for anxiety ($p<.001$). These findings can contribute to a broader understanding of the relationship between an overload of visual stimuli and anxious-like behaviors, and highlight the potential of using fruit flies to explore the underlying mechanisms contributing to social anxiety. Given the debilitating nature of social anxiety, identifying its triggering mechanisms could result in more specific and effective treatments.

How an Overload of Visual Stimuli Contributes to Anxious Behaviors

Jordyn Summer

Introduction

SAD

- **Social anxiety** (SAD): Mental health condition where social interactions cause irrational anxiety
- Those with social anxiety tend to feel disowned, have an increased risk for depression, substance abuse, and are suicidal

Sight as a Mechanism for SAD

- Sensory overload of vision is a symptom of SAD
- Happens when there's too much to see at once
- Can make it hard to focus, think clearly, or stay calm

Overcrowding as a Stressor

- Crowded environments can increase stress and anxiety→triggering SAD-like behaviors

Drosophila melanogaster as a Model for SAD

- Anxious behaviors have been studied in fruit flies to understand mechanisms of stress and social anxiety

Purpose

- Determine whether vision is a mechanism for producing anxious behaviors in Drosophila melanogaster

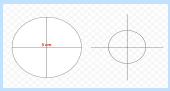
Methodology

Fly Stocks

- Blind stock: (stock 3631)
- Wild type (stock 3605)
- 5-HT2A (stock 33418): Targets serotonin receptors
- Stock 68222: Drives the expression of the 5-HT2A gene

Preparing Fly Stocks & Overcrowding Conditions

- Stocks were placed in empty plastic vials
- Flies were placed in increasingly crowded conditions (6, 12, 25, 50, 100, 200 flies per petri dish)



Creating Measurement Circles

- Outer circle: 5 cm diameter
- Inner circle: 3 cm from the center of the larger circle

Experimental Setup

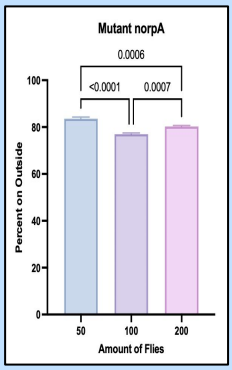
- Petri dishes with 5 cm diameters were used
- Flies placed in a freezer (-20°C) before testing

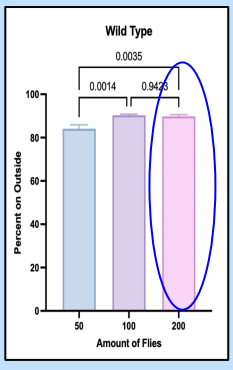
Recording Fly Behavior

- Video paused at 0, 30, 60, 90, 120, 150, and 180 seconds for analysis

Results & Analysis

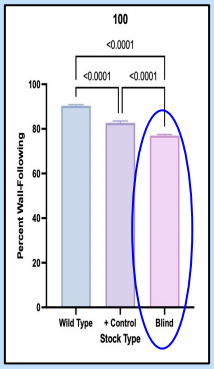
Percent Wall-Following by Stock

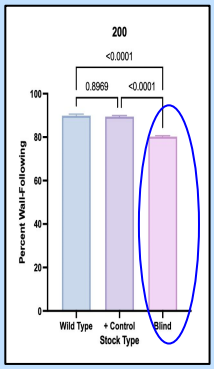




- Mutant *norpA* exhibit decreased anxious-like behavior in percent
- Wild type show increased anxious-like behavior under the same conditions

Percent Wall-Following as Stocks got Overcrowded

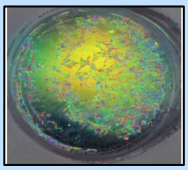




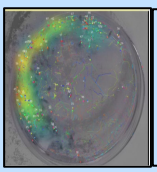
- Blind flies consistently exhibit reduced wall-following behavior
- This suggests decreased anxious-like behavior

Conclusion & Future Research

- Hypothesis was overall supported→Mutant norpA flies did not exhibit anxious behaviors and did not follow the wall wild the wild type stock did



Heat map: Mutant norpA flies with 100 flies



Heat map: Wild Type stock with 100 flies

Future Research

- Test other senses including hearing, taste and smell
- Identifying social anxiety triggers can help develop targeted desensitization treatments
- Vision may trigger anxiety, while blindness prevents it by blocking visual cues that induce anxious behaviors
- Creating glasses and therapies that reduce visual stimuli can improve daily comfort for those with visual overload



Block Blue Light, n/dz



AssistData, n/d

Ohtaro Tanaka

The Effect of Ets96B on Feeding Behavior in Socially Isolated Models of *Drosophila melanogaster*



Location of Research:
Harrison High School

Mentor:
Ms. Allison Blunt

Will be Attending:
Case Western University

Intended Major:
Biology

Fairs & Awards:
WESEF 2025 - 1st Place Animal Science
JSHS 2025 - NYS Upstate Speaker Finalist
Regeneron STS -Applicant
HHS Symposium - 2025

Loneliness and social isolation may be linked to obesity. Quaresma et al. (2021) and Cortes-Garcia et al. (2022) found that increased eating behaviors are a general response in individuals in stressful environments. This behavior is likely related to dopamine, a neurotransmitter associated with feelings of pleasure, reward, and motivation. As eating is a method to experience the rush of pleasure caused by the release of dopamine, individuals with lowered dopamine in stressful environments may have increased overconsumption of food to compensate for the low dopamine levels. Therefore, when an organism is socially isolated, it may be prone to overeat. The study aimed to determine whether the dopamine receptor signaling pathway plays a role in connecting feeding behavior and social isolation. It may play a key role in neuronal processes, including motivation for rewards. The hypothesis was that the knockdown of the gene would result in a decrease in feeding in both the social and isolated environments. Mutant Drosophila melanogaster for the Ets96B gene was used as the model for this study because it is a homolog of the human gene ETV5, a human gene associated with the regulation of the dopamine receptor signaling pathway. Methods involved conducting a modified CAFE (Capillary Feeding) assay where the feeding behaviors of male and female isolated and social flies with the expressed mutated Ets96B gene were compared to wild-type controls. Flies were placed in vials with caps, where 0.1M blue sucrose solution through micro-tips was inserted. Flies endured a 24-hour starvation period before engaging in the 24-hour feeding period. Results showed that the isolated flies ate significantly more than the social flies ($p<0.05$), while the food consumption in isolated flies from both Ets96B and their Wild-type counterpart had no significant difference ($p>0.05$). In addition, the female social Ets96B group ate significantly less than the Wild-type social group ($p<0.05$); the male social groups had the same trend but the results were insignificant. Implications are that, Ets96B has a link to feeding behavior in different socialization, as it inhibits the receptor activity of dopamine.

The Effect of Ets96B on Feeding Behavior in Socially Isolated Models of Drosophila melanogaster

Ohtaro Tanaka

Introduction

Obesity = Major Health Problem



Obesity = BMI > 30 kg/m^2

Chronic Diseases = **Increased**

Social Isolation is Linked to Obesity

Isolation → Low Dopamine → Overeating

Dopamine Receptor Signaling Pathway (DRSP) = related to Eating and Isolation

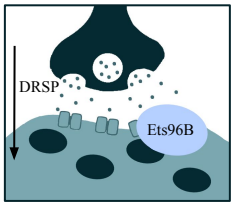
= ⬆ DRSP

= ⬇ DRSP

Drosophila melanogaster as a Model Organism



Ets96B is Related to DRSP in *Drosophila*; Williams *et al* found that Ets96B negatively influences DRSP



Ets96B "blocks" DRSP → Disable Ets96B → Increase DRSP activity??

Disabled Ets96B through the Gal4-UAS system

Gap in Knowledge: Is feeding/isolation affected through DRSP?

Purpose: Determining if DRSP mediates feeding/isolation

Methodology

Hypothesis	**Isolated**	**Social**
+ **Wild Type** (Block DRSP)	**Most** feeding	**Less** feeding
Cross (Doesn't block DRSP)	**More** feeding	**Least** feeding

Fly Strains → Control/Experimental Groups

Strain 1: Gal4 → **Cross**

Strain 2: UAS → **Cross**

Strain 3: Wild → **Control**

Sample Population per Group

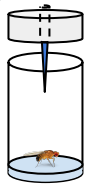
Male/Female

1 Isolated

10 Social

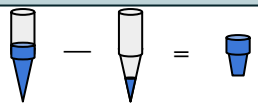
Controls





Independent	**Dependent**
Social state & Genotype	Feeding

Method 1: Volume Difference



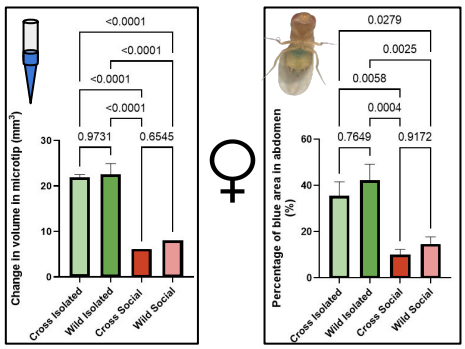
Method 2: Ratio of Areas



$$\frac{\text{Blue area}}{\text{Abdomen Area}} = \textbf{Ratio}$$

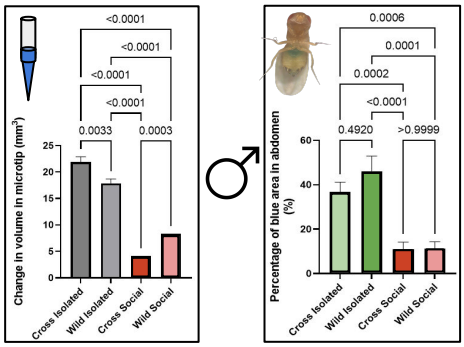
Results & Analysis

Feeding in Female Flies



Female Flies
-Isolated Flies ate significantly more than Social Flies
-Crossed Flies ate less than Wild Type Flies
-Both Methods Followed Hypothesis

Feeding in Male Flies



Male Flies
-Isolated Flies ate significantly more than Social Flies
-Most Crossed Flies ate less than Wild Type Flies
-Not both Methods Followed Hypothesis

Conclusion & Future Research

Hypothesis = Somewhat Supported

1. Isolated will eat **more** than social → **Isolated > social** significantly ($p<0.05$)

2. Cross will eat **less** than WT → **Cross < WT** as a trend ($p>0.05$)

Limitation

There are probably **more genes** that are responsible for DRSP

Solution

Further analysis into other genes

Immunohistochemical study on brains

Conclusion

- ⋆ **Aim:** Investigate whether if overeating is associated with social isolation based on the mechanism of DRSP
- ⋆ **Findings:** Isolated>social, Cross<Wild
- ⋆ **Importance:** Higher dopamine = less feeding

Applications

Deactivation of Ets96B results in limited feeding → **Medication** that deactivates Ets96B

Valeria Torres

Constructing a Multiple Linear Regression Model to Predict Family Engagement in an Economically Diverse Suburban High School



Location of Research:
Harrison High School

Mentor:
Ms. Allison Blunt

Will be Attending:
Barnard College

Intended Major:
Neuroscience

Fairs & Awards:
WESEF 2025 - Participant
JSHS 2025 - NY Upstate Speaker Finalist
Regeneron STS -Applicant
WESEF 2024 - Honorable Mention Award
Somers 2022 - Participant
HHS Symposium - 2023, 2024, 2025

Family engagement refers to the process of families and educators working together to improve the students' well-being, development, and education. Family engagement results in the formation of reciprocal partnerships built on trust and respect. Students whose families are engaged in school demonstrate improved social skills, attendance, behavior, grades, and adaptation to the school environment. If family engagement can be predicted, it is possible for schools to create targeted programs to encourage families that will promote student learning. This is particularly important in an income and ethnically diverse school district whose mission statement includes building equity and opportunity for all students. Therefore, the purpose of this study was to use a multiple linear regression model to determine which demographic factors predict family engagement in an economically and ethnically diverse high school. 76 parents responded to a survey constructed and translated into English, Spanish, and Japanese; parents rated the questions on the survey using a 7-point Likert scale. A forward selection approach was conducted using the p-value in R Studio version 4.4.1 until a parsimonious model was achieved. Family affluence ($p < .01$), defined as a measure of family wealth, and the level of education achieved by the parent ($p < .05$) were significant drivers of family engagement scores, and the predicted equation: 196.685 - 23.170 (less than college education) + 3.119 (family affluence) was generated. A regression of the predicted scores generated using the equation versus the actual scores for family engagement for a second cohort of 49 participants revealed a slope that was significantly non-zero (R^2=.09, p=.04). The implications of the model include that school administration, guidance counselors, and educators can potentially use this model to identify families that are not engaged, improving learning for at-risk students.

Constructing a Multiple Linear Regression Model to Predict Family Engagement in an Economically Diverse High School

Introduction

Family Engagement

(U.S. Department of Health and Services, 2012)

Reciprocal Partnerships

Partnerships = Tied to Student Success (Mapp 2020)

Economically Diverse & Large Suburban High School in NY

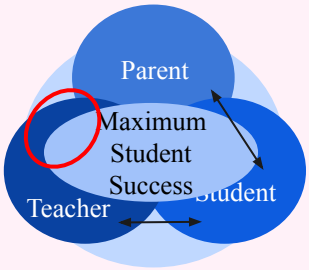
Core Values

Equity + Access

School administrators → identify families that are not engaged

Create programs to target families + improve student outcomes

Figure 1. Parent, Teacher, & Student Connection



(Heyen, 2024)

Parent-Teacher Relationship Less Well Defined

Interviews of economically disadvantaged A.A. parents + **regression analyses** (Overstreet et al, 2015)

Predictors

- Community Involvement
- Educational Aspirations for C & S
- School Receptivity
- Employment Level

Purpose of the study: Determine the extent to which a multiple linear regression model can be used to predict family engagement.

Methodology

Role in the Study: Independently constructed the model under the supervision of my science research teacher after obtaining **IRB approval**

Independent Variable	Dependent Variable	Controlled Variables
- Family Affluence - Language Spoken - Education Level - Work Status - Relation to Student - Ethnicity	Family Engagement	- 7-Point Likert Scale - Survey Administered via Google Form - Suburban High School in NY

Steps Taken to Construct Multiple Linear Regression Model

5 Mathematical Assumptions for Creating Linear Regression Met → Variables Coded + Collapsed into Two Categories → Forward Selection Approach Using P-Value → Tested for Interactions Between the Variables → Parsimonious Model Created → Survey Re-Distributed to Examine Model's Predictive Power

Results & Analysis

Table 1

Demographic Information for First Cohort (N=76)

	Frequency (N = 76)	Percent
Marital Status		
Married	63	82.9
Not Married	13	17.1
Employment Status		
Full Time	43	56.6
Not Full Time	33	43.4
Relation to Student		
Mother	19	75
Father	57	25
Language Spoken		
English	49	64.5
Not English	27	35.5
Parental Education Level		
College	64	84.2
Less than College	12	15.8
Ethnicity		
White	50	65.8
Not White	26	34.2

(Torres, 2025)

Most Participants were College Educated, English-Speaking Full-Time Workers, White, Mothers, and Married

Table 2

Multiple Linear Regression Analysis

Multiple Linear Regression Model	
Independent Variable	Dependent Variable: Family Engagement
Constant	196.685*** (10.568)
Less than College Education	−23.170*** (7.215)
Family Affluence	3.119** (1.391)
Observations	76
R^2	.249
Adjusted R^2	.228
Residual Std. Error	21.951 (df=73)
F Statistics	12.079*** (df = 2; 73)

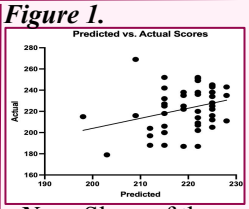
Note. *p<.1; **p<.05; ***p<.01

(Torres, 2025)

Family Affluence + Parental Education Level = significant predictors (p<.05)

25 % of variability explained

Figure 1.



Note. Slope of the line significantly non-zero (p=.04, R^2=.09) (Torres, 2025)

Regression Equation Generated:

$\hat{y}$= 196.685 - 23.170 × Less than College + 3.119 × Family Affluence

Conclusion & Future Research

Hypothesis was mostly supported

Significant correlation between predicted and actual family engagement scores, BUT low R^2 value

✓ Family affluence + parental education level were significant predictors of F.E. → aligns with prior research (Applyrs, 2018; Kaplan and Liu, 2000)

Limitations

- Convenience sampling at back-to-school night
- Observational study = correlations between variables

Future Research

- Recruit at other locations to reach low-income families
- Examine other variables outside of demographics

Implications

Tool could potentially be used to identify underserved populations

Create programs to target families to increase equity & improve student learning outcomes

Parker Yates

Ambivalent Sexism, Racial Resentment and Voter Intention in the 2024 U.S. Presidential Election



Location of Research:
Harrison High School

Mentor:
Dr. Christopher Stout, UC San Diego
Dr. Julie Nguyen

Will be Attending:
Massachusetts Institute of Technology

Intended Major:
Brain and Cognitive Sciences

Fairs & Awards:
WESEF 2025 - U.S. Air Force Award
Regeneron STS 2025 - Applicant
WESEF 2024 - U.S. AID Science Champion Award
Somers 2023 - 1st Place in Behavioral Sciences
HHS Symposium - 2023, 2024, 2025

In the 2024 Presidential election, Kamala Harris's biracial identity as a Black and South Asian woman uniquely situated her as someone whom voters might stereotype. This study examined the extent to which sexist and racist attitudes influenced voter intention during the 2024 Presidential election cycle and whether this varied between men and women. Employing the ambivalent sexism theory, both hostile sexism, outright negative attitudes toward women, and benevolent sexism, subjectively positive attitudes toward women that reinforce gender inequity, were measured. Anti-Black prejudice was tested through measuring racial resentment. It was hypothesized that greater endorsement of hostile sexism, benevolent sexism, and racial resentment would be significant predictors of intention to vote for Donald Trump. A nationally representative sample of participants completed an online questionnaire about 6 weeks prior to the 2024 Presidential election ($n = 246$). The results indicated that racial resentment ($p < 0.01$) and benevolent sexism ($p < 0.05$) were powerful influences on intention to vote for Trump, and hostile sexism was marginally significant ($p < 0.1$) when controlling for other factors. However, once an intersectional approach was taken, men's political behavior varied from women's. Among men, hostile sexism was a positive significant predictor of voting for Trump ($p < 0.05$) when controlling for all other factors. Conversely, for women, this relationship was negative and posed no significant relationship to voting intention for Trump. This study reveals that Harris faced barriers to winning support due to sexist and racist beliefs, and when broken down between men and women voters, men with greater sexism were more likely to resist voting for Harris than women.

Ambivalent Sexism, Racial Resentment and Voter Intention in the 2024 U.S. Presidential Election

Introduction

2024 U.S. Presidential Election

Visible example of potential role of biases in elections

Candidates
Democrat: Kamala Harris
Republican: Donald Trump

Biracial South Asian and Black woman

Both gendered and racial prejudice may have been at play

Ambivalent Sexism Theory

Hostile Sexism (HS)
- Outright sexism that more people recognize
- Negative perceptions of women

Benevolent Sexism (BS)
- Subjectively positive attitudes towards women
- Underlying layer of dominance (Glick and Fiske, 1996)

Racial Resentment

- The belief that racial prejudice is no longer a barrier to the economic advancement of minority groups (Kinder & Sears, 1981)

Hypothesis

Greater endorsement of ambivalent sexism and racial resentment will be predictive of the intention to vote for Donald Trump.

Methodology

My Role in Study: Study conducted independently
Mentor consulted for inclusion of constants in survey and model selection

- Survey constructed on Qualtrics
- 246 participants recruited through Prolific (nationally representative sample)
- Survey distributed about 6 weeks prior to the 2024 U.S. Presidential election

Survey Construction

Key Variables → **Hostile and Benevolent Sexism** 8-item scale (Winter, 2023); **Racial Resentment** 4-item scale (Tesler and Sears, 2010)

Constants in Statistical Model → Sociodemographics; Economic anxiety; Party affiliation; Conservative ideology

Dependent Variable → **Candidate Evaluations** Who they intended to vote for

Results & Analysis

Logistic Regression Model

Table 2. Predictors of GOP Vote Intention in 2024 U.S. Presidential Election

Variables	Logistic Regression Model		
	Estimate	SE	Marginal Effects
Constant	-9.37***	1.81	
Party Affiliation	5.47***	1.18	0.37
Benevolent Sexism	3.23*	1.47	0.22
Hostile Sexism	2.53	1.35	0.17
Racial Resentment	3.34**	1.26	0.22
Conservative Ideology	3.95**	1.33	0.26
Economic Condition (worse)	1.05*	0.53	0.07
Age	0.003	0.02	
Gender	0.98	0.57	
White	-1.02	0.58	
Education	0.30	0.82	
Rurality	-0.90	0.80	
Marital Status	-0.69	0.58	
Evangelical	-0.73	0.60	
Observations	246		

Note. Dependent variable: intention to vote for Donald Trump = 1 / otherwise = 0
* p < 0.05; ** p < 0.01; *** p < 0.001

Significant predictors:
- Party affiliation
- Benevolent sexism
- Racial resentment
- Conservative ideology
- Economic anxiety

BS = significant positive predictor ($p < 0.05$)
- ↑ probability of intention to vote for Trump by 22 percentage points

RR = significant positive predictor ($p < 0.01$)
- ↑ probability of intention to vote for Trump by 22 percentage points

HS = marginally significant positive predictor ($p = 0.06$)

Conclusion & Future Research

Aim: to evaluate whether HS, BS and RR predicted voting intentions in the 2024 U.S. presidential election

Results: BS and RR were significant predictors of intention to vote for Trump, HS was a marginally significant predictor

Hypothesis: Mostly Supported

Importance: BS, a more subtle form of sexism, was a more powerful influence on voting intentions than HS
- Highlights challenges faced by marginalized candidates

Future Research

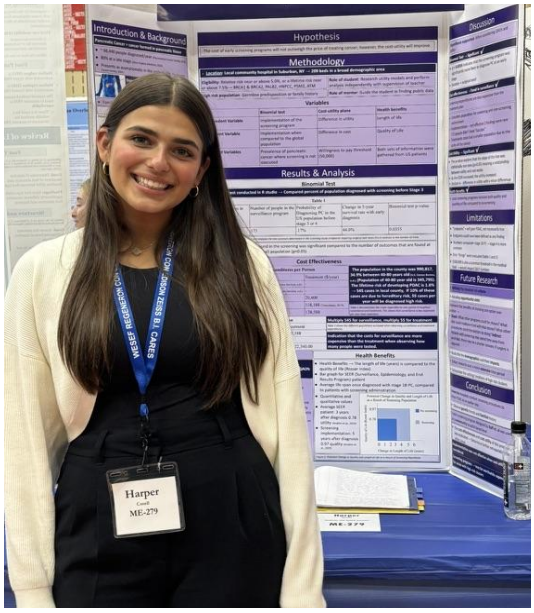
- Examine actual vote choice
- Explore role of sexism and racial resentment across different racial and ethnic groups
- Apply similar methodology to assess bias in future elections with marginalized candidates from both parties

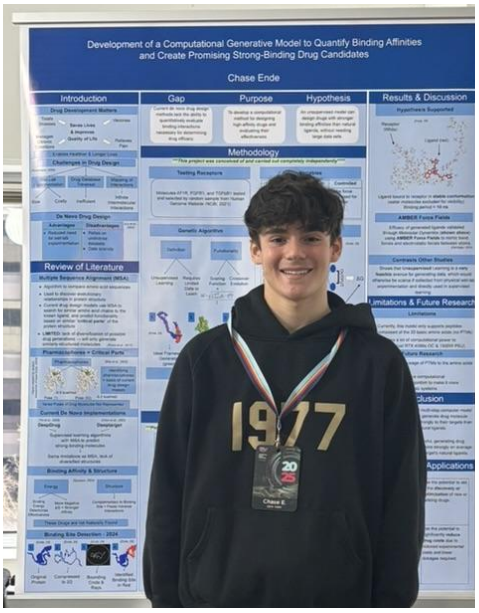
Implications for both politicians and voters

- Campaign strategy and voter targeting
- Raising voter awareness of bias
- Bias prevention and media literacy

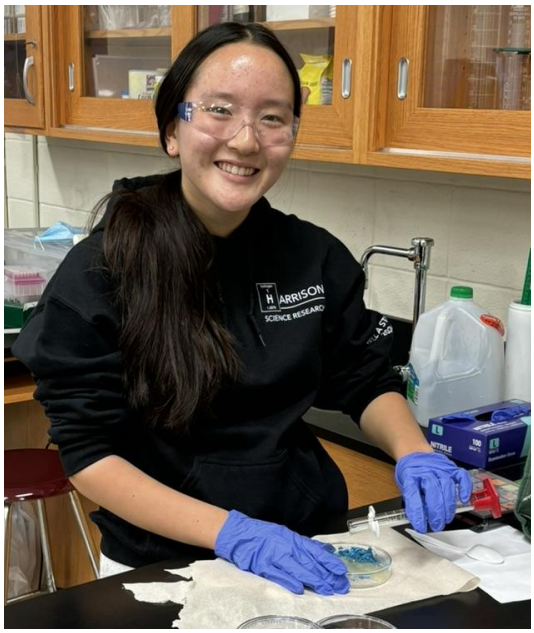
Science Research Juniors





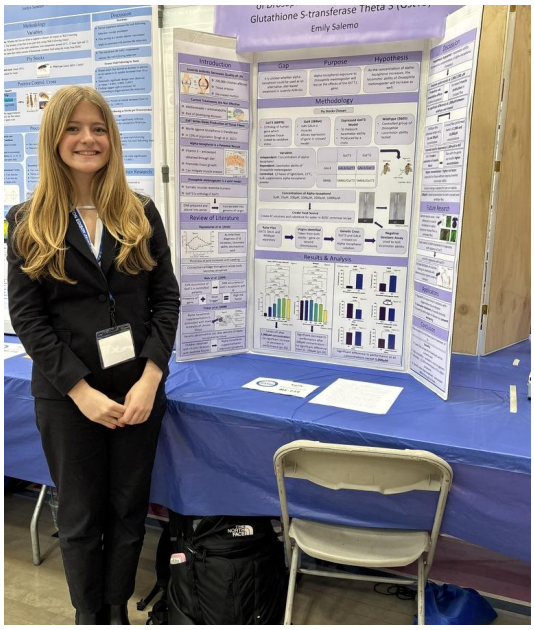














Liam Azar

The Impacts of Noise on Quantum Computing Hardware and Solutions to Problems



Mentor:
Danny Qenani
Yale University

Quantum computers are uniquely manufactured to use a combination of quantum mechanics and information theory to explore complex situations in physics and simulate complicated systems such as predicting the weather and stock market. Quantum computers use the principles of superposition and entanglement to carry out large computations exponentially faster than classical computers. Quantum processors need to be heavily isolated to remain in their quantum state as a result of the system being prone to decohering, or breaking down. However, the quantum computers must provide us with precise control over their processors to perform operations, measurements, and initialization techniques. These requirements can lead to different arbitrary interferences, called noise, which can lead the qubits to decohere from its quantum state and derive incorrect answers. Mitigating noise while maintaining a high number of qubits is the most sought after goal in quantum computing. Therefore, this study aims to determine how much noise hinders the accuracy of computational outputs, how noise is affected when more processing power is being utilized, and how noise is affected when more information is being computed; these are tested by comparing the results of solving the particle in a box problem when using a noiseless quantum simulator to actual quantum hardware, a different number of qubits, and different sized matrices. They were estimated using the quantum phase estimation algorithm, which estimates a unique value, called an eigenvalue, “hidden” within square matrices. The Bhattacharyya Distance method was used to compare the bar graphs of results, which models the overlap of these graphs to represent similarity. It was found that noise in general led to a somewhat large change in results, the increasing of matrix sizes led to a very minor change in results, and changing the amount of precision qubits led to a major change in results.

Jack Badner

The Effect of Mental Toughness on Athletes’ Fear of Returning to Their Sport Post-Injury



Approximately 2 million injuries occur each year amongst high school athletes in the United States who participate in competitive sports. Injuries have been known to negatively impact mental health and often affect an athlete’s willingness to return to their sport. Mental toughness is a personality trait that measures an individual’s ability to maintain focus during times of adversity. By teaching young athletes how to improve their mental toughness, it may build resilience and make it easier to return to their sport following an injury. The purpose of this study is to determine how an athlete’s mental toughness affects their fear of returning to their sport after an injury. The hypothesis is that the greater mental toughness attributed to an individual, the lower fear levels that will arise when returning to play their sport post-injury. Additionally, the results will demonstrate whether different types of injuries correlate with levels of fear when athletes are returning back to their sport. The methodology will entail recruiting varsity athletes between the ages of 14 to 18 who have experienced an injury in their sport. Participants will be asked two sets of questions. The first set of questions will measure mental toughness, and the second set of questions will assess fear levels associated with returning to their sport post-injury. It is expected that athletes with greater levels of mental toughness will report lower fear levels when returning to their sport post-injury. Further research will examine the effect of personality characteristics, other than mental toughness, on athletes’ fear of returning to their sport post-injury.

Noelie Boquet Couderc

Determining the Extent that Radioprotection can be Enhanced through the Use of *Deinococcus radiodurans* MDP and *Tardigrada* Dsup Protein: Implications for Space Exploration



Mentor:
Rafael Colon
Mason Lab at Weill Cornell

Ionizing radiation is the number one risk to astronaut health beyond low Earth orbit. This type of radiation, consisting of subatomic particles, X-rays, and gamma rays, which can remove electrons from matter, causes serious DNA damage, leading to cancer and a multitude of injuries in the body. Manganese is a commonly used compound in radioprotection therapy and is found in the majority of radioresistant organisms. *Deinococcus radiodurans*, one of the most radioresistant microorganisms in the world, protects its repair proteins against radiation using MDP, manganese that naturally forms with peptides and phosphorus. The *Tardigrada*, an extremely radioresistant microorganism, is also used in radiation therapy for Dsup, their damage suppressor protein, which protects the tardigrade DNA during stress. However, Dsup protection remains partially obscure and has not been linked to manganese or MDP. Therefore, the purpose of this study will be to determine the extent to which radioresistance can be enhanced using both MDP and Dsup, and to learn more about Dsup functions. The methodology will involve a transient transfection where plasmids will be used to express MDP and Dsup in HEK293 cells, which will then be irradiated under increasing amounts of gamma Cs-137 radiation. Cell survivability will be measured and analyzed. Cells expressing both MDP and Dsup are expected to have an additive or enhanced radioprotection. Further research will explore the potential of MDP and Dsup for treatments against ionizing radiation for astronauts.

Harper Canell

Evaluating the Effects of a Local Community Hospital Approach to Pancreatic Cancer Screening in an Elevated Risk Population: A Cost-Effective and Cost-Utility Analysis



Mentor:
Dr. Joshua Raff
White Plains Hospital

Pancreatic adenocarcinoma or pancreatic cancer (PC) is a cancer that involves uncontrollable cell division around the pancreas. PC is extremely challenging to diagnose, as it presents as asymptomatic in the early stages. As a result, university hospitals have implemented screening programs to detect cancer at an earlier stage. These programs use Magnetic Resonance Imaging and Endoscopic Ultrasound in hopes of detecting the cancer before progression occurs, allowing for treatment to be more successful. There are many germline connections regarding pancreatic cancer, as genes associated with the disease are passed down, placing these people at elevated risk. As familial clusters of PC and deleterious germline mutations have been observed in communities that may not be near the university programs, there is an unmet need for screening programs at local community-based hospitals. Due to this, a local community-based hospital created a pilot screening program to screen elevated-risk populations for PC. The cost-effectiveness and cost-utility of this program were evaluated to determine if similar programs should be implemented in other communities. The methods involved using a binomial test to determine if the community-based hospital identified endpoints in the early stages more effectively than if there was no screening in the general population. Results showed that significantly more early-stage endpoints were identified in the surveillance program than in the general US population ($p<.05$). In addition, the program did not prove cost-effective as costs associated with PC were determined to be $11,463,753.40/year for surveillance compared to $7,622,340.00 /year for treating those diagnosed with PC. However, when utility is considered, screening yields a gain of 5 years with a 0.97 quality of life. This is greater than non-screening as it possesses 3 years gained with a 0.78 quality of life showing that screening expenditures may be beneficial. Implications include the fact that more research is necessary, but it may be possible that screening programs are a worthwhile investment for community-based hospitals in locations with clusters of individuals at high risk.

Matthew Carrea

Extracting and Repurposing Used Textile Dyes for Future Applications



Mentor:
Dr. Julian Silverman
FIT

“Fast Fashion” is a response to rapidly evolving fashion trends resulting in an impulsive disregard of textiles. Globally as of 2023, the Fast Fashion industry produces 1.92 billion tonnes of fabric each year. It is expected that waste will be doubled by 2030, leading to the crowding of non-biodegradable clothing in landfills, polluting the planet, and depleting habitats for animals. The purpose of this study is to tackle landfill accumulation by repurposing used and neglected textile articles that flood landfills, by performing extractive techniques, which will remove dyes from these textiles and will revive neglected dye resources to be used in future applications and products. All samples were tested on 5cm by 5cm 100% cotton samples. Results show that sodium hydrosulfite at 0.05 molar, was most effective in extracting dye as spectrophotometry data proves that its percent yield was closest to the standard curve of Royal Blue RIT dye and as other solutions used did not show any numerical or physical sign of pigment extraction in their fabric or dried samples. Industries may find dyes extracted from used textiles to be useful as they may serve as an alternative dye as opposed to manufacturing new ones, saving resources and bringing the volume of landfills down.

Angelina Costabile

Repurposing Everyday Materials to Produce Electricity



Globally in 2024, over 80% of all batteries used in electric vehicles (EVs) consisted of Lithium-Ion batteries (SRD, 2025). While Lithium-Ion batteries are rechargeable, they still have a limited shelf-life, meaning the demand for them is consistently rising. The extraction of Lithium and other fine minerals contained in Lithium-Ion batteries breaks many ethical and sustainability guidelines. Thus, scientists have been searching for alternative batteries that can hold the same if not better energy density of Lithium-Ion batteries as well as containing sustainable materials. The purpose of this study is to maximize energy generation from a Galvanic cell utilizing readily accessible and commonly available materials. The methodology will involve constructing a Galvanic cell in which graphite, aluminum, and salt water will be the main components of the cell; the anode, cathode, and liquid electrolyte respectively. Different molarities, electrode surface areas, and thicknesses will be manipulated to discover the combination in which the cell produces the most energy. A voltmeter will be used to measure the effectiveness of each configuration, providing insight into which conditions yield optimal performance. By exploring these variations, this research aims to contribute to the development of more environmentally friendly and cost-effective energy storage solutions. Future research may pave the way for the global expansion of fully sustainable battery technologies.

Chase Ende

A Novel Computational Generative Model that Identifies Ligands: A Potential Way to Reduce Cost & Time in Identifying Promising Drug Candidates



The process of discovering new drugs is intricate and costly. Current methods in *de novo* drug design do not provide quantitative binding information necessary for assessing the strength of the interaction between a newly created drug molecule and its biological target in the body. Therefore, it is pressing to create a novel computational drug design method that can provide accurate binding affinity data for evaluating the effectiveness of developed drugs. This study aimed to address the limitations of current *de novo* drug design methods, which lack the ability to quantitatively evaluate binding interactions necessary for determining drug efficacy. The hypothesis was that an unsupervised computational model for drug design, which has the advantage of not requiring a very large amount of data—a prerequisite often difficult to meet when observing interactions on the atomic level—can effectively generate drug molecules with stronger binding affinities to a target receptor than its natural ligands. Methods involved mapping out the cavities in a selected receptor molecule using a custom cavity detection program , building molecular frameworks within the cavity to collect information about binding poses and mechanisms, and finally, using a genetic algorithm—a type of unsupervised learning model architecture that uses agents and a crossover function to converge to an optimal solution—to find the best amino acid chain sequence to fold into a shape similar to the generated framework with the best binding affinity. Results showed that each computationally generated ligand had a greater affinity for its target receptor than its natural ligand, with the binding affinity values consistently surpassing the accepted value of the natural ligand's binding affinity. This novel, unsupervised computational drug design model demonstrates the potential to create drugs with stronger binding affinities to specific target receptors, which is indicative of enhanced drug efficacy. By not requiring large datasets and requiring significantly less wet lab work to identify suitable drug candidates, the model could reduce costs and enhance efficiency of early-stage drug development.

Juliana Greco

The Impact of Coaching Styles on Athlete Burnout and Dropout in High School Sports



Mentor
Luke Olssen
Liverpool John Moores University

Self-determination theory is a psychological theory that states people are more motivated and perform better when they are autonomous, supported, and part of groups. Athlete burnout is when an athlete gets stressed or overworked, feels drained mentally and physically and loses interest in their sport. Coaches use different styles or approaches to motivate their athletes. Autonomy supportive coaching is when the coaches give more freedom to the athletes to make decisions regarding training with the hope of motivating them. Alternatively, authoritarian coaching is strict and presses the athletes with an element of fear. Athletes who feel that they are being advised and consulted in their own training may be less prone to drop out compared to athletes who believe that they are being pressured to follow strict rules. This study will examine the correlation between different coaching styles and burnout and dropout levels among male and female high school athletes. Specifically, it will explore whether autonomy supportive coaching lowers burnout and dropout compared to a more controlling coaching style. . Varsity male and female high school student athletes will be administered a coaching behavior scale to assess their view of their coach's leadership style, and the athlete burnout scale to assess levels of stress associated with their sport. It is anticipated that autonomy supportive coaching having less dropping out and lower burnout among athletes because autonomy supportive coaching provides athletes more control over the training, eliciting a sense of motivation, enjoyment, and empowerment, which act as buffers against stress and promote a sense of well-being overall. These findings can be used to advise coaches on how best to motivate athletes and keep them engaged long-term in their sport. Future studies may investigate longitudinal data to confirm these results.

Thomas Hazelton

The Extent to Which Sensory Filtering by Astrocytes Impacts Cognitive Flexibility



Astrocytes are a subgroup of glial cells that can be found in various places in the brain. One of their major roles is to clear the synapse of glutamate, a key excitatory neurotransmitter. When glutamate is continuously bound to receptors on postsynaptic neurons it causes them to become overstimulated and can lead to excitotoxicity, causing neuronal damage and death, interfering with the completion of cognitive tasks. The purpose of this study will be to induce sensory overstimulation in adolescents to determine whether sensory filtering or adaptation occurs which could be influenced by astrocyte functions. The hypothesis will be that playing continuous, repetitive noise at 85 decibels will interfere with the ability for participants to accurately complete the Stroop Color and Word Test. Participants will be exposed to loud continuous sounds at 85dB then asked to complete the Stroop Color and Word Test. The purpose of the sound will be to cause distraction by overstimulating neurons resulting in excess glutamate levels. The test will be scored by determining the number of colors guessed correctly after being overstimulated. Astrocyte recovery time will be determined by when in the test the participant's accuracy increases. It is expected that participants' performance will be less accurate because of neuronal inhibition, but over time the participants' answers will increase in accuracy meaning that astrocytes have cleared the synapse . This could mean that Scientists have found that astrocyte regulation of synapses contributes to one's ability to complete cognitive tasks and sensory filtering.

Mizuki Horiuchi

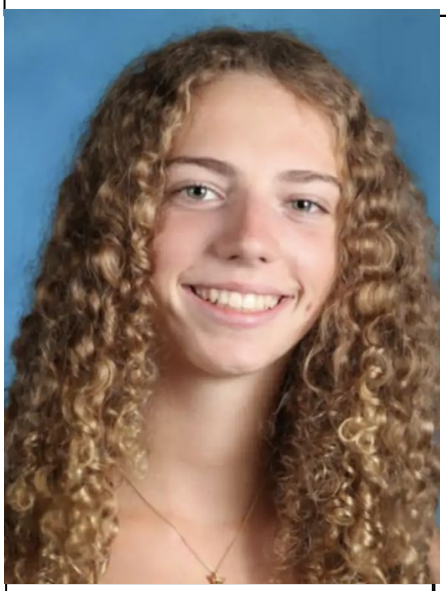
Determining the Epigenetic Effects of Iron Supplementation in the P1 Generation on the Offspring of Mutant *Drosophila melanogaster* for the Malvolio Gene



Currently there are over 2 billion people suffering from iron deficiency anemia.. Iron deficiency anemia is a common disorder where the body does not receive enough iron for the body to create hemoglobin within the blood causing symptoms such as headaches, dizziness, and fatigue. In humans, the gene SLC11A2, is associated with anemia because the SLC11A2 creates the protein divalent metal transporter 1 (DMT1) which allows for the transport of the positively charged iron ions. *Drosophila melanogaster* with the Mvl gene is a good model for anemia in humans because the Mvl gene codes for DMT1's, just like the human version. Wu (2022) found that the Mvl mutant experiences iron deficiency and iron supplementation mitigates the effects of the deficiency. However, it is unclear if supplementation in the P1 generation can benefit the F1 generation with a similar genetic makeup. Therefore the purpose was to determine whether iron supplementation in the P1 generation of *Drosophila melanogaster* with the Mvl gene will rescue the effects of iron deficiency in the F1 generation. The hypothesis was that if the P1 of *Drosophila melanogaste*r with the expressed Mvl gene is supplemented with 1 mg/L of FeSO4, then the P1 generation will perform better in the negative geotaxis assay. Iron supplementation of 1 mg/L was mixed with homemade cornmeal food using the BDSC recipe and was administered to the flies. Because iron deficiency can lead to lethargy and decreased locomotor ability a negative geotaxis assay was conducted to measure changes in locomotor ability on days 2,3,4 of life. Preliminary results showed that when flies with the Mvl gene were supplemented with iron in the P1 generation, the offspring performed significantly better in the negative geotaxis assay compared to when the parent generation was not fed iron ($p<0.0001$), and compared to the wild type flies fed iron ($p<.0001$). Implications are that further research is warranted to determine if iron supplementation for those with a genetic predisposition could improve outcomes for future generations.

Stella Johansson

The Extent to Which Dinoflagellates Can Adapt to the Combined Stressors of Warming and Acidification



Mentor:
Dr. Nicole C. Millette
Virginia Institute of Marine Science

Phytoplankton, microscopic marine algae, are among Earth's most essential organisms. Phytoplankton are at the base of the aquatic food web and generate about half of the atmosphere's oxygen through photosynthesis. However, climate change is becoming increasingly worse, and the ocean will become warmer and more acidic. These environmental stressors may have adverse effects on phytoplankton, some stressors more than others. If phytoplankton populations decline, the entire marine ecosystem could suffer as disruptions at the base of the food web ripple upward. Additionally, a reduction in phytoplankton would accelerate climate change, as fewer of these organisms would be available to absorb carbon dioxide from the atmosphere. The purpose of this study is to determine how phytoplankton respond to various combinations of warming and acidification by measuring their cell growth to evaluate the extent of these conditions' impact. It is hypothesized that increased temperature and decreased pH will have the most detrimental effect on phytoplankton growth. The methodology will involve culturing dinoflagellates under different acidification and warming conditions: controlled, increased temperature and same pH, same temperature and decreased pH, and increased temperature and decreased pH. Growth rates will be measured using cell counts. Comparisons between changes in warming and acidification will help identify which combinations of environmental stressors will have the worst effect on phytoplankton. Phytoplankton growth is expected to slow or be stunted due to changes in temperature and pH. Further research will explore how different phytoplankton species respond to these conditions and identify potential solutions to mitigate the negative effects.

Beverly Kang

Binary System Analysis of the Implications of the Deep-Water Cycle on P-Wave Speeds in the Upper Mantle



Mentor:
Dr. Christine McCarthy,
Columbia University

The deep-water cycle is the process of dynamic equilibrium between water entering Earth's interior (mantle) through the subduction of oceanic plates (regassing) balanced by the release of water vapors from Earth's interior (degassing). Understanding the deep mantle's role in the water cycle is crucial because it can influence water availability on the Earth's surface. Because the mantle is below thousands of kilometers of dense rock with high pressures and temperatures, there is a limited ability to analyze its processes; therefore, there is controversy when trying to understand its processes. Many studies have shown that mantle transition zones may hold up to six times the amount of water on Earth's surface and cause low-velocity P-wave zones. However, some studies have determined that water is insignificant to dampening P-wave speeds. In this study, a binary system of ice and NaCl was utilized to assess the impact of a partial melt system on P-wave velocities. Using Proceq 54 kHz Transducers and Tiepie, P-Wave velocities were determined for a pure ice sample, a .56% NaCl sample, and a .83% NaCl sample at 253K and 257.98K. A significant decrease in P-wave velocities of the .56% sample from 253K and 257.98K was observed, implying that the two-phase melt system reduced P-wave velocities ($p<.01$). These findings support theories about partial melting and the deep-water cycle as partial melting were determined a significant factor in P-wave speed reduction. In addition, at both 253K and 257.98K, there was a significant difference between the P-wave velocities of the .83% sample and the .56% sample ($p<.001$). We made observations about porosity of .83% that could be extrapolated to analyze wave speeds in a less dense, three-phase system. The reduction in P-wave velocities from the .56% and the .83% sample raised questions about water storage in the MTZ and the interconnection relationship between density and regassing.

Matthew Kirshner

Comparison of Tau PET Values in the Medullary Pyramids to ROI's in Alzheimer's Disease



Mentor:
Dr. Carolyn Fredericks
Yale University

Alzheimer's disease (AD) is a neurodegenerative disease with pathology defined by the overaccumulation of Amyloid-Beta (Aβ) "plaques" and tau-protein (tau) in the cortex. This pathology is primarily believed to be the result of mutations in the APP, PSEN1, and PSEN2 genes. It is commonly believed that AD only affects the cortical region of the brain; however, studies have demonstrated the exhibition of AD pathology in the cervical and thoracic regions of the spinal cord. Given the dearth of information and data about Alzheimer's disease spinal cord (ADSC) pathology, the purpose of this study is to provide more information about the early stages of AD and its pathological relationship with the subcortical region and cervical region of the spinal cord. The study will utilize Statistical Parametric Mapping 12 (SPM12) to preprocess images and compare tau PET SUVR values in regions of interest (ROI) to the Corticospinal Tract of diagnosed Alzheimer's patients in the ADNI study. Images are sourced via the Image and Data Archive at the University of Southern California Stevens Neuroimaging and Informatics Institute from the ADNI study. 50 individuals will be examined (50% Male, 50% Female), all diagnosed with AD after clinical assessment in the ADNI study. ROI's will be defined and sourced through Computational Anatomy Toolbox (CAT12) using the Johns Hopkins University White Matter DTI Based atlas. It is expected that the Corticospinal Tract will share similar tau PET SUVR values with the ROI's, indicating AD's simultaneous pathological occurrence in the cortical, subcortical, and spinal cord regions.

Jessica Kritzman

Whether Similarity, Credibility, or Authenticity Mediate the Relationship Between a Consumer's Age and their View of an Advertisement



Despite an increase in the older population's market size and consumer power, less than 10% of models in advertisements in the US are over the age of 45 (Eisend, 2022). The purpose of this study was to determine whether similarity, credibility, and/or authenticity serve as the mediating variable in the relationship between a consumer's age and their view of an advertisement. It was hypothesized that similarity will mediate the relationship between the consumer's age and their view of the advertisement to the greatest extent because the greater the similarity between the model's age and the consumer's age the more positive their view of the advertisement is. A total of 122 female participants, aged 18 and above, were exposed to advertisements featuring either younger or older models in the contexts of makeup and technology. The study's findings revealed that similarity was the only significant mediator($P < .05$) between a consumer's age and their view of an advertisement. These full mediations indicate that similarity between a consumer's age and the model's age positively influences the consumers view of the advertisement. Notably, credibility and authenticity were positively correlated with consumers' view on advertisements, suggesting that both younger and older consumers hold model credibility and authenticity in high regard, however, this was not related to the age of the viewer. The findings suggest that brands in both the technology and beauty industries would benefit from greater inclusion of older models to challenge ageist stereotypes, enhance engagement, and take advantage of the purchasing power of this expanding demographic.

Emma Mazzella

The Extent to Which Failure to Meet Daily Protein Requirements Impacts Knee Stability: Implications for Knee Injuries in Female Athletes



Female athletes are consistently overlooked when it comes to athletic injuries due to their unique physiological aspects. For this reason, people cannot assume key findings from males apply to females. Knee injuries, especially those associated with knee valgus, have been increasingly more prevalent in female athletes. Nutritional requirements like protein intake as well as hormonal fluctuations may impact injury susceptibility in female athletes. Protein is essential for muscle repair and overall athletic performance, yet many female athletes fail to meet their daily requirements. It is unclear whether this low protein intake is connected to ligament stability. The purpose of this study is to observe whether female athletes meet their daily protein requirements during season via MyFitnessPal and examine if there is an impact on knee valgus and stability during landing movements. This study uses the phase of the menstrual cycle as a controlled variable in order to isolate the effects of protein intake during certain hormonal fluctuation periods, as menstrual cycle hormones impact ligament stability. This study will involve female athletes all participating in the same sport where each will track their protein intake. Their menstrual cycle phase will be recorded so hormonal fluctuations can be controlled for. Specific jumping and landing tasks will be performed while being recorded with a 3D motion capture technology to analyze the biomechanics and knee valgus angles, and to assess ligament stability. It is expected that female athletes who had inadequate protein intake will show greater knee valgus angles which may increase their risk for knee injuries since proteins are a key structural component of ligaments, impacting their strength and elasticity. These findings can support the concept that nutrition may play a crucial role in injury prevention, especially during certain phases of the menstrual cycle.

Simon Modica

The Impact of Stimulant Medication on Auditory and Visual Reaction Time in Individuals with Attention Deficit Hyperactivity Disorder

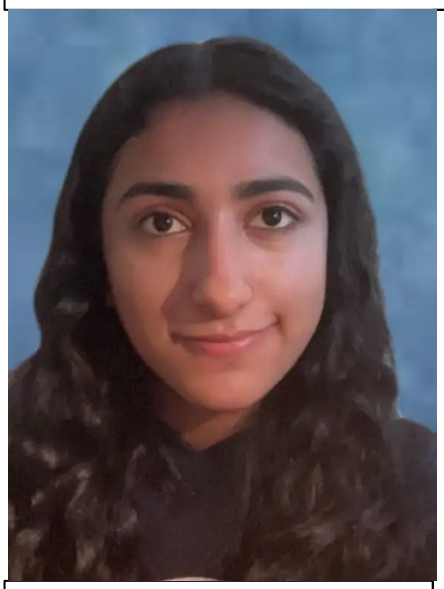


Mentor:
Ms. Mary Blount
HHS

The World Anti-Doping Association bans stimulant medications, including those for ADHD, in collegiate and professional sports. Athletes with ADHD face challenges such as hyperactivity and impulsivity, which can increase their risk of injury. Reaction times, both auditory and visual, are paramount for success in many sports, as even millisecond differences can impact outcomes. While stimulant medications may help individuals with ADHD improve focus; the effect on athletic performance and reaction times is unclear. It was hypothesized that adolescents and emerging adults with ADHD take stimulant medication their reaction time (both auditory and visual) will be faster than their ADHD peers who are not on medication, but not as fast as their non-ADHD peers. A modified ADHD Self-Report Scale was used to measure the severity of ADHD Online resources were used to test reaction times for both visual and auditory tasks, The results showed that participants with ADHD who were taking medication had visual reaction times that were significantly faster than those of their peers who were not taking medication ($p<.05$), and that there were no significant differences between the medicated group and the control group ($p>.05$). However, there were no significant differences between any of the groups for auditory reaction time. The lack of substantial group differences in auditory reaction times raises the possibility that stimulant drugs may not have the same effect on auditory sensory processing as they do on visual processing. However, in both instances even though the medicated group did better than the ADHD group, they did not perform significantly better than the control group ($p>.05$) indicating that medication may not afford an advantage but rather provide equity for ADHD individuals. Further research could be warranted due to the need for more studies to inform sports rules and practices.

Adeena Naeem

Analyzing the Impact of Water Diversion on Agricultural Output and Productivity in the Nile River Basin: A Linear Regression Approach

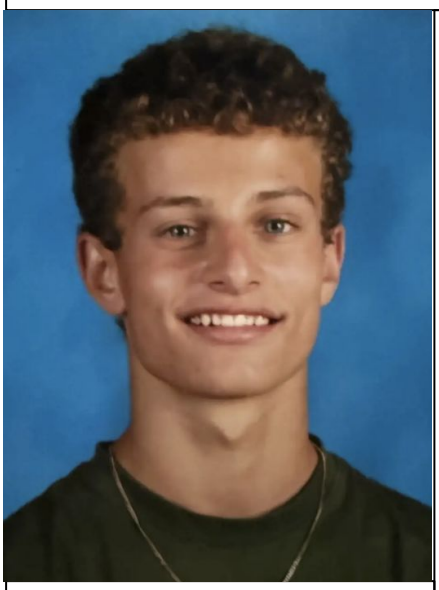


Mentor
Dr. Aiello-Lammens
PACE University

This study investigates the impact of water diversion in the Nile River Basin on agricultural output in Egypt and Ethiopia. Water diversion is the process of changing the natural flow of a body of water towards a different direction from its natural path. Using linear regression models and Excel graphing software, the relationship between water availability and crop productivity is evaluated, focusing on the key variable of crop area harvested. Scenarios are developed to explore how variations in water access—modeled through exponential changes in resource availability—affect agricultural sustainability over time. Initial findings indicate that higher diversion rates reduce area harvested exponentially while increasing net area harvested for the recipient country. Additionally, the study emphasizes the criticality of water as a foundational resource for regional stability, highlighting the socio-economic vulnerabilities exacerbated by mismanagement or external diversion. This research provides insights into sustainable water use strategies and underscores the urgency of asserting equitable water resource management given worsening climate conditions and rising tensions. Dispersing quantifiable effects of policy decisions is critical towards creating more ethical, equitable and efficient policy solutions to issues such as climate change and political instability.

Noah Podolak

Determining the Effects of p21 Deletion on Imaginal Wing Disc Regeneration in *Drosophila melanogaster* Using UAS-Reaper to Express Injury



Mentor:
Dr. Rachel Smith-Bolton
University of Illinois at Urbana-Champaign

Regenerative processes refer to replacing lost or damaged tissue with identical new tissue. Today, no genes are known to specifically control regeneration in humans, although some genes may be significant. p21 is a tumor suppressor gene and regulates the proliferation of cells. Prior research indicates that deletion of p21 may increase regenerative ability. Knowing how p21 works may expand our understanding of how to improve tissue repair and healing in humans. To model tissue damage and regeneration, this study uses *Drosophila melanogaster* with an ablation system consisting of rotund-Gal4, UAS-Reaper, Gal80ts, and TM6B. Rotund-Gal4 targets the imaginal wing disc. UAS-Reaper induces apoptosis in a controlled manner. Gal80ts allows for temperature-dependent activation, ensuring precise timing of tissue injury. TM6B is an identifier. The flies will be kept at 18°C until the experiment begins. At the appropriate developmental stage, they will be shifted to 30°C to activate UAS-Reaper, inducing cell death. Following this, the flies will be returned to 18°C to allow for tissue recovery. Regeneration will be measured by analyzing the degree of wing disc repair. It is expected that flies with p21/dap4 deletion will show increased wing disc regeneration compared to wild-type controls. If p21 inhibits regeneration, its absence should allow for greater tissue recovery following injury. These findings could have implications for regenerative medicine and chronic wound treatment.It is the hope that this research will provide insight into potential therapeutic applications for chronic wounds that affect millions of people.

Emily Salemo

The Effect of Alpha-Tocopherol on Locomotor Ability of *Drosophila melanogaster* Mutant for Glutathione S-Transferase Theta 3 (GstT3)

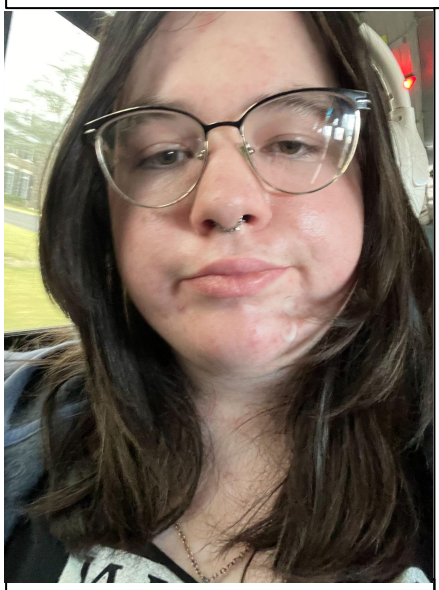


Mentor:
Dr. Cale Whitworth
BDSC

Over 200,000 children in the United States suffer from Juvenile Arthritis (JA), a condition where muscle tissue is severely atrophied, decreasing size and strength. The Glutathione S-Transferase Theta series of genes has been associated with the muscle erosion characteristic of JA. Current treatments for JA can be neurotoxic, creating the need for a safer treatment. α-tocopherol or Vitamin E is known to have protective effects against muscle tissue breakage and may reverse damage associated with muscle erosion. The purpose of this study was to determine whether α-tocopherol improved the locomotor performance of the model *Drosophila melanogaster* ortholog GstT3 for the human gene GstT1, which is part of the Glutathione S-Transferase Theta gene series. The hypothesis was that as the concentration of α-tocopherol increased, the locomotor ability of *Drosophila melanogaster* would increase as well. The methodology involved two parts; first, a genetic cross between *Drosophila melanogaster* with unexpressed UAS-GstT3 and a muscle GAL4 was raised on 0μ*M*, 20μ*M*, and 1000μ*M* of α-tocopherol. This cross allowed the hatched generation to express the gene GstT3 in muscles. The second part involved a negative geotaxis assay to test locomotor performance. This was done to see if α-tocopherol was able to reverse muscle erosion and restore locomotor ability to the flies. Results showed flies treated with 1000μ*M* of α-tocopherol had the greatest increase in performance ($p<.0001$), and that there was no significant difference between the locomotor abilities of the WT and GstT3 flies on the 1000μ*M* diet ($p>.05$), supporting the hypothesis. Based on these results, it can be inferred that α-tocopherol may have promoted the production of muscle and tissue cells within the *Drosophila melanogaster*, mitigating muscle erosion. Future research would involve assaying the flies to look for differences in muscle breakdown between α-tocopherol treated and non α-tocopherol treated GstT3 flies.

Cassidy Satterfield

Determining whether Nuclear Energy Would Better Meet The Demands Associated With AI Usage in the Next 20 Years

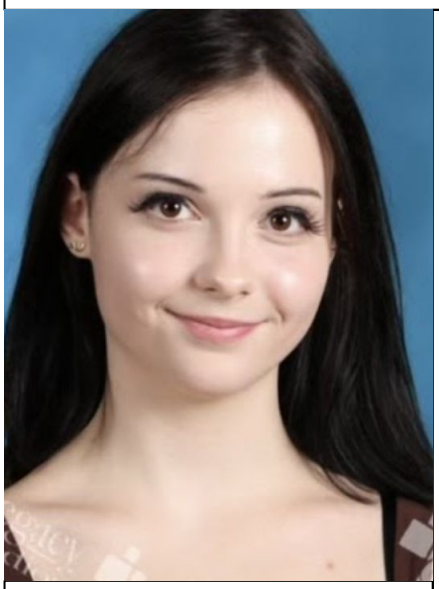


Mentor:
Dr. Kerry Manzo,
Purchase University

Last year, Pennsylvania's Three Mile Island, the location of a 1979 partial nuclear meltdown which officially closed in 2019, was reopened for Microsoft data centers in order to power its Artificial Intelligence (A.I.) and cloud computing data centers. This event aligns with the recent A.I. boom which has exhibited exponential training energy consumption growth since ~2016. The training phase of A.I. is energy intensive and generates substantial CO_2 emissions. It is unclear whether the current and future infrastructure can produce enough energy in an economically feasible way to power the growing A.I. needs without further exacerbating the climate crisis, including CO_2 emissions. The purpose of this study is to estimate the projected energy demands of increasing A.I. use in the next 20 years and determine whether nuclear energy is better able to meet these demands while minimizing cost and pollution output. The methodology will include four parts: 1. modeling A.I. usage in Megawatt/hour (MWh) over time and creating equations to predict continued use over the next 20 years given 2 different scenarios, exponential growth and a plateau. 2. Determining the amount of fossil fuels versus nuclear energy needed to support the total MWh predicted. 3. Figuring out the cost associated with using fossil fuels as opposed to nuclear energy. 4. Determining the total CO_2 emissions associated with each energy source. It is expected that the monetary, energy costs, and emissions associated with A.I. will offset or greatly reduce the actions being taken to fight against climate change.

Gabrielle Schiele

Using Stimuli and Positive Reinforcement to Measure Learning, Behavioral Reactions, and Cognition in *Oryctolagus cuniculus*



Mentor:
Ms. Eve Burtness
Blueback Bunnies Rabbitry

Oryctolagus Cuniculus, the common rabbit, has recently been used in studies on Animal-assisted Intervention Therapy (AAIT). AAIT is a type of therapy that recognizes the significance of a human-animal bond and utilizes trained animals to reap the potential benefits to a human's physical and mental health from their supervised interaction. Studies have shown that interacting with rabbits in therapeutic settings has been found to show significant decreases in levels of social anxiety and depression and improvements in social skills in adolescents suffering from cognitive disorders and other mental health issues. Cognition can be defined as the ability to acquire knowledge and understanding. An understanding of an animal's cognition is necessary to determine if it could pass therapy training. The purpose of this study is to determine the limits of cognition in rabbits for data that could be applied to AAI therapy research, as well as the further usage of rabbits in therapy settings. It is hypothesized that rabbits will be excellent candidates to pass therapy training because they will improve their timing to complete specific tasks after an increasing number of trials have been performed. The time it takes for each rabbit to complete a task will be recorded throughout 6 trials in a puzzle-solving test, a jump-down test, and a problem-solving test to observe any changes in performance over time. Preliminary results of the problem-solving test show a significant decrease in performance time as trial time increases ($p<.05$). These results suggest that the rabbits understood how to complete the task faster as time passed, implying that they have the ability to learn basic skills and actions that could be applied in AAI training and therapy.

Sei Shinozaki

Investigating How Differences in Elevation Affect the Tendency for Fires to Spread After Earthquakes



A typical secondary disaster caused by an earthquake is an earthquake-related fire. In fact, more than 29,500 fires occurred in the Great East Japan Earthquake that occurred in 2011. In addition, in the Great Kanto Earthquake that occurred in 1923, approximately 210,000 houses were burned down, as most buildings at the time were made of wood.Reconstruction costs would amount to thousands of billions of dollars when converted into current prices. The purpose of this research is to investigate the tendency for fires to spread after earthquakes. It will be hypothesized that there is a relationship between the tendency for fire to spread after earthquakes and difference of the elevation. There are many articles about relationships between difference of elevation and spread of fire but they focus on relationships between very low areas and very high areas. Also after an earthquake, the fire spreads in a very small range of areas and the difference of elevations are not so massive compared to examples in those articles. The methodology will be comparing information about fire resources, spreads of fire from two earthquakes (the Great East Japan Earthquake in 2011 and the Great Kanto Earthquake in 1923) using maps from FDMA (Fire and Disaster Management Agency) and maps which shows difference of elevation in these areas. It is expected that fires will spread more easily in areas affected by earthquakes at lower elevations because lower areas are dryer than higher areas; fire spreads to higher areas because of wind the fire generated. Further research will investigate the ways to stop fire spreading after earthquakes.

Nolan Simmons

The Effect of Vibro-Acoustic Stimuli on Movement Patterns and Mechanoreceptors of Spotted Lanternflies (*Lycorma delicatula*)



The Spotted Lanternfly (SLF), *Lycorma delicatula,* is an invasive species from China posing a significant threat to North American ecosystems due to its rapid population growth and detrimental feeding behaviors. In an effort to create innovative, non-invasive control methods that minimize environmental disruption, this study investigated whether vibro-acoustic stimuli, specifically substrate-borne vibrations, can either attract or repel SLF to the vibration source. It is accepted that if the SLF crawls away from the source, that vibration is important in disrupting the mechanoreceptors. Moving towards the source would suggest that the given frequency is naturally used for communication, and no movement suggests indifference to the sound. The focus on vibro-acoustic control stems from the insect's reliance on mechanoreceptors on their legs to detect vibrations for communication, as they lack conventional auditory systems. The experimental design involved exposing SLF to a range of frequencies from 0-600 Hz to determine which frequencies disrupted their natural behaviors. Frequencies below 300 Hz demonstrated significant movement away from the source ($p<.001$), 300 hZ attracted and anchored the SLF onto the tube, 450 hZ fostered clustering, and >450 Hz found no significant effect on behavior. These key findings indicate that Spotted Lanternflies exhibit specific behavioral responses to substrate-borne vibrations, with lower frequencies triggering negative responsive movement. Surprisingly, 50% Spotted Lanternflies moved toward the 300 hZ vibration, and positioned on the resonance tube. These results highlight the potential for developing frequency-based traps or deterrents as part of integrated pest management strategies. Further research is needed to test the effectiveness of these frequencies in diverse environmental conditions, like variations in plant density, temperature, and humidity, which may affect the transmission and reception of vibrations.

Riko Suzuki

Spectroscopic and Environmental Evaluation of Water-Based Paints Formulated from Cosmetic Waste Pigments



Cosmetic waste, particularly unused eyeshadows, contributes to significant environmental waste. One potential solution is repurposing the pigments from these cosmetics for alternative uses, such as in the production of paints. While synthetic pigments are commonly used in paints, they pose environmental risks, and repurposing cosmetic waste could reduce these concerns. This study aims to extract pigments from unused eyeshadows and incorporate them into water-based paints, testing their viability under different conditions of humidity, light, and temperature. The paints will be evaluated for their color, range, durability, and resistance to environmental factors, with the expectation that the repurposed pigments will provide a sustainable alternative to traditional paint sources. Preliminary results suggest that eyeshadow pigments can produce vibrant colors, and when paired with eco-friendly binders, these paints will offer a cost-effective and environmentally conscious solution. These findings could help reduce waste in the cosmetic industry while providing a sustainable option for the paint industry.

Mentor:
Dr. Julian Silverman,
FIT

Science Research Year I















Stella Artuso

Determining the Method by Which Phenethyl Isothiocyanate Inhibits Cell Proliferation and Induces Apoptosis in Cancer Cells Tumor Suppression



Cruciferous vegetables are commonly consumed vegetables, such as broccoli and watercress, which contain the cancer fighting compound phenethyl isothiocyanate (PEITC). PEITC has been found to inhibit cell proliferation and induce apoptosis to reduce the spread of cancers. However, the mechanism by which it works is unclear. *Drosophila melanogaster* models have been instrumental in understanding cancer development. Specifically, flies with a mutated UAS-yki.S16A gene located along the Hippo pathway when crossed with GAL4 causes tumor development in the eye and may provide clues as to the mechanism by which PEITC works. This study will elucidate whether mutations in the Yki pathway will decrease effectiveness of PEITC to determine whether PEITC would still be an effective tumor suppressant in individuals with mutations in this pathway. If the Hippo pathway is an essential mechanism by which PEITC decreases tumor growth, then flies with the mutated UAS-yki.S16A gene will develop tumors because the UAS-yki.S16A mutation prevents phosphorylation inactivating the gene increasing cell proliferation. If the Hippo pathway is not an essential mechanism, flies with mutations in the Yki gene will exhibit decreased tumor growth, indicating an alternate pathway, the Caspase Cascade, as the primary mechanism. The hypothesis will be that as the concentration of PEITC increases, the severity of *Drosophila* eye tumors will decrease, indicating the Caspase Cascade as the main mechanism. A dose response study will be conducted using 0, 25, 50, 100, and 150 μM of PEITC added to homemade cornmeal fly food (BDSC recipe). A metric will be created to measure the extent of bulging/golding in the phenotype of the eye to grade the severity of the eye defect, where 0 represents the normal fly eye, and 3 the most severe phenotype. Kaplan-Meier curves will be created to document changes in the percent survival of the flies. Implications include understanding the role of how genetic mutations could impact the effectiveness of PEITC in reducing tumor growth.

Sydney Atanasio

The Extent to Which Different Gut Microbes Impact Reaction Time in *Caenorhabditis elegans*



Mentor:
Prof. Tamara Tal
Helmholtz Centre for Environmental Research

Intuition is the process in which the brain uses past experiences, internal signals and environmental cues to make a decision. Since an essential aspect of intuition is how fast the decision is made, it has been suggested that shorter reaction times should indicate intuitive over deliberative processes. The gut-brain axis represents a bidirectional communication system that links the brain's emotional and cognitive centers with the digestive system's physiological processes. However, the connection between gut microbes and reaction time has not yet been tested. The purpose of this study is to test the impact of different gut microbes on reaction time in the model organism *Caenorhabditis elegans*. It is hypothesized that *Bacillus subtilis* will have the greatest effect on reaction time because it has been shown to enhance stress resistance in *C. elegans*. The methodology will entail bleaching the guts of *C. elegans* to remove all gut microbes. Subsequently, the gut will be recolonized through the addition of probiotic powder on an agar plate containing one gut microbe: *Lactobacillus rhamnosus*, *Bacillus subtilis*, or *Lactobacillus plantarum.* Reaction time will be evaluated through chemotaxis and touch-induced response assays and response times will be measured using the software WormLab. Future research will evaluate if different combinations of the bacteria influence reaction time to different extents.

Kaylee Ausserlechner

Determining if Lasting Cognitive Effects in Meniere's Disease Come From Vestibular Dysfunction or Dizzy Spells Using *Drosophila melanogaster*



Meniere's Disease is an inner ear disorder that affects people later in life. It has been associated with cognitive impairment including attention, memory and executive function disorders. The main symptom of Meniere's is vertigo, a sensation of spinning without actually being in motion. Meniere's has been linked to vestibular dysfunction which could be a cause of vertigo. However, it is unclear if lasting cognitive symptoms in Meniere's come from dizzy spells or vestibular dysfunction. α-Dystrobrevin(DTNA) is a gene in humans that plays a crucial role in muscle function. The *Drosophila melanogaster* ortholog is Dystrobrevin (Dyb) which has been validated as a model for vestibular dysfunction and for Meniere's Disease. Dystrobrevin (Dyb) is needed for proper function of the Johnston's organ, a fly's inner ear, and is involved in proprioception. Even though the vestibular system in the fly is slightly different from in a mammal, there is similarity in the underlying principles of the neurons that respond to mechanical stimuli and have the ability to detect movement. The purpose of this study is to determine if *Drosophila melanogaster* Dyb mutants for vestibular dysfunction have longer lasting cognitive impairment than wild type flies after being spun in a vortex to induce dizziness. The hypothesis is that after being spun, the *Drosophila* Dyb mutants will take significantly longer to recover than the wild type flies because of vestibular dysfunction. The methodology will involve having the Meniere's DTNA fly and wild type fly both perform a cognitive test in a T-maze. One side will have a reward and the other will not. Their choices will be recorded and then the flies will be spun in a vortex. After being spun, they will perform the same test immediately after, 24 hours later, and 48 hours later. It is expected that the Meniere's DTNA fly will take longer to recover than the wild type fly after being spun. Also, it will be shown that vestibular dysfunction plays a role in the lasting cognitive effects in Meniere's disease.

Ron Blaustein

Properties and Capabilities of Different Sources of Waste Ash for Concrete Development



Mentor:
Dr. Dan Hochstein,
Manhattan College

In 2018, 34.6 million tons of municipal solid waste were combusted into ash for energy recovery. 58.82 percent of incinerated waste came from the sources of food, plastics, papers, and metal. Once burned ash may be disposed of in landfills. Rather than dispose of waste ash, an alternative could be to utilize it for cement products. Municipal ash is capable of exhibiting and enhancing the cementitious properties of alkalinity, low permeability, and slow reaction rate. With differences in ash chemistry possible it is important to examine how different chemical compositions of ash impact cement before widespread implementation occurs. The purpose of this study will be to document common chemical compositions of incinerated ash and compare the properties of cement made from each composition. The bricks will be analyzed with standard cement lab testing for quantitative data outlined below. The hypothesis is that cement with fibrous and alkaline properties will have higher compressive strengths and durability while ash lacking these properties will have lower capability under testing. The methodology will be to first obtain ash from different sources, specifically commercial cement ash for a control, incinerated foods from a local restaurant, ash from an incineration plant, and school waste (mainly paper). Tests for pH, solubility, alkalinity, particle size, and concentrations of certain desirable minerals will be carried out. Cement Bricks will be manufactured from each ash composition in a controlled process. The bricks will be tested on compressive strength, density, ultrasonic pulse velocity, Vicat setting time, and gillmore setting time, heat of hydration, and water absorption using standard cement lab equipment. It is expected that ash with high alkalinity and solubility will find more success in testing. Future research will examine other aspects of the ash compositions deemed successful including possible costs, long term degradation, carbon footprint, and availability. Other waste materials with similar properties such as red mud (bauxite residue) can also be tested if properties and composition align with found research.

Dylan Bouteneff

The Effect of Temperature on Diversity of Atmospheric Bioaerosols in a Temperate Climate

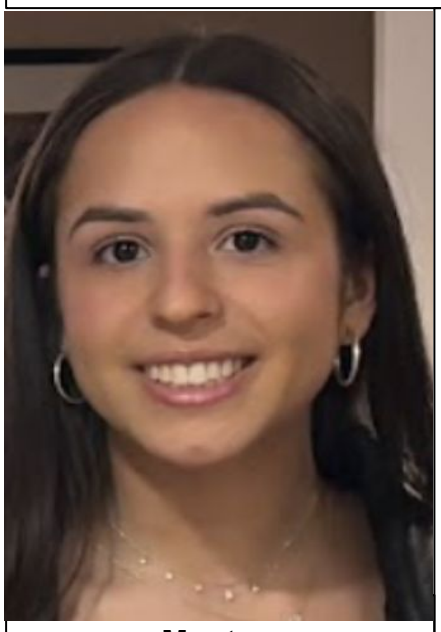


Mentor:
Dr. David J. Smith
NASA

Microbes have been known to use the atmosphere as a medium for transportation and a potential habitat, and have been found to be influenced by meteorological and atmospheric conditions, such as serving as ice nuclei for cloud formation and dispersal of microbes via wind currents. Due to the high transferability of bioaerosols through the atmosphere, such as a microbe's ability to travel across the world in about two weeks, the dispersion and diversity of microbes is a subject of much interest, as well as the way in which bioaerosols are introduced into the atmosphere. The purpose of this study will be to determine how the diversity of bioaerosols in the atmosphere will be affected by different temperatures. It is hypothesized that as atmospheric temperature increases, more bioaerosols would be introduced into the atmosphere via convection, resulting in higher microbial diversity, however bacterial and more so fungal diversity will begin to level off as temperature approaches 35°C.The methodology will involve flying a (F11 Ruko) drone up 100 meters into the air on different days, carrying a petri dish and thermometer with similar meteorological conditions with the exception of a varying temperature. Then the sample taken with the petri dish will be analyzed via microbial morphology to study differences in appearance between the different samples. Additionally, to analyze the diversity on a genomic level, microbes will be analyzed via 18S/16S PCR rRNA high throughput sequencing. This experiment will show how different temperatures affect the atmospheric microbial environment over a suburban area. Further research could include sending samples of cultured cells to a lab to test the effect of other meteorological conditions, such as UV rays, or comparing results from changes in temperature across different locations.

Emma Cabral

Determining the Extent to Which an AI FaceCode Algorithm Can Decode Facial Images Without Bias to Determine Personality Traits and Motivators



Mentor:
Roman Kikta
Phenometrix

AI systems, although seemingly autonomous, are algorithms coded and designed by humans, to perform specific tasks, make decisions and process data. Since they are coded by humans, it is possible that AI algorithms may exhibit human-like biases. Human facial features provide cues about personality and behavior, with previous studies linking composite facial images to personality traits. Facial recognition technology operates by analyzing individuals and comparing their facial features against a trained database with inputted images or videos. A Texas-based company uses an original AI algorithm to decode core personality traits and predict motivators based on facial phenotypes depicted in a photo of an individual; however, it is unclear if the predictions made by the algorithm contain biases based on stereotypes. The purpose of this study is to determine the extent to which the AI FaceCode algorithm can decode facial images without bias to determine personality traits and motivators. The hypothesis is that the AI FaceCode cannot accurately decode facial images or determine personality traits and motivators without bias. The methodology will involve teenage participants of different genders and ethnicities taking three photos with different expressions: smiling, neutral and frowning for the AI FaceCoding system to analyze to determine if they're decoded the same. The AI System will also generate a report on the participant's personality traits based on the Big Five Inventory and motivators based on the Spranger and Allaport test. The student will complete these tests, and results will be compared. It is expected that the AI FaceCode algorithms results will not be equivalent to either the Big Five personality test or Spranger and Allport tests data. Further research will explore ways to improve AI FaceCoding technology in order to determine ways to limit bias based on stereotypes.

Lori Chin

The Extent to Which Folate Methylates Genes Associated with Non-Small Cell Lung Cancer (NSCLC)



Mentors:
Dr. Kwok-Kin Wong
Dr. Ting Chen
Perlmutter Cancer Center

Lung cancer causes an estimated 1.6 million deaths per year and requires complex treatments such as chemotherapy and targeted therapy. Though these treatments often make significant differences in tumor growth, the presence of mutations such as KRAS (Kirsten Rat Sarcoma) often confers resistance to EGFR (epidermal growth factor receptor) inhibitors, promoting drug resistance in tumor cells. DNA methylation, a process where methyl groups are added to a cytosine base of DNA to inhibit the expression of a gene without changing its sequence, is a potential option for tumor resistance prevention. Folate is a common methylator and is essential for DNA synthesis, and would be considered an indirect methylator because it does not directly donate methyl groups but plays an important role in the one-carbon metabolism pathway which produces the methyl group donor.. The purpose of this study is to determine the extent to which folate can reduce drug resistance in lung cancer cells by observing the methylation process and measuring cell viability, The methodology will involve conducting a dose response study applying folate to lung cancer cell lines. The DNA methylation process will be observed using bisulfite genomic sequencing, which identifies the methylation status of DNA. The DNA will be treated with sodium bisulfite converting unmethylated cytosines to uracil. Cell viability of the lung cancer cells will also be measured and recorded over the course of 1-4 hours using an MTT assay. It is expected that the folate will result in a decreased rate of drug resistance in the cancer cells while increasing drug effectiveness. Further research will involve identifying similarities within heterogenesis tumors, in order to test DNA methylation which is a known limitation of DNA methylation in cancer research.

Elle Dinour

Evaluating the Extent to Which Using Betaine to Methylate the Yki Gene in *Drosophila melanogaster* Affects Tumor Growth



DNA Methylation is a chemical process where a methyl group is added to DNA or proteins, which can alter their function by silencing genes, changing their expression. These chemical modifications can be passed down to offspring. Betaine, a known methyl donor, is a chemical compound that can be naturally found in beets and increases DNA methylation. Different types of cancer have genetic predisposition *Drosophila melanogaster* is a validated model for studying cancers. In particular, flies containing the UAS-yki.S16A mutation results in tumorous growths in the fly eye when crossed with the GAL 4 promoter. The purpose of this study will be to determine if betaine could methylate the UAS-yki.S16 gene altering the production or growth of tumors in the F1 generation. It is hypothesized that a higher intake of betaine will increase methylation of the UAS-yki.S16 gene, leading to decreased tumor growth in the eyes of the F1 generation of *Drosophila melanogaster.* A dose response study will be conducted where 0mM, 0.1 mM, 1mM, 10mM, 100mM, 1000mM concentrations of betaine will be fed to the virgin female flies containing the mutant yki.S16A gene before they are crossed with a GAL 4 that drives expression in the fly eye. A graded metric scale will be used to rank the tumors present in the F1 generation based on severity of the tumor. If the yki gene is methylated then it is predicted that tumor growth will decrease or remain constant compared to the growth of the flies with the yki gene not being methylated. This is a significant concept in looking at transgenerational cancer cases where a gene from the parent can be passed down to the offspring, potentially causing cancer to develop in the offspring as well. If the parent is aware that they contain a potentially harmful gene then they can consider adding certain compounds known to reduce methylation such as betaine to their diet in order to reduce expression of the gene in their offspring.

William Duffelmeyer

Determining Whether Arm Angle, Type of Pitch and Pitching Velocity Influence the Incidence of Elbow Injury in Right Handed Pitchers Versus Left Handed Pitchers



Over 30% of the pitchers in the MLB have received Tommy John surgery. This high percentage of injuries can cause players to get cut from rosters or their contracts reduced. Overall it is commonly believed that right hand pitchers get more speed on their fastball but lefties are much better overall at throwing off speed pitches like sliders and changeups. These pitches rely less on speed and more on the correct spin of the ball. The purpose of the study will be to determine whether the type of pitch, the arm angle while pitching, and the pitching velocity of right-handed (RHP) versus left handed pitchers (LHP) correlate most with pitcher injuries. Methodology will require watching film of RHP and LHP to analyze different arm angles while throwing as well as accessing pitching records to determine whether pitch type, and/or velocity of pitches correlate to the incidence of elbow injury. Implications include potentially raising awareness of factors that put pitchers most at risk for Tommy John and similar surgeries.

Hana El Khoury

The Effect of Sulfur Vacancies on Bandgap and Electrical/Thermal Conductivity in Monolayer MoS_2



Mentor:
Professor Vinod Menon
CUNY

2D materials are a class of nanomaterials that are one to two atoms thick. 2D materials, the most famous ones being graphene (conductor) and MoS_2 (semiconductor), can be created through a variety of processes, downsizing a bulk material to such a nanoscopic size. Creating a monolayer of MoS_2 allows for exaggerated properties which supports a variety of uses in electronics, seen by its bandgap of 1.8 eV. Despite such exaggerated properties, chalcogen vacancies, a defect in the 2D material, can alter the bandgap, in turn affecting the molybdenum disulfide properties. Band gap is the distance between the valence band of electrons and the conduction band which determines the minimum amount of energy required to excite an electron in the conduction band which allows it to participate in conduction. The purpose of the study is to evaluate the effect of a sulfur vacancy in monolayer molybdenum disulfide on the band gap and applications in electronics. The hypothesis is that a single sulfur vacancy will increase the band gap, decreasing thermal and electrical conductivity. The methodology will involve using a density functional theory engine to model two monolayer MoS_2's and removing one sulfur atom from one MoS_2. After doing this, the band gap in the 2D material will be measured and the changes will be evaluated and compared. It is expected that creating a sulfur vacancy in the MoS_2 will create a greater shift in the band gap, in turn increasing the band gap to higher than 1.8 eV and decreasing its exaggerated properties of high thermal and electrical conductivity. Determining the effects of sulfur vacancies in MoS_2 could help lead to further discoveries in technologies such as creating more efficient phones and laptops and lead to further question such as the effect of sulfur vacancies on other factors such as flexibility and sensitivity, contributing to more efficient technologies such as pollution detectors and more secure communication.

Cayla Ende

Comparing the Effectiveness of a Ketogenic Diet on Decreasing the Time of Recovery After Inducing Paralysis in *Drosophila melanogaster* with the para[ST76] allele vs. a GAD1 Mutation



Epilepsy is a neurological disorder characterized by two or more recurrent seizures caused by abnormal hyperactivity or hypoactivity in the brain. Unfortunately, approximately 33% of patients with epilepsy do not respond to existing drug treatments. In humans, epilepsy may result from various mutations, such as in the SCN2A gene, which causes sodium imbalance, and the GAD2 gene, which reduces inhibitory transmission in GABA neurons. The ketogenic diet is a low carbohydrate, high fat diet that could provide an alternative for treatment of epilepsy in drug-resistant patients by increasing the excretion of excess sodium or increasing ketone body production which aids in the synthesis of GABA and increases inhibitory signaling. *Drosophila melanogaster* is a valuable model for studying epilepsy because there is a high degree of conservation of genes and pathways involved in seizure mechanisms, including the para[ST76] ortholog for SCN2A and GAD1 ortholog for GAD2. The purpose of this study will be to compare the effectiveness of the ketogenic diet in reducing recovery time post seizure in para[ST76] mutants versus GAD1 mutants. It is hypothesized that the ketogenic diet will more effectively reduce recovery time in GAD1 mutants by directly improving ketone-driven GABA synthesis, compared to indirectly decreasing sodium levels in para[ST76] mutants. The methodology will involve raising Drosophila with the para[ST76] allele and GAD1 alleles on a ketogenic diet using the recipe from Heliyon. Flies will then be heated to 38oC using a water bath to induce paralysis. Recovery time will be measured for comparison across groups. The implication of this study is that determining the mechanism for how a ketogenic diet reduces seizures could help create targeted therapies for patients who do not respond to drugs. Future research will evaluate which carb to fat ratio is most effective at reducing recovery time.

Hannah Feldman

The Effect on Alpha-Tocopherol on Regeneration Rates in *Planaria*



Tissue regeneration is a crucial aspect of the treatment for certain diseases like Multiple Sclerosis, where nerves deteriorate over time. Planaria are a valuable model organism for studying regeneration due to their unique ability to regrow missing parts. Vitamin E is an antioxidant that has been shown to promote the growth of cells, however, its role in regeneration remains unstudied. Vitamin E can aid in regeneration because previous studies have shown that it creates an alternate pathway for regeneration, which will increase the regeneration rate. The purpose of this study is to determine whether varying doses of Vitamin E can catalyze the process of regeneration within Planaria. It will be hypothesized that worms treated with higher amounts of Vitamin E will regenerate at a faster rate than worms not treated with Vitamin E. The methodology will involve a dose response study in which Planaria will be given different quantities of vitamin E after they have been cut in half, with one group receiving no vitamin E for comparison. The amount of time it takes for the eyes to reappear on the head will be measured to determine the rate of regeneration. It is predicted that Planaria treated with the highest dose of vitamin E will have the fastest regeneration rate. Further research will investigate how vitamin E can aid in healing and regenerating nerve growth in other living organisms, including humans.

Alessandra Ferrara

Determining if The Type of Hospital a Patient Attends for Axillary Lymph Node Dissection (ALND) Affects Their Quality of Life Postoperative



Mentor:
Dr. Andrea Barrio
Memorial Sloan Kettering

Approximately 20% of women undergoing breast cancer treatment, including surgery to remove lymph nodes, may experience lymphedema, a condition causing chronic swelling in the arm or leg near the surgical area. An Axillary lymph node dissection involves removing multiple lymph nodes under the armpit. Because it disrupts more of the normal tissue in the underarm area, axillary lymph node dissection is likely to affect arm function and cause lymphedema. There are two main different types of hospitals, academic medical centers, or teaching hospitals, are unified with medical schools and focus on research, education, and specialized care, while community hospitals focus on general and acute care for the local population. Community hospitals often have lower surgical volumes, and studies show that both low-volume hospitals and surgeons are linked to higher complication rates. The purpose of this study is to determine whether the type of hospital (academic versus community) impacts the postoperative quality of life (QoL) in breast cancer patients who undergo axillary lymph node dissection (ALND). ALND, will be used to identify matching procedures at both hospital types. The methodology includes analyzing patient outcomes, complication rates, and success rates using tools such as the ACS NSQIP Surgical Risk Calculator and Kaplan-Meier survival curves. Findings may guide improvements in care quality and identify other factors that influence patient QoL after breast cancer surgery.

Emma Fonteboa

Engineering a Device for the Alleviation of Visual Symptoms Caused by Progressive Supranuclear Palsy



Progressive supranuclear palsy (PSP) is a rare neurodegenerative disease that leads to a progressive inability to carry out basic functions related to balance, movement, speech, and vision. Due to it being such a rare disease little is understood about its cause and there is currently no cure, however, there are ways to support patient functioning despite the symptoms that they may be experiencing. One major symptom associated with PSP is difficulty controlling eye movements, which restricts them from looking up and impairs vertical gaze and peripheral vision. Currently, there is no form of treatment that helps improve this. Therefore, the purpose of this study will be to design a form of glasses with prisms that would enable the individual to see more peripherally. The methodology will involve constructing the glasses and having participants complete a visual field test with and without the glasses for comparison. It is expected that the glasses will improve a person's peripheral vision field of view. The implications of this device would be improving patient quality of life and safety as they could better navigate independently and interact with the world more efficiently. Future research could be enhancing the design of the glasses to better support patients with other visual symptoms such as light sensitivity.

Lianni Forbes

Using *Caenorhabditis elegans* to Determine if the Use of Dermatitis Shampoos Alleviates Skin Irritation

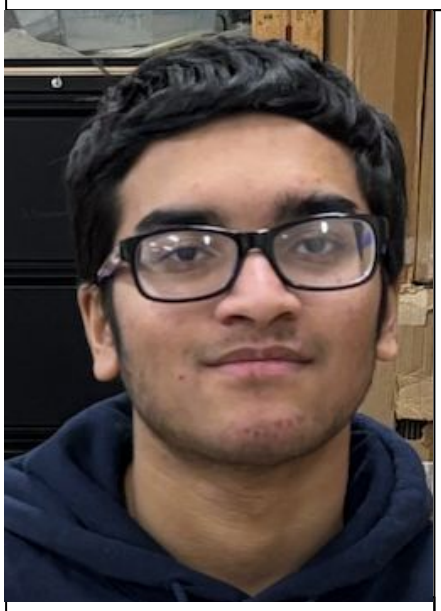


Mentor:
Prof. Amy McMichael, MD
Wake Forest School of Medicine

Central Centrifugal Cicatricial Alopecia (CCCA) is a lymphocytic alopecia prevalent among black women or women of African descent around the age of 30. The mechanism for this type of alopecia is still unknown, although in recent studies an increase in the gene expression of PADI3 has been linked to hair loss associated with CCCA as well as to other types of fibrosis and irritation in different parts of the body. Dermatitis, which is another type of skin irritation disorder, is treated with shampoos that have main active ingredients including zinc, selenium sulfide, and salicylic acid, which contain anti-inflammatory properties. The purpose of this study is to test and see if these dermatitis shampoos provide a possible solution to alleviating skin irritation associated with conditions like CCCA. The methodology will involve using *Caenorhabditis elegans* with a mutated Pad1 gene, an ortholog of human PADI3. Worms will be cut, and different concentrations of each of the dermatitis shampoos will be applied to the cuts. Wound closure would be measured using Image J after 12 hours, 24 hours, & 48 hours. It is expected that the dermatitis shampoos with the highest concentrations of the zinc will accelerate wound closure, as it alleviates skin irritation associated with dermatitis.

Atharv Gandhi

Harnessing Different Properties of Activated Soot Particles for Use as Electrodes in Producing the Most Optimal Voltaic Battery Cells



Mentor:
Professor Mahmoud Amin
Manhattan College

Many communities that are often disproportionately impacted by pollution and climate change, are also more likely to suffer from poor energy access. These are known as energy insecure frontline communities. Sites around these areas consist of unsolid particulate matter (smoke, water droplets, and mists) and solid particulate matter (dust, soot, and dirt). Among these, carbon soot is the most solid and conductive, and its porous structure means it has the most potential for use in small-scale energy systems. Soot is a black powdery or flaky substance consisting largely of carbon, produced by the incomplete combustion of organic matter. Some studies have shown promise for soot that has been heat treated as an electrode, but the optimal process for creating soot electrodes is yet to be established, especially in low-resourced areas. The purpose of this study will be to harness soot particles for use in battery and energy systems. Soot will be used as an electrode to more efficiently power batteries and energy storage systems. It is expected that this will make the storage of energy more efficient and allow energy insecure communities better energy sources, while reducing particulate matter in the surrounding environment. The methodology will involve measuring different levels of compactness, thickness, and amounts of soot to determine optimal battery viability. Further, the activation of the soot will aid in improving the energy density and life cycle of the battery. Future research will involve creating a portable device that will sense and capture soot particles (products of incomplete combustion) from the air, filter them through microfluidic devices, and process them into a conductive layer, integrating them into battery cells. This device will help provide consistent amounts of portable power in polluted areas via a portable, small-scale energy system.

Sasha Geller

Evaluating Whether Structural Differences Exist in the Amygdala of Females with Premenstrual Dysphoric Disorder



Premenstrual dysphoric disorder (PMDD) is a severe form of premenstrual syndrome (PMS), and is characterized by extreme versions of typical emotional and physical symptoms. Nearly 50% of people with PMDD are originally misdiagnosed with bipolar disorder or depression before receiving the correct diagnosis, additionally, on average it takes 12 years to receive a diagnosis. Furthermore, it is estimated that premenstrual disorders account for millions of lost workdays annually, contributing to gender disparities in workplace advancement. To address this, it's necessary to understand the causes of PMDD, as of now, there is no consensus. Major theories include altered emotional processing, hypersensitivity to hormonal fluctuations, and structural brain differences. This study will focus on brain differences in the amygdala because recent research has found higher reactivity of the amygdala in PMDD females. The goal of this study is to identify an objective diagnosis for PMDD which could dramatically reduce the time to diagnosis from the current average. The hypothesis is that there are structural differences in the amygdala between persons with severe emotional dysregulation during the luteal phase of the menstrual cycle and those with normal emotional regulation. The methodology will consist of analyzing a publicly available neuroimaging data set. The data will be analyzed using Statistical Parametric Mapping (SPM) software. SPM was selected because of its widely used applications in analyzing structural differences in the brain and voxel-based morphometry (changes to volumetric pixels or 3D pixels). SPM was created specifically for human neuroimaging analysis, is used by thousands of researchers, and is cited extensively in peer reviewed journals such as *Nature Neuroscience*. Further research will identify what the structural differences are in greater specificity and will reinforce any causal relationships. Long term impacts of this research could aid in making an objective diagnosis of PMDD, thereby expanding treatment options.

Aurelien Haberkorn

Determining the Degradability of Biodegradable Golf Balls Under Varying Environmental Conditions



Mentor:
Prof. Ashlee Jahnke
Texas A&M

Each year more than 400 million golf balls are lost in the woods, water, or other boundaries that are off the golf course. This is an environmental problem as golf balls are primarily made of rubber and plastics, taking an estimated 100 to 1000 years to completely break down in nature. Biodegradable golf balls composed of PVA (polyvinyl alcohol), cornstarch, glycerin, and calcium carbonate have been marketed as an environmentally safe alternative. Biodegradable means at least 90% of the materials must be broken down into harmless products under aerobic conditions 6 months. Companies claim these golf balls completely break down after 2 to 4 weeks when submerged in water and 6 months when left on land. However, golf balls are used on courses with varying environmental factors and it is unclear how well the golf balls biodegrade when exposed to different environmental conditions. The purpose of this study will be to test different biodegradable golf balls under varying environmental conditions and measure the extent to which they are able to break down. The hypothesis will be that both brands labeled biodegradable will not degrade under dry conditions because they are made of over 65% of PVA and 15% of Glycerin which are water-soluble substances. The methodology will involve testing two different biodegradable golf ball brands (AlbusGolf and BGB Biodegradable Golf Balls®) and seeing how they will break down under conditions of varying UV, temperature, humidity, and water exposure with all other factors kept constant. The masses of the golf ball materials will be recorded and FTIR analysis will be conducted to monitor chemical reactions. It is expected that the biodegradable label on the packaging is misleading, as break down will depend on the location in which the golf ball is used.

Jonathan Hanna

The Effect of Intermittent Fasting on the Healthspan and Lifespan of Transgenic Alzheimer Model Aβ42 *Drosophila melanogaster*



Alzheimer's disease (AD) affects 58 million people worldwide, this number is expected to skyrocket to 153 million by 2050. Significant characteristics of AD include memory loss, cognitive decline, behavioral change as well as decreased lifespan. AD is known to be caused by aggregates of Aβ-peptides forming amyloid plaques, the accumulation of these plaques leads to neuronal inflammation and later to neuronal cellular death. While there is no cure for AD, intermittent fasting (IF), a dietary restriction that limits food-eating periods may lessen these effects of AD. Previous research showed IF can reduce amyloid in the brain and improve cognitive functioning. However, the optimal regimen of IF to produce these effects is still unknown as well as if IF can have an effect on longevity. The purpose of this study is to find the most optimal regimen of IF to increase the healthspan and lifespan of model *Drosophila melanogaster* expressing "Arctic" AβPP mutation. The methodology will include feeding transgenic Aβ42 *Drosophila melanogaster* three different feeding regimens throughout their lifetime: 1. Every other day feeding 2. 8 hours of feeding and 16 hours of fasting 3. 2 days feeding, 5 days fasting. Because AD has age-dependent deterioration in movement coordination, a negative geotaxis assay will be conducted on days 7,8 and 9 of life. In addition, the probability of survival will be documented using Kaplan-Meier curves. It is expected that the 2 days feeding/5 days fasting regimen will be the most optimal to increase healthspan and lifespan in the flies because longer fasting times may slow down the rate that amyloid beta plaques are deposited in the brain, increase the rate at which the plaques are cleared, and reset circadian rhythms improving sleep and digestion.

Valeria Huerta

Determining Whether an Association Exists Between the Musical Factors of Pitch/Tempo and Moral Judgment in Adolescents



Music plays a key role in the lives of teenagers and can influence relationships, emotions, and identity. Although music has been studied in various contexts (personality/behavior), the potential correlation between music and moral values has been less examined. Moral principles shape cultural, social, and individual experiences, helping individuals to distinguish right from wrong. It is known that the musical factors of pitch/tempo are connected to emotions, where pitch affects emotional perception and tempo influences mood, and together they have a predictable effect on emotions. It is also known that emotions are instrumental to fueling real-life moral decisions. It is unknown if the musical factors of pitch and tempo directly affect moral decisions. The purpose of the study will be to determine whether an association exists between moral principles of adolescents and the pitch and tempo of a musical composition. The hypothesis is that there is a connection between pitch/tempo in music and moral decisions in adolescents. It is predicted that fast tempo and high pitch music will result in stronger moral responses due to their influence on emotional arousal. The methodology will entail administering the *Moral Foundations Questionnaire* to adolescent participants (14-18), to obtain baseline moral values. The subjects will be separated into 5 groups, the control group will have no music playing; 4 groups will take the questionnaire while a musical clip will be played with the same lyrics but distorted into 4 groups with each group receiving a different musical sound (1. Fast tempo/low pitch, 2. Slow tempo/low pitch, 3. Fast tempo/high pitch, 4. Slow tempo/high pitch). If a connection is established, it could help explore the influence of music on adolescents' moral development or a reflective relationship between music and beliefs regarding moral formation.

Kailah Hunter

Determining Whether Societal Gender Stereotypes Mediate the Relationship Between Attitudes Towards Mental Health and Access to Mental Health Services



Gender stereotypes are harmful beliefs and assumptions about the differing characteristics men and women possess. For example, men are expected to lack vulnerability and appear both mentally and physically strong. Therefore, they are taught that expressing emotions and seeking help is a weakness. A stereotype towards men is that they should keep their emotions to themselves and in control. This contributes to a social stigma surrounding attitudes towards mental health services. This stigma not only impacts the individual's mental health and access to helpful services, but also, data on disorders and mental health is missing due to the lack of male participation and/or male resentment in mental health services. Therefore, the purpose of this study will be to determine whether societal gender stereotypes will mediate the relationship between attitudes towards mental health and access to mental health services. It is hypothesized that societal gender stereotypes will mediate the relationship between attitudes towards mental health and access to mental health services especially for men. The methodology will surveying men and women from different political affiliations, cultures, ethnicities, and cultures. They will be surveyed using 3 scales: the Mental Health Seeking Attitudes Scale (MHSAS), Gender Roles Belief Scale (GRBS), and the Community Attitudes toward Mental Illness (CAMI). Further research will study the coping mechanisms of men and how early interventions could raise awareness about the benefits of seeking mental health services.

Ryu Irahara

The Combined Effects of Temperature and Acidification on Regeneration Rates and Motility of Planaria: Implications for Ecosystems



Mentor:
Dr. One Pagan
West Chester University

Planarians are considered an indicator species because they are sensitive to changes in the environment, assisting in the communication of information about the condition of an ecosystem. The use of indicator species is important as they can signal changes in the environment that may not be evident by direct measurement. Recent studies have shown the capability of planaria to adapt to rising temperatures related to climate change, with higher temperatures resulting in increased regeneration rates and relatively normal motility. At acidic pH, they exhibit negative behaviors of incomplete regeneration or death. However, when rising temperatures are combined with additional environmental stressors such as acidification, they may exhibit notable changes. Therefore, the purpose of this study is to determine how the combined environmental stressors of increasing temperature and acidification affect both the regeneration rates and behavior of Planaria. The methodology will involve exposing Planaria, to the pHs of 7, 6.5, and 6 at the temperatures of 23 °C, 25 ºC, 27 ºC, and 30 º,C which are based on the deviation of extreme freshwater temperatures and pH. It is expected that increased temperature and a decrease in pH will impair the regeneration rate, motility, and decrease the survival rate due to their inability to adapt to combined environmental stressors.

Jonida Ismajlukaj

Determining Whether the Yki Pathway Promotes Ferroptosis and Results in Decreased Tumor Development



Activation of the YAP pathway is a key driver of tumor progression. Because the YAP pathway has both tumor-promoting and tumor-suppressing roles depending on the scenario, it is important to determine which scenarios could lead to the YAP pathway promoting tumor progression. Because the YAP pathway is an important factor that prevents us from developing cancer, it is important to know whether or not it inhibits or promotes ferroptosis. Because the activation of the YAP pathway is caused by dysregulation of the Hippo pathway, which causes uncontrolled cell growth, it is expected that ferroptosis would be promoted by unactivated YAP. The purpose of this study will be to determine whether increasing iron intake in the *Drosophila melanogaster* with the expressed UAS-yki.S16A mutation would decrease tumor development. A dose-response study will be conducted where 5 mM, 7.5 mM, 10 mM, 12.5 mM, and 15 mM dosages of iron will be fed to *Drosophila melanogaster* with the UAS-yki.S16A mutation. A metric will be created to measure any change in morphology in the fly eye. It is expected that as iron supplementation increases, tumor development decreases. Further research will determine other factors that contribute to how often ferroptosis is happening, whether or not those factors increase or decrease ferroptosis, and why.

Priya Kaji

The Effects of Different Complexities of Dissolved Organic Nitrogen on the Growth of Phytoplankton



Mentors:
Senior Scientist Daniel Repeta
Dr. Charlotte Lee
Woods Hole Oceanic Institute

Even though dissolved organic nitrogen (DON) is more abundant than dissolved inorganic nitrogen (DIN), the uptake rate of DIN such as ammonia by phytoplankton is much greater. A potential reason for this is that DON consists of more complex molecules. For example, DON can come in sources such as urea, amino acids, and peptides that are metabolic waste products of marine organisms, or from organic fertilizers such as manure. Dissolved organic nitrogen sources are of increasing complexities: proteins are made of amino acids that are degraded to form urea. The purpose of this study will be to determine the effects of differing complexities of DON on the growth of phytoplankton. It is hypothesized that in terms of organic nitrogen, the less complex forms such as urea will stimulate more growth than the complex forms such as proteins. The methodology will include collecting water and sterile filtering, then adding in the different complexities of dissolved organic nitrogen such as urea. Unfiltered seawater would need to be added in after that to inoculate the water and allow the phytoplankton to grow, and the amount of growth will then be measured through cell counts. It is expected that the less complex forms of DON will stimulate the most amount of growth because it is the easiest to break down into ammonia for use. Further research will include looking more into how phytoplankton is able to use DON on a molecular scale.

Ritsu Kimura

Determining the Extent to Which the Application of Bacterial Cellulose Produced From SCOBY Kombucha Improves Soil Aggregate Stability, Water Capacity, and Permeability in Different Soil Types



Mentor:
Ms. Morgan Irons
Cornell University

The UNCCD estimates that 250 million people are directly affected by desertification, the soil degradation in arid, semiarid and dry sub-humid areas caused by climate or human activities that results in a decline in agricultural productivity. One low-cost, sustainable solution could be the introduction of a SAP (super-absorbent polymer), which can improve the water capacity, soil aggregate stability, and permeability of the soil that is essential for soil fertility. Cellulose nanofiber (CNF) is one possible SAP that could be applied to improve soil properties for agricultural production. However, most of the production methods require toxic chemicals and advanced equipment that prevent its sustainable production. SCOBY Kombucha can provide acetic acid bacteria (AAB) and serve as a source for synthesizing bacterial cellulose (BC) with the addition of sugar. While its application has been used in the textile industry, its use for agricultural applications is limited. The purpose of this study is to produce BC and analyze impact to soil properties for soils of different mineral composition due to the BC application. The hypothesis will be that soils that are primarily sandy in composition will demonstrate the greatest change in soil properties after the application of BC. Methods include incubating AAB from Kombucha with Hestrin-Schramm (HS) medium for 7 days to produce BC. Then adding 1wt% of BC into 100g of 5 simulated soils (Loamy, Silty Clay Loam, Sandy Loam, Loamy Sand, Sandy) to analyze soil water capacity, aggregate stability, and permeability. It is expected that BC will improve the agricultural properties of soil and provide a low cost, eco-friendly way to increase the productivity of crops in deserted regions. Future research will look at what food waste substrate for SCOBY Kombucha produces the ideal quantity of BC and how the addition of organic matter impacts soil properties once BC has been applied.

Tessa Konnari

Determining Activities That Most Positively Engage Dementia Patients



Mentor:
Meg Boyce, American Alzheimer's Association
Sallie Carlin, Willow Towers

Dementia patients often suffer from social withdrawal leading to feelings of depression. Because they can be aware of changes in their memory and cognition, they may isolate themselves because they lose their sense of self accelerating cognitive decline and worsening mental health. However, it may be possible to engage these individuals to improve their quality of life. Dementia is a term for a wide range of disorders that are all progressive conditions which affect memory, thinking, behavior, and interfere with everyday life. The purpose of this study will be to determine what activities most engage dementia patients, and whether the activities positively affect their demeanor. The hypothesis will be that 1. men will engage most with sports related content, and females will engage most with babydolls and wedding themed activities. 2. Dementia patients will be observed smiling more frequently and having a beneficial reaction to whatever they are observing. The methodology will include setting up stations and having multiple raters to be at each station; these raters will observe the patients as they engage with each station. The raters will rate the patients on facial expressions on a 1 to 5 scale, 1 being the worst(sad/frowning) and 5 being the highest(happy/smiley), posture 1 being the worst(closed off) and 5 being the highest (open body posture), and the amount of time patients spend at each station will also be recorded. It is expected that the dementia patients will have a positive reaction to the stations because while short term memory is a major symptom, dementia patients are often able to recall memories from their past. Future research will focus on designing interventions that improve the overall well-being of dementia patients.

Kent Koyama

Evaluating the Protective Effects of Vitamin D on *Drosophila melanogaster* ORMDL Mutants: Implications for Asthma



Over 28 million (1 in 12) people in the U.S suffer from asthma, a chronic respiratory disease that affects breathing by causing inflammation and narrowing of airways. The gene ORMDL3 Is associated with asthma and may work by decreasing Sphingolipid synthesis causing immune cells to react harshly to allergens. Sphingolipids are a major group of lipids that make up cell membranes; the dysregulation of Sphingolipid metabolism can contribute to airway hyperresponsiveness leading to asthma. Vitamin D can potentially rescue the effects of the gene ORMDL3 by increasing Sphingolipid synthesis. *Drosophila melanogaster* is a good model for studying asthma because ORMDL3 has an excellent ortholog ORMDL with a best score and reverse score of 14/14 in Flybase. The purpose of this study is to investigate if vitamin D is effective for suppressing the ORMDL gene in *Drosophila melanogaster*. It will be hypothesized that as the dosage of Vitamin D increases, decreased locomotor function and lifespan will be rescued in the ORMDL mutants. Locomotor ability would be tested because asthma can have systemic effects impacting overall function.The methodology will entail conducting a dose response study where flies where ORMDL is expressed will be fed varying concentrations of Vitamin D. Wild type flies will serve as a control. Locomotor abilities will be assessed using the negative geotaxis assay and percent survival will be tracked using Kaplan Meier Curves. Implications are that Vitamin D could potentially be a natural treatment for asthma and other allergic reactions.

Dylan Kozak

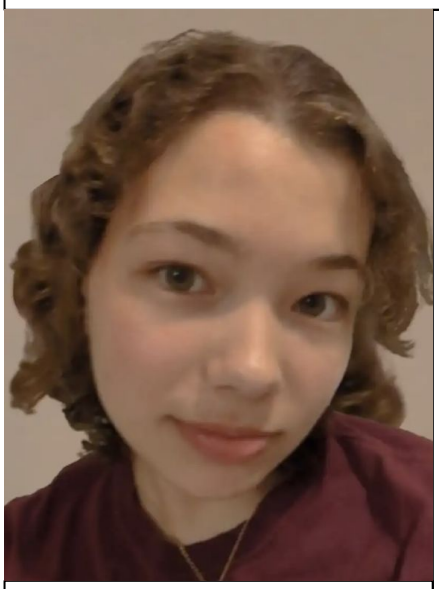
Examining the Impact That Family Narratives About Traumatic Events Have on the Mental Health of Their Children and Grandchildren



The transmission of trauma and anxiety across generations may occur through the memories and narratives shared within families, since stories shape how individuals perceive and process their own experiences of trauma. When family members talk about traumatic events, they often include the emotional reactions and fears associated with those experiences. Children who listen to these stories absorb the actual events, emotional significance, and coping strategies accompanying them. The process may affect how future generations understand their traumatic experiences, which may result in increased anxiety symptoms. The main goal of this research is to examine the impact that family members' stories about traumatic events have on the mental health of their children and grandchildren. The hypothesis predicts that families who frequently discuss their traumatic events and their history of trauma will demonstrate elevated anxiety symptoms in their descendants, meaning children will have a higher incidence of anxiety symptoms. The methodology will use surveys to collect information about family stories of trauma and their well-being, and trauma recall frequency. By surveying different generations from families and asking questions about how these events are discussed and or remembered in the family, find the levels of anxiety or stress they experience from hearing these stories, and how often they talk about these memories or trauma. Families who frequently discuss their traumatic events alongside their history of trauma will demonstrate elevated anxiety symptoms, such as excessive worrying, restlessness, sleep disturbances, and higher ratings on the anxiety scale. This study can create awareness of how listening to family stories of trauma contributes to anxiety and inform about how to develop targeted interventions for affected individuals.

Kinga Kozyra

Genetically Modifying Bacteria to Degrade PET Plastics More Efficiently



Mentor:
Dr. Nathan Crook
Ms. Tianyu Li

The global demand for plastic has increased due to its low price and its wide variety of uses in many sectors. In 2024, 67.7 million tons of plastic was produced and not disposed of properly, leading to plastic pollution and accumulation in the environment. Polyethylene terephthalate (PET) is commonly found in daily used items such as plastic water bottles, taking 450 years to degrade in the ocean. Wen Yi Chia et al. (2020) found that exposure to PET plastic decreases reproduction rates and destroys habitats, leading to extinction in marine animals. Human exposure to plastics through inhalation, ingestion, and skin contact can result in damaging crucial body and brain cells. Recently, it has been discovered that *Ideonella sakaiensis* naturally produces a plastic degrading enzyme, PETase. However, *Ideonella sakaiensis* is a wastewater bacteria which may not survive in saltwater environments. *Vibrio natriegens* (Vn) is a saltwater bacterium that has been genetically modified to produce proteins in saltwater conditions. Current studies have already used Vn to produce PETase but it is time consuming and unclear under what conditions the enzyme is expressed optimally. The purpose of this study will be to determine the optimal temperature and pH levels of the expression of PETase enzymes in *Vibrio natriegens*. The methodology will require the insertion of the PETase gene into Vn and testing the modified organism at 0ºC, 15ºC, 30ºC and 45ºC in exposure to PET powder. 30ºC and 45ºC were chosen because most enzymes favor higher temperatures below 50ºC. The temperatures 30ºC and below were added to mimic the temperatures of the ocean. The pHs used will be 7, 7.5, 8, and 8.5. The pHs close to 8 were chosen to imitate the pH of seawater while the pH of 7 was used since most enzymes prefer more neutral environments. High performance liquid chromatography will be used to obtain the amount of proteins being produced in each condition. Since Vn is a halophilic organism that grows in warm seawater, it is expected that Vn will favor a neutral pH environment of 7 and high temperatures of 45ºC. Future research will expand plastic biodegradation methods by genetically modifying algae to produce PETase in saltwater. Algae could potentially be a better alternative to bacteria because they are already saltwater organisms that can withstand ocean conditions, capture microplastics, and can colonize plastic surfaces, breaking down the plastic polymers and using them as a carbon source for energy.

King Kritikos

Developing Initiative Among Adults with Autism Through Targeted Interventions



Autism Spectrum Disorder (ASD), is a neurodevelopmental condition characterized by persistent challenges in social communication and interaction, along with restricted, repetitive behaviors. Many parents of children with autism wonder if their child will be independent as adults. Though individuals with autism receive resources and help for independent living and self-driven behaviors throughout their high school years, these teachings often regress after they graduate because these behaviors are not institutionalized as they were previously. Many parents have implemented interventions to foster independence. Two such interventions are training with cognitive aids and video modelling. Training in the use of a cognitive aid involves families creating a plan to use items like alarms and calendars to set reminders, used to spark initiative. Video modeling is when a video model of an activity is shown, and a subject is told to replicate this activity, which is used to improve task completion quality. The purpose of this study is to determine if the combination of an intervention used for starting initiative and one used for increasing the quality of a completed task will be more effective than being used separately. The methodology will involve using the interventions: training with cognitive aids and video modeling to teach autistic adults who attend a day program the skills of meal preparation, hygiene, and housekeeping. There will be three cycles; each adult will be taught a skill using only training in the use of a cognitive aid, only video modeling, or using both together. Effectiveness will be measured by latency time in response to prompts, task completion rate, and amount of reminders needed for initiation of a task. It is expected that the combination of interventions will be most effective because they will improve both the quality of the task completed and how independently it is carried out.

Kayli Kyu

Determining whether DNA Methyltransferase Inhibitors Improve Immunotherapy Outcomes in Patients with Advanced Hepatocellular Carcinoma



Immunotherapy is a type of cancer treatment that prioritizes the use of the host's body to kill cancer cells, and has been used in the past decade to treat advanced stages of Hepatocellular Carcinoma (HCC) due to its long-term effects and few side effects. Hepatocellular Carcinoma (HCC) is a common cancer with a primary malignant tumor and is the second ranked in mortality rates across the globe. Because the immunosuppressive tumor microenvironment (TME) in HCC acts as a barrier against immunotherapy, the cancer cells are protected, resulting in the rapid metastasis of HCC. Hypermethylation, the process of adding an abundance of methyl groups, causes rapid alterations in gene expression and leads to an increase in gene mutations, preventing the immune system from recognizing cancer cells. Once this mechanism is identified, DNA methyltransferase inhibitors may be used to reduce hypermethylation and potentially enhance tumor suppressor activity. The purpose of this study will be to determine whether DNA methyltransferase inhibitors improve immunotherapy outcomes in patients with advanced HCC. The hypothesis will be that DNA methyltransferase inhibitors will slow tumor growth and increase the efficiency of immunotherapy in HCC. The methodology will involve the analysis of data from databases such as OncoDB and cBioportal which provide information on how hypermethylation behaves with DNA methyltransferase inhibitors and the interaction between HCC and immunotherapy. A methylation array and bisulfite sequence will be created after examination using bioinformatic analyses of the relations between methylation status, DNA methyltransferase treatment, and immunotherapy response. Based on the data collected, the expected results will be that the use of DNA methyltransferase will prevent hypermethylation and cause an increase in immunotherapy outcomes.

August Lipple Smetana

Evaluating the Potential of Bio-Based Plastics for Use in Protective Sports Equipment



Protective sports equipment is largely composed of high-strength plastics, like polycarbonate or polypropylene, that are enhanced to be particularly durable and impact resistant. These materials are strong yet light, making them ideal for performance. Simultaneously, they are cheap and easy to manufacture in bulk. However, both production and disposal of protective sports gear poses significant environmental problems: extraction of raw materials leads to excess carbon dioxide emissions and old gear ends up in landfills. Current materials can take upwards of 100 years to degrade in natural conditions, whereas bio-based plastics made primarily out of biomass have been developed to decrease production pollution or degrade in less time. Bio-PET (Bio-based Polyethylene Terephthalate), PHA (Polyhydroxyalkanoates), and PLA (Polylactic Acid) based bioplastics have been developed and used in other industries as alternatives. However, these materials have not yet been tested to determine if they can serve as alternatives in personal sports equipment while providing the properties necessary to maintain performance. The purpose of this study will be to determine which bio-based plastic would serve as the most favorable alternative for synthetic materials currently used in protective sports equipment, such as shin guards or other contact sports padding. The methodology will involve testing samples of bio-PET, PHA, and PLA for their impact resistance using the Charpy Impact Test, compression strength using the Uniaxial Compression Test, and hardness using the Vickers Hardness Test. It is expected that Bio-PET will have the best overall performance, especially in hardness and compression strength. Further research will include finding ways to improve the qualities that the most favorable material is lacking, and introduce it into new industries.

Marcus Lipton

Evaluating the Effectiveness of Cysteine on the Inhibition of Ferroptosis



Intracerebral hemorrhages (ICH) are a type of stroke which involves the rupturing of blood vessels in the brain. It is estimated that in 2020, 18.9 million people suffered from ICH. A key factor in the damage to the brain is ferroptosis. Ferroptosis is a programmed cell death due to an accumulation of reactive oxygen species (ROS). There are few therapeutic options to limit ferroptosis. When iron levels are elevated in the cell, they catalyze the production of ROS increasing oxidative stress. Reduced glutathione (GSH) is used by the cell to neutralize ROS however, excess ROS depletes GSH, the substrate for enzyme glutathione peroxidase 4 (GPX4). Without sufficient GPX4, the harmful lipid peroxide cannot be converted into the less harmful lipid alcohol. When lipid peroxides accumulate, ferroptosis occurs. Cysteine, an amino acid that can help with antioxidant functions, is essential for glutathione synthesis and supports GPX4 activity, and therefore may be a therapeutic option. The purpose of this study is to evaluate the effectiveness of cysteine supplementation on performance of the GPX4 enzyme to inhibit ferroptosis. A dose response study will be conducted where *Drosophila melanogaster* which overexpresses the transferrin receptor 1 (TFR1) protein will be tested. An overexpression of the TFR1 protein leads to more intracellular iron because TFR1 brings iron into the cell. This increased amount of iron will induce ferroptosis. Wild type flies will be used as a control. The flies will be fed cysteine supplements in the following dosages: 0, 0.05,0.5,5, and 50 μM. A negative geotaxis assay will be conducted to determine if cysteine leads to improvement in locomotor ability. Ferroptosis causes rapid cell death, if more cells die in the brain, locomotor abilities should be impaired. If cysteine is supported to inhibit ferroptosis in flies, further research in animals with more complex brains could be warranted.

Marissa Lusardi

Determining Whether Theta Waves Mediate the Relationship Between Feedback from Financial Decision-Making Tasks (Win/Loss Outcomes) & Subsequent Risk-Taking Behavior



Neurofinance is a branch of neuroeconomics investigating how the brain processes financial information and makes decisions. It studies how our brains can unconsciously influence our behavior in relation to financial choices, specifically under the conditions of risk, reward, and uncertainty. One key concept in this field is loss aversion—reacting more strongly to losses than gains of the same size. Previous research has shown that people who experience financial losses are more inclined to make riskier decisions in the future in an attempt to gain back what was lost. Studies have also linked increased theta brainwave activity following financial losses, which may signal error processing and learning. This is due to theta waves linking to intuition. However, there is limited research on how loss aversion and neural signals shape decisions in a risk/reward feedback loop. The purpose of this study will be to determine whether brainwave activity—specifically theta and beta waves—mediates the relationship between feedback from financial decision-making tasks (win/loss outcomes) and subsequent risk-taking behavior. It is hypothesized that after losses, theta waves will increase, causing subsequent financial decisions to be riskier due to higher intuition and an emotionally driven state being induced. After a win, a possible increase in beta activity would suggest a more analytical and strategic mindset, leading to more cautious decisions. The methodology will include recording real-time brainwave activity using the Muse EEG headband while participants complete a risk-based decision-making task. Data will be collected on participants' neural responses to wins/losses, focusing on theta brainwave frequencies. It is expected that theta activity following financial losses will be associated with greater risk-taking behavior. Future research may explore a person's implicit risk-taking bias naturally and how that may impact their decision-making regardless of previous wins/losses.

Kerilyn Marsh

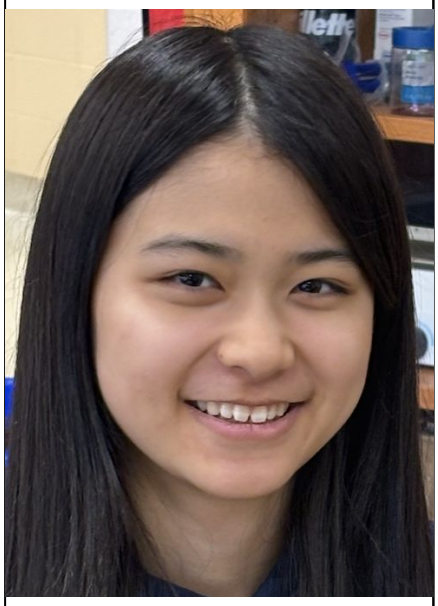
Determining the Concentration of PFAS in Mascaras Following the No PFAS in Cosmetics Act (2023-2024)



A “forever chemical” known as PFAS (per- and polyfluoroalkyl substances) has been increasingly found in everyday makeup products. This is of much concern to consumers due to the potential health risks as they have been associated with high cholesterol levels, changes in liver enzymes, lower antibody response to certain vaccines, more extreme COVID symptoms and thyroid hormone disruption. The No PFAS in Cosmetics Act (2023-2024) banned the intentional use of PFAS from all cosmetic products and packaging by January 2025. However, there is some speculation that PFAS remains due to cosmetic brands’ lack of knowledge and unintentional formation of PFAS due to the reactions between other compounds used in the product. PFAS chemicals have become a growing concern in mascara products particularly, where it is used for its long-lasting and water-resistant properties within the actual mascara as well as the mascara wand to ensure the product doesn't adhere to the packaging. The purpose of this study is to test for the presence of four different PFAS in different mascaras following The No PFAS in Cosmetics Act (2023-2024). Mascara properties being tested are the mascara formula before and after the PFAS ban and natural ingredients compared to artificial. The methodology will involve testing for the presence of specific harmful PFAS’s including Perfluorononyl Dimethicone, Perfluorooctyl Triethoxysilane, C9 15 Fluoroalcohol Phosphate and PTFE in variety of mascaras. Solid phase extraction (SPE) will be used to extract organic fluorine. Then using liquid chromatography-tandem mass spectrometry to analyze the fluorinated compounds. It is expected that mascara products will still contain some PFAS within the product due to PFAS chemical properties. Further research will investigate if there is an efficient way of ensuring the removal of all harmful PFAS to mascara products and packaging.

Miho Masumura

Perfectionism as a Mediator Between Parental Expectation and Perceived Stress in Adolescents



In recent years, perceived stress among high school students has been increasing. One cause of this may be pressure they feel from parental expectation. When students try to meet high standards set by their parents, they may begin comparing themselves to others, which causes stress. This kind of thinking is explained by social comparison theory, in which people judge themselves based on how they measure up to others’ expectation. This research aims to explore whether high parental expectations are related to higher levels of perceived stress in high school students, and whether perfectionism - the tendency to try their best - explains that connection. The relationship between high parental expectation and student stress is established, but it only explains the stress caused by a parent's over-control. However, it is unclear if perfectionism is another mediator of the relationship between high parental expectation and students’ perceived stress levels. This research will use a survey targeting high school students in order to assess their perceived parental expectations, levels of perfectionism, and perceived stress. This will use validated psychological scales, such as Child and Adolescent Perfectionism Scale (CAPS), and the Perceived Stress Scale. In addition, the role of gender and culture will also be examined to determine whether they change how parental expectations affect student stress. Understanding this relationship may help schools and families provide better support for students who exhibit perfectionistic tendencies due to high parental expectations.

Isani Mitra

Determining Whether Humidity During Heat Shock Affects the Function of the Heart in *Lumbriculus variegatus*



Mentor:
Prof. Matthias Schneider
Technische Universität Dortmund

Climate change models predict that the global humidity will rise along with global warming, with up to a 7% increase in humidity possible for each 1℃ increase in global temperature. With temperatures rising by 0.06℃ each year, the potential humidity of the environment may increase by as much as 4.2% each decade. Certain climatic factors, such as temperature, have been confirmed to worsen heart conditions in humans because they increase the strain on the heart. However, humidity has not been directly researched for its effects on the circulatory system of *Lumbriculus variegatus*. *Lumbriculus variegatus* (California Blackworms) are a good organism to study the circulatory system, as they contain blood arteries, have a pulsation rate regulated by the nervous and endocrine systems, and have transparent bodies that allow for their pulse propagation to be viewed under a microscope. The purpose of this study will be to determine whether differences in humidity affect the function of the circulatory system in California Blackworms. The hypothesis will be that an increase in humidity will lead to worsened heart function and a decreased rate of rhythmic contractions. A dose response study will be conducted where *Lumbriculus variegatus* will be exposed to relative humidity levels from 10-90% in intervals increasing by 20% and then exposed to high temperatures of 30 C. Then, their resulting pulse rate will be calculated by counting the basal pulsation rate through a microscope. It is expected that an increase in humidity during heat shock will result in an increase in basal pulse rate in the blackworms. Future research will target more complex animals, such as mice, with circulatory systems more similar to humans in terms of function and organs.

Ines Monti Mihanovich

Synthesizing Alginate Hydrogels: Optimizing Mechanical and Biocompatible Properties for the Repair of Cartilage Tissue



Mentor:
Dr. Tony Chen
Hospital for Special Surgery

Hydrogels derived from synthetic or natural polymers are promising materials for cartilage repair, they currently serve as cell-free implants or scaffolds. PVA (polyvinyl alcohol) has mechanical characteristics more similar to those of cartilage than those of other hydrogels, but cannot integrate well with surrounding cartilage tissue. Naturally derived polymers lack mechanical properties to withstand force, but are biochemically similar to cartilage and support healthy cartilage growth. These properties of hydrogels are controllable through the materials crosslinking density, as it can determine the load-bearing capacity and degradation of an implant. The purpose of this study will be to synthesize alginate hydrogels with varying crosslinking density, to determine the optimal quantity of crosslinking agents to reach mechanical properties to be applied for cartilage repair implants. The hypothesis is that a hydrogel with a higher crosslinking density will have stronger mechanical properties, but have less biocompability. PVA Hydrogels will be prepared through multiple freeze-thaw cycles and act as a control variable, while alginate hydrogels will be prepared with varying amounts of crosslinking agents and curing time. Tests will include mechanical strength, load-bearing capacity, swelling, and degradation rate. Future research will assess long-term in-vivo studies to see the biocompatibility of optimized hydrogels.

Rihanna Mota-Sanchez

Assessing Whether Adolescent Apartment Dwellers Will Experience Less Sleep And Lower GPAs than Their Peers Who Live In Houses



New Yorkers who live in apartments experience disturbances when sleeping such as light pollution and noise. Sirens, restaurants, construction, street activities, and proximity of others in the dwelling are some noise disturbances that detract from a good night's sleep when living in an apartment. These issues are often not present when living in a house. The purpose of this study is to investigate whether living conditions, specifically living in a house or apartment buildings, affects both the quantity and quality of sleep reported by adolescents, and their academic performance. The methodology will involve surveying high school students who live in either an apartment or a house and who attend the same suburban high school in the northeastern United States to assess their sleep habits and academic performance. A two-way ANCOVA will be conducted to determine whether adolescent apartment dwellers will experience less sleep and lower GPAs than their peers who live in houses even though they attend the same school district. It is expected that because of exposure to noise and light pollution, as well as closer living quarters, adolescents living in apartments will report lower quality and quantity of sleep, and their grades will be poorer.

Sophie Olsey

Developing a Mathematical Model That Predicts How Replacing a Percentage of Blacktop with Plastic Could Increase Supply for Roadbuilding



Every year an estimated 20 million metric tons of plastic end up in land, freshwater, and marine ecosystems. This pollution impacts the stability of ecosystems and can be detrimental to the health of organisms in the environment. One possible way to reduce levels of plastic waste in the environment may be to reuse plastic waste in the production of blacktop. A major component of blacktop is asphalt, which is expensive and can be difficult to obtain, leading to construction delays. Studies have shown that approximately 36% of the blacktop can be replaced with plastic without compromising the integrity of the material. However, it has not yet been shown how incorporating plastic into blacktop can impact supply levels for road building. The purpose of this study is to conduct a life cycle assessment that evaluates how replacing a percentage of blacktop with plastic could maximize supplies available for road building and decrease plastic pollution. The methodology will involve creating process flow diagrams to compare the materials and energy inputs and outputs throughout the manufacturing and installation of asphalt made with 36% plastic as binder. Metrics assessed will include: cost of production, purchase price, process mass intensity, energy used in production, energy used in transport, equivalents of carbon dioxide released, and price per cubic foot of asphalt. Machine learning will be used in conjunction with the life cycle assessment to maximize the efficiency and effectiveness of extending available resources using plastic repurposing and assess the environmental impact. Further research will investigate how the addition of plastic in black top affects long-term road performance.

Samuel Parsley

Determining Whether Liposomal Glutathione Can Counteract the Negative Symptoms of PE MP's on Larval Crawling and Adult Climbing in *Drosophila melanogaster*



Each week, the average person ingests about 5g of plastic from various sources-a number rising with plastic use. In humans, plastic accumulation can impair daily functions, causing respiratory and skin irritation, cognitive decline, and cellular damage that disrupts the body's balance and homeostasis.Liposomal glutathione is an antioxidant that protects cells from reactive oxygen species (ROS) and supports liver detoxification by removing toxins like BPA and phthalates from MP's and other substances. Because it is food grade, it can potentially be ingested and used to combat the negative symptoms that stem from MP's. While much research exists about the effect of microplastics on marine organisms, little exists on terrestrial organisms. This study aims to determine whether liposomal glutathione can counteract the negative effects of polyethylene microplastics (PE MP's) on larval crawling and adult climbing in *Drosophila melanogaster.* The methodology will involve raising wild type Drosophila melanogaster on a PE MP diet of 10 mg mL 1 PE MP which Ranjan et al. (2024) showed decreased crawling and locomotor function. 24 hours after hatching, larva will be tested in the crawling assay then transferred for 24 hours to food containing liposomal glutathione and tested again. The amount of liposomal glutathione will differ in concentration from 0mM, 1mM, 2mM, 3mM, and 4mM. Similarly, adult flies will be raised on the PE MP diet for 48 hours, tested in the negative geotaxis assay, and then transferred for another 48 hours onto the liposomal glutathione diet. A second negative geotaxis assay will assess if liposomal glutathione rescues the effects of microplastic exposure. It is expected that liposomal glutathione will mitigate the effects of PE MP's in *Drosophila melanogaster*, meaning that it could potentially be a treatment for symptoms associated with MP toxicity.

Gabriela Perez Capcha

Computationally Discovering Target Drug Candidates for C1GALT1 to Develop Treatments for Ewing Sarcoma



Mentor:
Dr. Mubasher Hassan
The Steve and Cindy Rasmussen Institute for Genomic Medicine

Ewing's Sarcoma (EwS) is the second most common bone cancer in children and adolescents. It is a highly aggressive cancer driven by the oncogenic fusion-protein EWSR1::FLI1. As a transcription factor, it is undruggable. Factors that promote EWSR1::FLI1 expression such as C1GALT1 are potential drug candidates. Current treatments: chemotherapy, are ineffective in patients with relapsed disease. Computer Aided Drug Design (CADD), the process of using computational methods and tools to discover, design, and optimize new therapeutic molecules, can overcome the problems with cost and time in standard novel drug development. This study aims to target C1GALT1 to identify potential EwS-targeted drugs using computer-aided drug design. The methodology entails 6 steps: 1. producing a 3D model of C1GALT1 from the Protein Data Bank. 2. FDA-approved drugs will be screened against the reference drug Itraconazole, an FDA-approved drug that has been shown to inhibit the growth of human EwS cell lines in culture. The screened drugs will be ranked on SwissSimilarity based on their predicted similarity to Itraconazole. 3. Prankweb or the Protein Databank will be used to predict the location of the active binding site residues of C1GALT1. 4. Best-screened drugs will be molecularly docked to C1GALT1 through pyRx and Autodock based on lowest binding energy (kcal/mol) and binding interaction patterns between ligands and target proteins. 5. Pharmacogenomics networks of genes potentially implicated in Ewing Sarcoma, will be created using the Drug Gene Interaction Database (DGIdb) and Drug Signatures Database (DSigDB). 6. The best screened and closely related drugs will be produced in molecular dynamics (MD) simulations to examine residual backbone flexibility through the Groningen Machine for Chemicals Simulations (GROMACS) It's expected C1GALT1 will theoretically be a stable and effective target drug candidate for EwS. Further bioinformatics studies may provide more information about the drug's behaviors through simulations.

Amalia Proctor

Determining the Effect of Increased Time Spent Engaging in a Guided Painting Activity on Mindfulness and Mental Wellbeing



In 2022, 23.1% of American adults and 49.5% of adolescents reported living with mental illness. This amount has greatly increased throughout the past decade, particularly in adolescents and young adults, due to the increased prevalence of social media, as well as isolation during the COVID-19 pandemic. Past research has shown that viewing art and participation in artistic activities has positive effects on an individual's mental health, likely due to increased mindfulness and expression of emotion. Mindfulness is the state of being present in the moment, and aware of one's own emotions, surroundings, and physical sensations. The purpose of this study will be to determine how length of time spent participating in an artistic activity impacts an individual's mindfulness and symptoms of wellbeing. The methodology of this study will involve instructing high school art students in similar ten minute, thirty minute, and hour long painting sessions. At the beginning and end of each session, each participant will fill out modified versions of the Positive and Negative Affect Scale and State Mindfulness Scale for Physical Activity. The scale will be modified to include the feelings "calm", "focused", and "in touch with my emotions". It is expected that increased time spent on an art activity will increase the reported wellbeing and mindfulness of participants. Further research will identify the effectiveness of different art mediums, particularly 2d versus 3d.

Charlotte Reville

Determining The Effect of Cytokines on Immune Related Adverse Events (irAEs) That Occur in Patients Undergoing Monoclonal Antibody Treatment on BRAF Mutant Melanoma



BRAF mutant melanoma is a type of skin cancer that is very fast developing. Treatment for this is monoclonal antibody (mAbs) drugs, antibodies that inhibit the activation of the targeted proteins. These treatments are effective but come with high amounts of immune related adverse events (irAEs), also known as side effects. This often leads to a high toxicity in patients, too many irAEs, and leads to discontinuation of treatment. Cytokines are proteins that play a crucial role in regulating the immune system. It has been shown that cytokines are a way to predict the amount of irAEs that will occur in mAb treatment in melanoma. This has not been tested in BRAF mutant melanoma. The purpose of this study is to determine the effect of cytokines on immune related adverse events (irAEs) that occur in patients undergoing monoclonal antibody treatment on BRAF mutant melanoma. The hypothesis of study will be when there is a high amount of cytokines there will be a lesser amount of irAEs leading to a longer duration of treatment therefore a more effective treatment. This study will be conducted by examining existing data of patients who have BRAF mutant melanoma, underwent mAb treatment and includes patient cytokine levels. By doing this, the effect of cytokine levels on the amount of irAEs can be determined. It is expected that when there are high levels of cytokines there will be a lower amount of irAEs. Further research includes looking at the different mAbs and seeing how they influence the effect of cytokine levels on the amount of irAEs, ultimately giving an idea of the demographics that are best suited for each mAb. This will allow doctors to provide patients with a personalized treatment that is effective for the individual.

Emily Savocchi

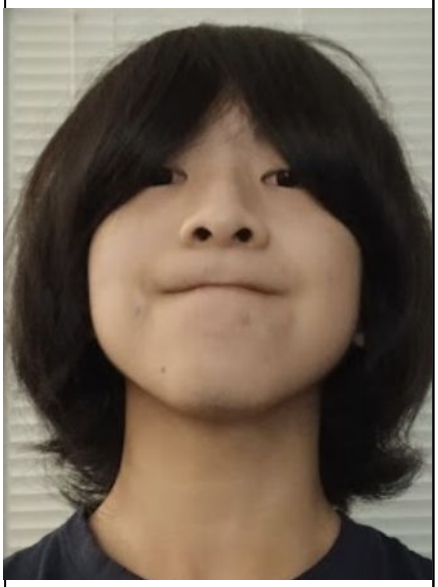
The Extent to Which Eliciting Stress Alters Brain Waves in Convergent and Divergent Tasks



Convergent and divergent thinking represent two ways to approach cognitive processing. Convergent thinking is directed toward identifying a correct solution, associated with beta and gamma brainwaves. Conversely, divergent thinking involves generating a range of potential outcomes and solutions, linked with alpha and theta waves. Stress influences the ability to focus and think creatively. Research has shown that different brainwave frequencies affect cognitive processes, such as problem solving, which will improve or impair cognitive processes. However, studies have not looked if stress alters brainwave activity associated with convergent and divergent thinking tasks. The purpose of this study is to determine the extent to which stress alters brainwave activity during convergent and divergent thinking tasks. The methodology will have participants complete the Remote Associates Test (RAT) measure of convergent thinking and the Alternate Uses Task (AUT) measure of divergent thinking while wearing the Muse device. EEG data will be collected before, during, and after each task, both without stress and with stress elicited by time pressure. Stress is expected to have a greater impact on divergent thinking because it is likely to reduce alpha and theta brainwave activity, which are critical for creativity. Therefore, stress will impact performance more on the RAT task on the AUT task.

Raito Sekine

The Role of Cognitive Distortions as a Mediator Between Self-Efficacy and Musical Performance Anxiety



Musical performance anxiety (MPA) manifests as physiological, cognitive, emotional, and behavioral symptoms of anxiety that occur before and during performances. Intense MPA can directly damage the career and well-being of musicians, but much remains unknown about the condition. The negative relationship between self-efficacy, one's belief in their ability to execute certain tasks, and MPA has been established by multiple studies. Cognitive distortions are irrational thoughts and assumptions, such as overgeneralization, that can negatively affect someone's mental well-being. These thoughts can cause excess anxiety and can be found more frequently in people with certain anxiety disorders. Because MPA is linked to the presence of an audience, cognitive distortions, especially those that focus on the audience's judgment, could have a significant negative influence on a musician's mental state while performing. The study will analyze the potential role of cognitive distortions as a mediator between self-efficacy and MPA. This means determining how self-efficacy's impact on cognitive distortions could explain the relationship between self-efficacy and MPA. The methodology will involve the collection and analysis of data from students who are involved in a high school music program. It is expected that a negative relationship between self-efficacy and MPA will be observed, with cognitive distortions having a significant mediating role. The confinement of MPA symptoms to performance environments means that it is uniquely distinguished from social anxiety disorder, which poses interesting questions regarding the development of MPA compared to social anxiety. The implications of this research could help identify similarities between anxiety disorders and contribute to treatment methods of MPA.

Emma Shuli

Evaluating the Link Between Regeneration and Memory: Testing Bioelectric, Light, Vibrational, and Probiotic Factors in *Dugesia planaria*



Mentor:
Dr. Oné R. Pagán
West Chester University

Planaria can regenerate their bodies more rapidly with the application of electricity as it helps guide their stem cells to the injured area more quickly. Javeed et al. (2021) found that this phenomenon is also applicable to humans in their peripheral nerve regeneration. Additionally, electrical stimulation can also aid in enhancing memory. A study carried out by Reinhart, Robert M. G., and John A. Nguyen (2019) showed that electrical stimulation of the brain can enhance memory so dramatically that it can enable a 70-year-old brain to complete the same tasks as that of a 20-year-old brain. The purpose of this study will be to determine if the correlation between regeneration and memory exists, and if so, what other factors, aside from electricity, could potentially speed up regeneration to then be able to enhance memory as well. The hypothesis is that regeneration does correlate with memory and infrared (NIR) light will be most effective in promoting regeneration, thus enhancing memory. The methodology will involve cutting off the posterior portion of planaria and placing them in four different enclosures: 1 with NIR light installed, 1 with a pneumatic vibrator, 1 with a bioelectrical machine, and the last group will be fed a consistent diet of fermented foods rich in probiotics. The regeneration of the worms will be monitored and recorded each week. After the data is collected, the most impactful factors will be applied to a different group of planaria brains. They will undergo a series of tests before and after exposure to determine whether these factors can also enhance memory. Further research will test other factors on regeneration speed such as sleep. These factors will also be tested on different lobes of the brain to determine how they can potentially enhance memory.

Gabriella Smyth

Determining the Difference in Microbial Diversity Between International and Local Airports



Surfaces at airports are touched by thousands of travelers daily, leading to a build-up of exposure to bacteria and fungi. This means that the potential for microbes to cross-contaminate such as bacteria, fungi, and pathogens is at a higher rate, raising health risks, especially in international hubs. This study will look for differences in the concentration and diversity of bacteria and fungi across international, national, and local airports. It is hypothesized that there will be a greater variety of microbes in international hubs than in local airports because international airports receive travelers from a wider range of regions, increasing the chance of exposure and transmission of diverse microbes. To test the hypothesis, samples will be collected from porous materials such as leather and vinyl seat coverings, drywall, and carpeting in international, national, and local airports in the Northeastern US. Bacterial and fungal samples will be cultured separately using Sabouraud dextrose agar plates for fungi and Petri dishes filled with agar for bacteria. The concentration and diversity of microbes will be determined using colony counts and molecular analysis through PCR (Polymerase Chain Reaction). Bray Curtis models will be created to quantify the difference in species composition between the different airports. In addition, microbial counts and types will be compared across material types. These findings could inform future research on strategies to reduce microbial contamination in public spaces. Results may lead to recommendations for improved cleaning practices and material selection better fitted for high-traffic areas such as airports. In addition, identifying specific materials that contribute to higher fungal concentrations could help guide travelers and designers in making better material choices. Future research may focus on material porosity or other strategies to reduce microbial growth and transmission.

Rosa Strino

The Effect of L-Carnitine and Pantothenate Supplementation on UAS-ENOK Knockdown *Drosophila Melanogaster,* A Model for Kat6A



Mentor:
Prof. Paul C. Marcogliese
University of Manitoba

Kat6A is a very rare genetic mutation that occurs during pregnancy. As of March 19, 2025, there are over 500 diagnosed cases of this syndrome worldwide. However, there is no exact number due to potential misdiagnosis and undiagnosed cases. Symptoms/signs of Kat6a include but are not limited to: autism, delayed speech, heart defects, and bone abnormalities. Kat6a is associated with reduced histone acetylation and leads to altered gene expression patterns and down regulation in essential proteins in cell metabolism. L-Carnitine, found in red meat, and Pantothenate (Vitamin B5), when combined may help with improving mitochondrial function, increasing histone acetylation, and correcting protein / transcriptomic expression patterns, potentially fixing the effects of the syndrome. Histone Acetylation is important for gene expression and cellular processes. When protein and transcriptomic patterns are corrected, it may help restore the gene expressions in Kat6A.The purpose of this study will be to determine whether L-carnitine and pantothenate taken together will improve locomotive function of the *Drosophila melanogaster* possessing the ENOK gene, which is an ortholog of KAT6A. The hypothesis will be that a combined diet will although not reverse the mutation, it hopefully will improve the defects. The method will involve crossing flies containing the UAS-ENOK and the ELAV-GAL4, a promoter that drives expression in neurons. Because Kat6a is associated with motor skill delays, the success of the diet will be measured by using the negative geotaxis assay. The expected outcomes will be for the fly to improve the climbing ability after being treated with these vitamins because they will improve histone acetylation and gene expression.

Lily Tse

Determining the Extent to Which the Amino Acid D-leucine Influences Number, Severity, and Recovery Time of Seizures After Heat-Induced Paralysis in para[ST76] Mutated *Drosophila melanogaster*



Dravet Syndrome is a rare genetic form of epilepsy which causes frequent prolonged seizures as well as other cognitive and motor skill issues. Dravet's Syndrome is caused primarily from a mutation in the SCN1A gene and is a refractory form of epilepsy which means that the syndrome is treatment/medicine resistant. This gene affects sodium channel, NaV1.1 channel, function, thus leading to an impulse abnormality in the brain which causes febrile seizures from the lack of proper gene function. D-leucine is an amino acid that plays a crucial role in regulating gene expression and could potentially rescue impaired sodium ion flow into neurons due to mutations in the SCN1A gene. Since *Drosophila melanogaster* has a well-characterized ortholog of the SCN1A ortholog called paralytic (para) that experiences temperature dependent paralysis, it is a good model for Dravets. The purpose of the study will be to determine the extent to which the amino acid D-leucine influences number, severity, and recovery time of seizures after heat-induced paralysis in para[ST76] mutated *Drosophila melanogaster*. It is hypothesized that D-leucine will reduce number, severity, and recovery time of seizures after heat-induced paralysis in para[ST76] mutants. Methods involve crossing mutants with the para(ST76] gene with the promoter elav-GAL4 so the gene expresses in neurons. The *Drosophila* crosses will be raised on 0 mM, 1 mM, 5 mM, and 10 mM D-leucine concentrations. Seizure-like symptoms will be invoked through heat stimulation. Then, the seizures will be measured by observing the time for, the number of seizures the flies endure, and the severity of the seizures. Future research includes investigating L-leucine to see if the D- versus L- forms have a significant difference on the SCN1A gene/ sodium channel.

Jack Weinberg

Determining Whether a Correlation Exists Between the Hardness of Different Artificial Turfs Under Various Temperature Conditions and Lower Extremity Injury Rates in the National Football League



Mentor:
Prof. Zachary Binney
Emory University

According to the National Football League (2024), lower extremity injuries account for about 33% of all NFL injuries and 50% of lower extremity injuries are non-contact. Lower extremity injuries are often tied to the type of playing surface, with injury rates occurring on artificial turf being higher than on natural grasses. However, even if the same surface is used at different fields, the injury rates are not the same. This phenomenon may be explained by temperature differences during games at the different stadiums. Temperature may impact the surfaces' hardnesses which could influence the amount of strain a player experiences when running on the field. This is important because higher impact forces may lead to more injuries. The purpose of this study is to determine the hardness of UBU Turf and FieldTurf under different temperature conditions and compare the hardness with the injury rates at stadiums with these types of turf. It is hypothesized that turfs tested at colder temperatures will be harder and associated with higher rates of lower extremity injuries.The methodology will entail testing the hardness of different turfs at 7.2°C (45°F) and at 21.1°C (70°F). The two surfaces will be acclimated to their appropriate temperatures before testing using a REVSCI incubator. The hardness of the surfaces will be determined by utilizing the Clegg Soil Impact Tester. For a real-world application, the results will then be compared to the injury rates at the various stadiums to determine the relationship between surface temperature rate and injury rate. It is expected that the surface at 21.1°C will be softer and there will be fewer injuries reported than the surface at 7.2° C. Further research will investigate if heating the playing field will lead to a decrease in injury rate.

Sasha Weiner

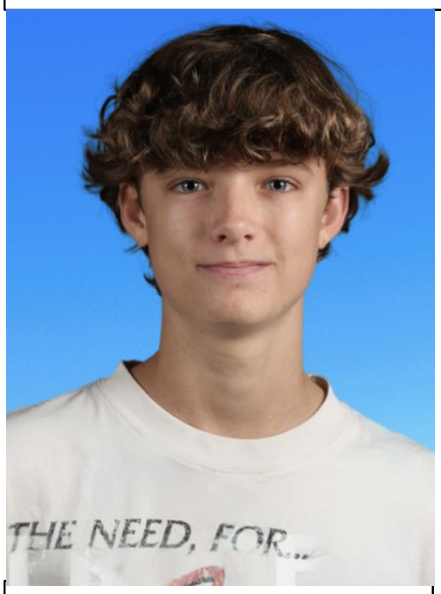
Determining if Parental Involvement Will Mediate the Relationship Between Exposure to Violence in the Media and an Adolescent's Mental Well Being (MWB)



Adolescents today have unpredicted access to newspapers, video games, social media and TV shows/news; which are all opportunities where they can be exposed to war or violence. According to Leiner, M et al. (2016), excessive exposure to viewing violent events in media can have a profound effect on children's sense of security, leave strong feelings of vulnerability, and result in emotional and psychological trauma. Parents have the ability to regulate this exposure, and so they must monitor media consumption and encourage positive media choices. Implementing these effects will lead to an increase in their child's mental well being. As a result, this study aims to highlight the importance of active parental engagement in mitigating the effects of this exposure. The purpose of this study will be to determine if parental involvement will mediate the relationship between exposure of children to violence in the media and mental well being (MWB). An absence of parental involvement will serve as a mediator in the relationship between exposure to violence in the media and adolescents' mental well-being. After IRB is obtained, the methodology will include a survey sent out to teens, where they will rate their exposure to violence in the news, on social media and while playing video games using a likert scale (1-5). They will also rate their parents involvement in their lives using the youth research and evaluation parental involvement scale and their Mental Well-Being using The Warwick-Edinburgh Mental Wellbeing Scale - WEMWBS. Demographic information will also be collected. Future research could examine how cultural background or socioeconomic status influences the relationship between media violence exposure, parental involvement, and adolescent mental well-being. This could help identify if certain groups are more vulnerable or resilient to these effects.

Flynn Williams

Investigating Possible Gene Pathways Regulated by SNPs Associated With OCD



Mentor:
Dr. James Knowles
Rutgers University

Obsessive compulsive disorder (OCD) is a neuropsychiatric disorder characterized by recurrent, unwanted thoughts and/or repetitive behaviors. It is relatively common with a 1-3% prevalence, often begins in childhood, and is commonly paired with comorbid disorders such as tics and anxiety. Although recent studies have discovered multiple single nucleotide polymorphisms (SNPs, places of genetic variation within a population) significantly associated with OCD, we are unaware of the genes those SNPs regulate, which is a crucial step in discovering the systems responsible for the disorder. Thus, the purpose of this study will be to investigate possible gene pathways regulated by the SNPs associated with OCD. It will be hypothesized that because OCD is a polygenic disorder with SNPs significantly associated across many chromosomes, many different systems and interactions will be discovered as being responsible and associated with OCD, namely the glutamatergic and serotonergic systems. The methodology will entail a pathway analysis utilizing computer programs like QIAGEN and GeneMania and statistical analyses that will be used to determine the probability of certain pathways being regulated by SNPs associated with OCD. The SNPs that will be investigated will be derived from a recent meta-analysis and genome-wide association study from Strom et al (2024) which has identified 15 different SNPs significantly associated with the disease. It is expected that multiple systems will be identified due to the polygenic nature of OCD, but results indicating that glutamatergic and serotonergic genes are being regulated by these SNPs will support current treatment methods attacking these systems. Further research will utilize the genes tagged by the study to evaluate interactions between multiple genes and different systems that will enable us to create better, specific medication for OCD.

Sophie Wong

Determining the Effect of Folate on Locomotor Ability in the Offspring of Female *Drosophila melanogaster* Exposed to Per- and Polyfluorinated Residues



PFAS, otherwise known as per and polyfluoroalkyl substances, are a group of synthetic compounds found in many common “non-stick” products sold worldwide. These compounds consisting of carbon fluoride bonds are almost impossible to destroy. PFAS alters gene expression through DNA methylation, affecting genes related to immune response and development. It has been found that exposure to PFAS has caused epigenetic changes in *Drosophila melanogaster*, resulting in lasting transgenerational impacts such as locomotive disruption, a sign of neurotoxicity. The purpose of this study will be to determine the ability of supplementary folate to reduce the locomotive effects in the offspring of female *Drosophila* exposed to per and polyfluorinated residues. The hypothesis is that flies treated with higher amounts of supplementary folate will have improved locomotor abilities because folate aids in the production of methyl donors that influence genes related to coordination/motor skills. The methodology will involve placing microwavable food packaging products under microwave stress for varying amounts of time (minutes), then collecting the perfluorinated residue from groups. Samples of the residue will be placed under FTIR to determine the presence of C-F bonds. Based on the results from this study, the concentration that produces the most observable effects will be given to 4 groups of female flies. Each group will be raised on one of the following concentrations of folic acid: 0.0, 0.9, 3.0, or 9.0 µg folic acid/mL. The female flies will then mate with non exposed male flies. The locomotive abilities of the offspring will be measured using the negative geotaxis assay. It is expected that higher concentrations of folic acid will counter the effects of the PFAS, improving the locomotor abilities of flies. Future research will identify if other types of B vitamins or antioxidants can reduce the neurological transgenerational effects of PFAS.

Fujiko Yamada

Determining the Effectiveness of Tannic Acid in Removing Microplastics from Soil Samples



Microplastics are broken down plastic particles that pollute various environments. The spread of microplastics have been found to affect the quality and structure of soil. A hydrolyzable tannin called tannic acid is richly found in multiple sources such as nutgalls, oakwood, various fruits, and more. The presence of tannic acid in water has been found to remove about 95.2% to 99.9% of microplastics through filtration. Tannic acid is an important source for the process of removing microplastics since it is able to capture small particles and is able to coagulate microplastics through forming metal-phenolic compounds. After the coagulation occurs, a separation method will still be needed in order to physically extract the coagulated microplastics. The purpose of this study will be to determine if tannic acid will aid in the removal of microplastics present in soil samples. The hypothesis will be that the microplastics present in the soil samples will be removed due to the presence of tannic acid solution. The methodology will include thoroughly mixing the same amount of microplastics into each soil sample. Each sample will be a different type of soil (clay, sand, loam). Tannic acid will be extracted by steeping plant materials in hot water at 80^{o}C. Different concentrations of tannic acid solution will be used to test soil samples. Every sample will be given time to fully absorb the solution allowing the microplastics to coagulate. An olive oil-based separation method will be used in order to physically extract the microplastics from the soil samples. This method will ensure that microplastics will be removed since the oil has a strong affinity with polymers. It is expected that tannic acid will be a helpful source when removing microplastics from soil. Further research will investigate if tannic acid is able to decrease the buildup of harmful elements in microplastic contaminated soil.

William Yates

Using a Supervised Learning Model to Locate the Directional Angles of Head Impacts in Collegiate Football Players with the Highest Probability of Concussion



In collegiate football, up to fifty percent of concussions go completely undiagnosed and without the proper care. A concussion is an impact to the head that results in a mild traumatic injury, altering the brain's function. AI (Artificial Intelligence) algorithms can analyze vast amounts of video data to identify patterns and insights that would be difficult for humans to detect. In doing so, it can provide coaches and athletes with data-driven insights to make better decisions about when to leave a game. The purpose of this study will be to code an AI model that is capable of analyzing existing athletic video footage to identify the angle of head impacts that resulted in concussion. Supervised learning will be implemented where the algorithm will be given short video clips that are labeled as either a concussive head impact or a non-concussive head impact. The methodology would involve training an AI model with past video footage from various games of collegiate American football. The AI model would have the purpose of locating the angle of impacts to the head that resulted in concussions of various severities allowing it to ultimately predict whether a certain angle of head impact will likely result in a concussion. Future research would improve upon the AI model, allowing it to analyze live game footage, determining a risk for concussion in real time, effectively saving players from further injury.

Sydney Young

Determining the Extent to Which Social Stress, Physical Stress, and Cognitive Overload Impact Memory Encoding and Retrieval



Mentor:
Dr. Matt Nichols
Psychologist

Many teenagers are exposed to stress during various experiences in their day-to-day lives. This stress can be social stress in response to social structures and interactions, physical stress in response to physical pain or discomfort, or cognitive overload stress due to exposure to excessive external stimuli. Stress activates the hypothalamic-pituitary-adrenal (HPA) axis, which results in secretion of the stress hormone cortisol. Cortisol increases heart rate and can attach to hippocampal receptors, impacting both memory encoding and retrieval. However, a direct comparison of the impact of social, physical, and cognitive overload stress on both memory encoding and retrieval has not yet been studied. The purpose of this study is to determine the extent to which social, physical, and cognitive overload stress affect memory encoding and retrieval. The methodology will involve three sessions across three days. In the control session, participants will undergo the Rey Auditory Verbal Learning Test (RAVLT) with no stress. In the encoding stress session, participants will be exposed to a stressor before the RAVLT. In the retrieval stress session, they complete the RAVLT without stress during encoding, but undergo the stressor before delayed recall. During the stressor, participants will be exposed to a serial number task with the Trier Social Stress Test (TSST), Cold Pressor Test (CPT), or excess sound and bright light for social, physical, and cognitive overload stress, respectively. Self-reported stress levels via the Visual Analogue Scale (VAS) will be collected at the beginning and end of each session, with heart rate measured throughout. It is expected that cognitive overload will most drastically impact both memory encoding and retrieval. Future research will identify ways to reduce the impact of stress on both memory encoding and retrieval, as well as examine gender differences on the impacts of stress on memory.



HARRISON HIGH SCHOOL
SCIENCE SYMPOSIUM

Some questions to ask students as you visit their posters:

1. **How did you get your idea? Why were you interested?**
2. **Did you work with a mentor?**
3. **What was the most rewarding part of your research?**
4. **What was the most challenging part of your research?**
5. **What are your next steps?**

Special Thanks:

The students and faculty of the Harrison Science Research program thank you for coming to this year's Symposium.

We hope you enjoyed the night as much as we enjoyed sharing our work with you!

Questions:

If you have any questions about the Research Program and/or tonight's event, please contact:
Ms. Allison Blunt at: blunta@harrisoncsd.org
Ms. Mary Blount at: blountm@harrisoncsd.org