

STUDENT **STEM** RESEARCH & INNOVATION SYMPOSIUM

"IGNITING CURIOSITY,
INNOVATION, AND
COLLABORATION"

MORGAN STATE
UNIVERSITY

MAY 23
2024



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Dear Guests,



On behalf of The Ingenuity Project and Baltimore Polytechnic Institute, we extend our gratitude for your support of the 2024 Student STEM Research & Innovation Symposium.

This year's event is a testament to the exceptional talent and dedication of our students to Science, Technology, Engineering, and Math (STEM) research. Their commitment to curiosity, innovation, and collaboration is truly inspiring.

Research has always been at the forefront of our curricular pursuits at the Polytechnic. Since the founding of the school in 1883, our students have consistently demonstrated a desire to push the boundaries of science and technology for the betterment of science and engineering, and society as a whole. As the programs have adapted and changed over the decades, one constant remains: Our students hold vast amounts of potential that need to be allowed and encouraged to thrive.

The success of this showcase would not be possible without the collaboration between The Ingenuity Project and the AP Capstone program at Poly. This partnership exemplifies the power of combining resources and expertise to create exceptional learning experiences for all students.

Earlier today, we hosted the inaugural Student STEM Leadership Conference for 300 ninth and tenth grade students. The conference featured inspiring and interactive sessions led by university faculty, STEM community leaders, and alumni, providing students with invaluable insights and fostering their passion for STEM fields.

We would also like to express our sincere appreciation to our generous donors and the supportive families of our students. Your contributions are instrumental in enabling these future innovators to thrive.

Thank you once again for joining us tonight. Together, we celebrate the remarkable achievements of our students and look forward to witnessing their continued success.

Sincerely,

Lisette S. Morris
Executive Director
The Ingenuity Project

Josh Headley
AP Capstone Coordinator
Baltimore Polytechnic Institute



Schedule of Events

5:00 - 6:00 pm	Student Poster Viewing and Refreshments
6:05 - 6:50 pm	Welcome and Alumni Panel
6:55 - 8:10 pm	Senior Ingenuity and AP Capstone Oral Presentations

AP Capstone Research & Ingenuity Senior Oral Presentations

6:55 - 7:10

1. **Room 210 A - Miya Mese-Jones** Creating Aortic Repairs with Virtual Surgical Planning (ING)
2. **Room 210 B - Stephenie Providence** Developing Cryptochrome Optogenetic Mutants to Optimize Protein Recruitment in Cell Migration (ING)
3. **Room 212 A - Zoe Hong** Split-Second Strategy: Effects of Time Pressure on Confidence and Accuracy in Decision-Making (ING)
4. **Room 212 B - Oluwadarasimi Gabriela Obafemi-Ajayi** The Undiscovered Perspectives of the School Nurse Role (APC)
5. **Theater - Camille Coffey** Exploring Lipoprotein De-fish-encies as a Result of Genetic Mutations (ING)
6. **Ballroom A - Tsion Tariku** East Baltimore Redevelopment Processes and their Residential Impact (APC)

7:15 - 7:30

1. **Room 210 A - Ava Pevsner** Decision Making: How the Path to a Consensus is Represented in the Brain (ING)
2. **Room 210 B - Cecelia Reichelt** Analyzing Blue Crab Diets to Understand Biodiversity in the Inner Harbor (ING)
3. **Room 212 A - Ruby Polansky** The Ants Go Marching One by One to Move Blocks: Harnessing Collective Behavior to Manipulate Ants (ING)
4. **Room 212 B - Brandon Isbell** Developing a Method to Investigate Color Preference and Circadian Rhythm in *Drosophila* (ING)
5. **Theatre - Lavender Hall** Efficacy of Nonsteroidal Aromatase Inhibitors on the Sex Differentiation and Gonadal Development of Female Zebrafish (ING)
6. **Ballroom A - Lance Shrum** The Repetition of History and its Current Impact on Global Politics (APC)

Schedule of Events

7:35 - 7:50

1. **Room 210 A - Lindsey Funes** Investigating the Immigrational Stance and Identity of Minors in the US (APC)
2. **Room 210 B - Maya Molina** Investigating Plant-Plant Interactions Under Drought for Two Grassland Species (ING)
3. **Room 212 A - Antonio Romerio** Riemann and Lebesgue Integration (ING)
4. **Room 212 B - Ruby-Rose Kumodzi** The Retraumatization of Black Students in the Classroom (APC)
5. **Theatre - Louis Lapp** FFTstack: Integrating Fourier Transform and Residual Learning for Arctic Sea Ice Forecasting (ING)
6. **Ballroom A - Ariana Stephens** A Gendered Analysis of Discrimination on Black Female Pediatricians in Medicine (APC)

7:55 - 8:10

1. **Room 210 A - Penelope Schenkel** Examining Sociodemographic Disparities in Preventive Measures Against COVID-19 (ING)
2. **Room 210 B - Kei Leigh Mese-Jones** Reconstructing Earth's Past: Assessing the Impact of Diagenesis on Upper Ediacaran Sedimentary Rocks (ING)
3. **Room 212 A - Jackson Dungee** The Zophobas Morio: A Possible Solution to the Plastic Crisis (ING)
4. **Room 212 B - Amelia Overton** Development of a Novel Analytic Assay for the Detection of Disinfectant Byproducts in UV Filters and Swimming Pools (ING)
5. **Theatre - Maria Chen** Developing 6-Gingerol and EGCG Loaded Liposomes to Target Triple Negative Breast Cancer (ING)
6. **Ballroom A - Lamine Niang** Teenage Reception to Adult Animation (APC)

Ingenuity Project - (ING)

AP Capstone Research - (APC)

Ingenuity and Poly Alumni Panelists

Thank you to our special Ingenuity and Poly alumni panelists for sharing your STEM journeys.



Gabriel Grell

Class of 2014

Astronomy PhD Candidate,
University of Maryland
Graduate Research Assistant at
NASA Goddard Space Flight Center



Phoebe Sandhaus

Class of 2015

PhD Candidate,
Penn State University
Astronomy and Astrophysics



Jonathan Cohen

Class of 2018

Engineer III
Baltimore County DPW&T,
Water Design Section.



Bria Macklin

Class of 2011

Postdoctoral Fellow at
Gladstone Institutes

STEM STUDENT LEADERSHIP CONFERENCE

Igniting Curiosity, Innovation, and Collaboration

To mark Ingenuity's 30th Anniversary milestone, the AP Capstone Research program and The Ingenuity Project joined forces to celebrate outstanding student research at Baltimore Polytechnic Institute. Together, they hosted an inaugural STEM Student Leadership Conference on the morning of the Symposium at Morgan State University.

The conference immersed nearly 300 Capstone and Ingenuity students in interactive sessions exploring key areas of STEM and Leadership. Students also participated in a poster session showcasing their research projects and a luncheon featuring conversations with STEM professionals from various fields.

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Honoring a Legacy of Support

A B E L L F O U N D A T I O N

As we celebrate Ingenuity's 30th anniversary, we thank The Abell Foundation for its firm belief in STEM Excellence for Baltimore City Public School students. In an interview conducted by seniors Camille and Louis, Robert "Bob" Embry, President of The Abell Foundation, reflected on the impetus for The Ingenuity Project and its accomplishments over the past three decades.

“ It was an effort to keep ambitious and talented Baltimore students in the public school system and focus on math and science which are a major issue for national success and humanity's success in the coming centuries. ”

- **Robert Embry**



Celebrating
30 YEARS





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Ingenuity Scholars Math Excellence

The Ingenuity Project cultivates a passion for mathematics in its students, preparing them for success at the collegiate level and beyond. This innovative curriculum and sequence is designed to equip students with a strong mathematical foundation and foster an appreciation for the beauty and challenge of problem-solving.

Poly's Math Club, led by Ms. No, is open to all students at Poly. The club provides students with opportunities to participate in math competitions outside the classroom to further their mathematical knowledge and study difficult math problems.

This Years Achievements

Johns Hopkins Future Scholars Lectures

Students met bi-weekly after school to discuss complex calculus problems and to prepare for the Future Scholar Exam in May.

Student Leader: Antonio Romerio

Participants: Matthew Yacobucci, Lev Eisner, Aidan Pierce, Bryan Hijam, Luna Singh, Samuel Valcarel, Sawyer Ross

American Mathematics Competition (AMC)

The American Mathematics Competitions, provided by the Mathematical Association of American, are a series of exams and materials that build problem-solving skills and mathematical knowledge in middle and high school students.

Grade 11/12 - Xander Dickens, Sawyer Ross, Francis Gittens, Penelope Schenkel

Grade 10 - Marshall Civil, Joseph Horwitz, Jerome Brown

Clemson Calculus Challenge

Ingenuity sponsored a trip to the 20th annual Clemson Calculus Challenge on Friday, April 19, 2024 where high schools from various parts of the US gather at Clemson University to solve extremely challenging Calculus problems both individually and as a team. This was Ingenuity's first time participating.

Participants: vahe Zaproshyan, Ellen Griffin, Bianca Crainceanu, Francis Gittens

M3 Math Modeling Competition

The M3 Modeling Competition challenges students to work in teams of 3-5 during a 14 hour time block to solve a real world math problems. This year, students worked on finding a solution to the housing and homeless crisis. This was Ingenuity's first time participating.

Participants: Lev Eisner, Aidan Pierce, Salloni Gill, Vahe Zaproshyan

University of Maryland Math Competition

Top Performers: Vladimir Gapeev, Xander Dickens

University of Maryland Math League

Participants: Antonio Erdas, Bee Lipson, Bryan Hijam, Erick Torres-Hernandez, Francis Gittens, Ira Geller, Lorenzo Vizachero, Marshall Civil, Matthew Yacobucci, Penelope Schenkel, Vahe Zaproshyan, Vladimir Gapeev

STEM Student Research Awards

Juniors and seniors participating in Ingenuity's Research & Innovation Practicum participate in several STEM competitions during the spring.

This Years Achievements

National Junior Science and Humanities Symposium (JSHS)

- **3rd Place, Camille Coffey - Oral Presentations** - Exploring Lipoprotein De-fish-encies as a Result of Genetic Mutation

Maryland Junior Science and Humanities Symposium (JSHS)

- **1st Place, Louis Lapp** - FFTstack: Integrating Fourier Transform and Residual Learning for Arctic Sea Ice Forecasting
 - **2nd Place, Camille Coffey** - Exploring Lipoprotein De-fish-encies as a Result of Genetic Mutation
- * Louis and Camille presented their research at the National JSHS in May in New Mexico.

Morgan State University Science, Mathematics & Engineering Fair

Overall Winner

- **1st Place, Lavender Hall** - "Fin"-tastic Fish Efficacy of Nonsteroidal Aromatase Inhibitors on the Sex Differentiation and Gonadal Development of Female Zebrafish
 - Lavender will present at Regeneron ISEF 2024, the world's largest pre-college STEM competition in May in Los Angeles, California.

Biological Sciences

- **1st Place, Lavender Hall**, - "Fin"-tastic Fish Efficacy of Nonsteroidal Aromatase Inhibitors on the Sex Differentiation and Gonadal Development of Female Zebrafish
- **2nd Place, Camille Coffey**, Exploring Lipoprotein De-fish-encies as a Result of Genetic Mutation

Earth and Environmental Science

- **1st Place, Maya Molina** - Investigating plant-plant Interactions Under Drought For Two Grassland Species
- **2nd Place, Kei Mese-Jones** - Reconstructing Earth's Past: Assessing the Impact of Dolomitization on Upper Ediacaran Carbonates

Mathematics and Computer Science

- **Honorable Mention, Zoe Hong** - Split-Second Strategy: Effects of Time Pressure on Confidence and Accuracy in Decision-Making

Engineering

- **3rd Place, Maria Chen** - Developing 6-Gingerol and EGCG Loaded Liposomes to Target Triple Negative Breast Cancer
- **Honorable Mention, Miya Mese-Jones** - Changing Aortic Arch Geometry with Virtual Surgical Planning



Ingenuity Senior Research Practicum

About Ingenuity Senior Research:

The seniors presentations represent the culmination of their research efforts. Students completing Ingenuity Research Practicum worked with members of the scientific community for their junior year and summer prior to their junior year. Each student has written a formal research paper detailing the results of his or her respective project. The papers were submitted to nation pre-college competitions, including Regeneron Science Talent Search, Junior Science and Humanities Symposium (JSHS), and Morgan State University Science-Mathematics - Engineering Fair.

Pictured in photo from left to right:

Top: Jackson Dungee, Amelia Overton, Stephenie Providence, Louis Lapp
Zoe Hong, Maya Molina, Brandon Isbell, Lavender Hall, Cecelia Reichelt, Camille Coffey
Kei Leigh Mese-Jones, Penelope Schenkel, Ava Pevsner, Miyah Mese-Jones
Front: Ruby Polansky, Maria Chen



Developing 6-Gingerol and EGCG Loaded Liposomes to Target Triple Negative Breast Cancer

Maria Chen

Mentor: Dr. Paul Kuhn

Supervisor: Harrison Khoo

Department of Chemical and Biomolecular Engineering, Johns Hopkins University



Breast cancer is the most common type of cancer worldwide, with one in eight women in the US being diagnosed. 10%-20% of all breast cancer cases are Triple-negative breast cancer (TNBC). Treatment of TNBC is difficult, as it tests negative for all three common breast cancer receptors. Detection via these receptors permits the tailoring of therapies for patients. In comparison to other breast cancers, treatment of TNBC is more difficult because it is harder to diagnose early and is very aggressive. Liposomes, a type of nanoparticle containing both hydrophobic and hydrophilic components, allow wider varieties of drugs to be encapsulated. Due to their ability to incorporate specific cancer-targeting ligands, liposomes can deliver therapeutics directly to tumors, making them effective delivery agents. 6-gingerol, a main constituent of ginger, and (-)-epigallocatechin-gallate (EGCG), the main component of green tea, both have proven anticancer effects, but have not previously been studied in combination in liposomes. A combination of 6-gingerol and EGCG was loaded into nontargeted and targeted liposomes and their cytotoxic effects on MDA-MB-231 TNBC cells were evaluated. Targeted liposomes utilized the PR_b peptide which targets $\alpha\beta_1$ integrins overexpressed on cancerous cells. Results show that the combination liposome with EGCG prove more effective at lower concentrations. At all other concentrations, single drug liposomes proved more effective. Targeted liposomes were more efficacious than non-targeted liposomes. These results will help create and inform alternative treatments for TNBC with fewer side effects due to improved targeting, while expanding the possibility for bridging Eastern and Western medicine methods.



Exploring Lipoprotein De-fish-encies as a Result of Genetic Mutations

Camille Coffey

Mentor: Dr. Steven Farber

Supervisor: Dr. Meredith Wilson

Department of Biology, Johns Hopkins University



One in three people are affected by metabolic disorders including obesity, high cholesterol, and high blood pressure, leading to increased risk of stroke, diabetes, and heart disease. The study of lipoproteins, which are macromolecules that play a crucial role in lipid transport in vertebrates, is essential to unpacking these diseases further. Deficiencies in lipoprotein production are a significant factor in the development of metabolic disorders. Zebrafish are particularly valuable for studying metabolic disorders because of their optical clarity during larval stages. My research analyzes mutations that affect the yolk, where the fish store fats and proteins during embryonic and larval stages.

To conduct a zebrafish mutant screen to investigate lipoprotein production, mutations were introduced across the zebrafish genome using chemical mutagenesis. When zebrafish develop lipoprotein production disorders, the yolk sac becomes opaque, leading to a phenomenon known as "dark yolk". My research focuses on Mutants 17 and 22, two of over thirty dark yolk screen mutants. For Mutant 22, genome sequencing followed by CRISPR/Cas9 editing of candidate genes is being used to find the target gene causing the dark yolk. Complementation crossing against mia2/ctage5 mutants revealed Mutant 17 has a mutation in the same gene. Research with other ctage5 mutants can help reveal more about the relationship between ctage5 and lipoprotein production. My research in lipoprotein production contributes to our understanding of how metabolic diseases are influenced by blood lipid levels and may contribute to efforts to mitigate their harmful effects.



The *Zophobas Morio*: A Possible Solution to the Plastic Crisis

Jackson Dungee

Mentor: Dr. Allen Place

Supervisor: Luke Feeney

Place Laboratory - Institute of Marine and Environmental Technology

Plastic waste is ubiquitous and unavoidable. Due to its low cost, durability, and insulating properties, combined with the fact that it is rarely recycled, polystyrene, a type of plastic, has become one of the most prevalent contributors to this issue. Polystyrene currently accounts for around 30% of global landfill space. However, the *Zophobas morio* has emerged as a promising combatant to this issue. The *Zophobas morio*, or the "superworm", is the larva of the darkling beetle. Researchers have recently discovered that this insect is able to consume and digest polystyrene. It is widely believed that the worm has this ability due to a microbe in their gut biome that is able to digest plastic. Although it may be impractical to use superworms to dispose of plastic on a large scale, it could be possible to isolate and analyze the specific microbe and synthesize a substance with similar characteristics. In my study, I looked at the effects of differing levels of polystyrene consumption on the growth and development of the superworm by raising superworms on 4 different diets. In addition, I looked at the effect of polystyrene consumption on superworm development, specifically pupation. To achieve this, I recorded the pupation success of superworms across each diet. Lastly, I assessed their ability to transform polystyrene into a biodegradable form by conducting an analysis of the superworm frass content. These results could help to determine the true potential for the superworm to be used as a sustainable disposal method of polystyrene.



Efficacy of Nonsteroidal Aromatase Inhibitors on the Sex Differentiation and Gonadal Development of Female Zebrafish

Lavender Hall

Mentor: Dr. Ten-Tsao Wong

Wong Lab, Institute of Marine and Environmental Technology

Early fish maturation is an issue for aquaculture farms and fisheries. Early maturation is determined when a particular sex matures earlier, affecting fish growth and filet quality. To address this, researchers have begun exploring environmentally responsible and sustainable ways of creating neomales (genetic females sex-changed to males) that can be used to produce all-female populations. These all-female populations reach sexual maturity later, allowing for more time to grow physically larger. Aromatase inhibitors have the potential to convert sexually mature females into neomales by preventing testosterone from converting to estradiol. While using steroids or steroidal aromatase inhibitors for creating neomales is largely restricted in the United States, nonsteroidal aromatase inhibitors have been proposed as an alternative solution. Casper transgenic zebrafish with two specific reporter expression systems that produce green fluorescence protein and red fluorescence protein in the gonadal region. Green fluorescence protein is detected in the ovaries, while red fluorescence is detected in the testes. Casper transgenic zebrafish were used to study the efficacy of three orally administered nonsteroidal aromatase inhibitors - Letrozole, Anastrozole, and Fadrozole - to sexually mature females. Results are measured by observing gonadal development and changes of green fluorescent ovaries to red fluorescent testes and sex-specific gene expression. The results of this experiment will aid in increasing the sustainability of aquaculture



Split-Second Strategy: Effects of Time Pressure on Confidence and Accuracy in Decision-Making

Zoe Hong

Mentor: Dr. Christopher Fetsch

Department of Neuroscience - Johns Hopkins University



Despite how frequently we make decisions, we still have much to learn about the mechanisms behind them. To make a well-informed choice, people must go through a lot of steps - a good decision isn't as simple as a "yes" or "no." However, if there is not enough time to complete a specific task, decision-makers cannot make a proper choice, as they cannot go through every step of the process. To examine how time pressure influences decision-making quality, we conducted an experiment using a game-like decision task. In

this task, there were three types of trials: one with a visible clock (indicating the time limit/deadline), one with an invisible clock (hiding the time limit/deadline), and one with no clock/deadline. After making a binary decision in a set of trials, participants reported their confidence level. We concluded that people may feel like their performance is getting worse, and therefore report lower confidence, regardless of their true accuracy, and will do so to a greater degree when the deadline is invisible. This research may have implications for how people react when making real-world decisions under time pressure, allowing us to better understand the decision-making process



Developing a Method to Investigate Color Preference and Circadian Rhythm in Drosophila

Brandon Isbell

Mentor: Dr. Andrew Gordus

Department of Biology, Johns Hopkins University



Color preference is a well-studied topic and primarily utilizes the fruit fly, drosophila, as a test subject. Previous research has shown that color preferences in drosophila are largely influenced by a color's intensity (brightness). In addition to having preferred wavelengths (colors), drosophila also prefer light within a certain range of intensities. A study by Lazupulo et al. (2019) suggested that the color preferences of drosophila also depend on the time of day. However, it neglected to consider the influence of light intensity in color

preference. To verify and expand upon the findings of this study, the Gordus lab redesigned the experiment with light intensity as a second independent variable. My research aims to deduce how the time of day influences color and light intensity preferences. Using a programmable Arduino device, drosophila are given choices between light stimuli of varying colors and intensities. To assess color preference, the experiment's results were analyzed using a Python program. Preliminary results suggest that our device accurately represents the influence of light intensity in color preference. However, the device has not been tested with time-of-day as an independent variable. Due to its various human applications, such as in advertising, neuroscience, and pest control, the implications of this experiment are significant.

Color preference is a well-studied topic and primarily utilizes the fruit fly, drosophila, as a test subject. Previous research has shown that color preferences in drosophila are largely influenced by a color's intensity (brightness). In addition to having preferred wavelengths (colors), drosophila also prefer light within a certain range of intensities. A study by Lazupulo et al. (2019) suggested that the color preferences of drosophila also depend on the time of day. However, it neglected to consider the influence of light intensity in color preference. To verify and expand upon the findings of this study, the Gordus lab



TFFTstack: Integrating Fourier Transform and Residual Learning for Arctic Sea Ice Forecasting

Louis Lapp

Mentor: Dr. Jianwu Wang **Supervisor:** Sahara Ali

Department of Information Systems - University of Maryland Baltimore County

Arctic sea ice plays integral roles in both polar and global environmental systems, notably ecosystems, communities, and economies. As sea ice continues to decline due to climate change, it has become imperative to accurately predict the future of sea ice extent (SIE). Using datasets of Arctic meteorological and SIE variables spanning 1979 to 2021, we propose architectures capable of processing multivariate time series and spatiotemporal data. Our proposed framework consists of ensembled stacked Fourier Transform signals

(FFTstack) and Gradient Boosting. In FFTstack, grid search iteratively detects the optimal combination of representative FFT signals, a process that improves upon current FFT implementations and deseasonalizers. An optimized Gradient Boosting Regressor is then trained on the residual of the FFTstack output. Through experiment, we found that the models trained on both multivariate and spatiotemporal time series data performed either similar to or better than models in existing research. In addition, we found that integration of FFTstack improves the performance of current multivariate time series models. We conclude that the high flexibility and performance of this methodology have promising applications in guiding future adaptation, resilience, and mitigation efforts in response to Arctic sea ice retreat.



Reconstructing Earth's Past: Assessing the Impact of Diagenesis on Upper Ediacaran Sedimentary Rocks

Kei Leigh Mese-Jones

Mentor: Dr. Emmy Smith **Supervisor:** Iona Baillie

Department of Earth and Planetary Sciences - Johns Hopkins University

Sedimentary rocks are important tools in decoding Earth's history as minerals in sedimentary rocks can act as "time capsules," preserving ancient sedimentary chemistry from when they formed. Although several methods are used to evaluate the environmental conditions during a rock's formation, they may not provide an accurate representation of these conditions, as the chemical fingerprint can be changed by diagenesis, or post-formation, low temperature alterations. Therefore, it is important to determine whether the chemical signature of a rock records original sedimentary chemistry or the chemistry

resulting from later processes that might have altered the rock. We do this by (1) analyzing carbonates that have been partially dolomitized and (2) doing a study between outcrop and core shales to determine the effects of oxidative weathering. Results from the first case study shows isotopic offset between different carbonate mineralogies. The shales will be analyzed using iron speciation. Through these different analyses, we hope to provide insight into the reliability of geochemical methods of analysis in order to determine more accurate ways of assessing past environmental conditions.



Creating Aortic Repairs with Virtual Surgical Planning

Miya Mese-Jones

Mentor: Dr. Axel Krieger **Supervisor:** Seda Aslan
Department of Mechanical Engineering - Johns Hopkins University

Coarctation of the aorta is a congenital heart disease that causes a narrowing in the aorta, which is the largest artery in the body. This disease prevents normal blood flow to the body, leading to increased blood pressure in the heart and risk of heart failure. To prevent this, we design grafts using a 3D imaging program with a 3D model of the patient's native aorta, which is obtained by MRI. These grafts replace the diseased area of the aorta with optimized geometry to increase blood flow. They are tested with virtual surgical planning to see the differences in blood flow between the repaired and native aortas. To validate

the simulation, we pumped water through both 3D-printed aortas to mimic a heart pumping blood. The graft was proven to work. The simulation showed that pressure drop within the repaired aorta was by 23.05%, as opposed to 54.41% in the native aorta. The flow loop's data matches this, with a 4.7% drop in the repaired aorta and a 32.2% drop in the native aorta. When printed, the graft is made with an electrospinning technique, which acts as a scaffolding for blood cells. As blood flows through the graft, the patient's own cells replace it. As a result, the artificial graft grows with the patient and does not have to be implemented again through surgery. These methods, especially virtual surgical planning, can be applied to many other surgical problems, which will help specialize and speed up treatment.



Investigating Plant-Plant Interactions Under Drought for Two Grassland Species

Maya Molina

Mentor: Dr. Meghan Avolio **Lab Manager:** Kelsey Coates
Department of Earth and Planetary Sciences - Johns Hopkins University

Droughts are predicted to become more common as the climate changes, which may impact how plants interact with each other. The relevant interactions between plants can be described as competitive (negative) or facilitative (positive). In non-drought conditions, plants are predicted to be more competitive as plants compete for light, water, and other resources. During drought, plants may be more facilitative, as they provide shading and might help prevent water loss through evaporation. However, if the drought gets intense

enough, all interactions are predicted to stop because plants will shut down physiology or die. To explore this prediction, a greenhouse experiment was conducted, in which various combinations of two grassland species, *Andropogon gerardii* and *Solidago missouriensis*, were exposed to varying degrees of drought. By examining the effect of drought on plants grown alone or with other plants, our goal was to explore how plant-plant interactions change during a drought. This was done by comparing biomass and height of plants grown alone to plants grown with other plants, either of the same species or a different species, under the different watering treatments. We found that plants grown with other plants under well-watered and drought conditions grew less than plants grown alone, while plants grown with other plants under extreme drought conditions grew more than plants grown alone, supporting the idea that drought causes plant-plant interactions to shift from competitive interactions to facilitative



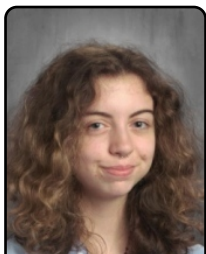
Development of a Novel Analytic Assay for the Detection of Disinfectant Byproducts in UV Filters and Swimming Pools

Amelia Overton

Mentor: Dr. Carsten Prasse **Supervisor:** Daisy Grace
Department of Environmental Health and Engineering - Johns Hopkins University



Water, a necessary component for human life, can contain chemicals that are toxic to humans. When disinfectants react with organic matter in water, they produce disinfection by-products (DBPs). DBPs can be composed of a class of toxic chemicals known as electrophiles, which characteristically bind nucleophiles (for instance, DNA and proteins) and cause adverse health outcomes in humans due to this reactivity. Electrophiles cannot be easily analyzed and identified using traditional DBP detection methods, so methods have been developed to indirectly analyze electrophiles through their reaction with nucleophile microbeads. Specifically, we are investigating a class of electrophiles known as carbonyls. Using our optimized microbead assay, we can identify the carbonyl compounds contributing to the observed toxicity in swimming pool waters. Specifically, we investigated the degradation of UV filters in sunscreens and observe if these DBPs are also found in sunscreen-containing pool waters. UV filters are known to break down into carbonyls when reacting with disinfectants which could cause health issues to people using them. Although the results contained high error bars, it provided us with the data to keep developing our optimized microbead assay.



Decision Making: How the Path to a Consensus is Represented in the Brain

Ava Pevsner

Mentor: Dr. Veit Stuphorn
Department of Neuroscience - Johns Hopkins University



Decision making is a vital component of everyday life. Complex neural mechanisms underlie every decision we make, but there is not a universally agreed upon model defining how decision making is represented in the brain. A hypothesis outlined by previous research depicted a sequential model, suggesting that one aspect of a decision is processed before the next in a domino-like effect among populations of neurons. Another example is a parallel model, where multiple proposed courses of action compete simultaneously on a neural level in the brain. The aim of my research is to conduct an experiment that presents participants with a multifaceted decision: an objective aspect, where the participant attempts to select the correct answer to receive a reward; and a subjective aspect, where the decision is dependent on the subject's personal preferences. Using analysis tools in Matlab, data from this experiment can be used to support a sequential or parallel model of decision making, or represent a new

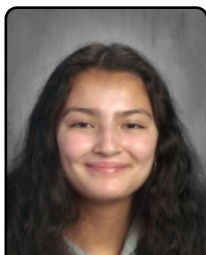


Riemann and Lebesgue Integration

Anotonio Romerio



In 1868, Bernhard Riemann introduced the Riemann Integral, the first rigorous definition for the area between a function $f(x)$ and the x -axis. For the first time, mathematicians could prove the classical properties of integration, including, most importantly, the Fundamental Theorems of Calculus discovered by Newton and Leibniz. The method employed by the Riemann Integral is elegant and simple, using increasingly fine partitions of the x -axis to approximate the area beneath a curve. However, beginning in the late 19th century, the increased interest from mathematicians in problematic functions (e.g. those that are nowhere differentiable, nowhere continuous, etc.) revealed that the Riemann Integral could not deal with these new objects. Today we explore these and other shortcomings of the Riemann integral and present a new definition of the integral given by Henri Lebesgue that almost perfectly resolves them. In doing so, we will discover how mathematicians can convert intuitive ideas like area into rigorous definitions, and we will see how one's guiding philosophy in mathematics can drastically change their insights, even in a field that supposedly always gives the "right" answer.



The Ants Go Marching One by One to Move Blocks: Harnessing Collective Behavior to Manipulate Ants

Ruby Polansky

Mentor: Dr. David Gracias **Supervisor:** Aishwarya Pantula
Chemical and Biomolecular Engineering - Johns Hopkins University



Intricate fabrication and manipulation at micro size scales is one of the grand challenges of science, as it requires complex techniques, expensive materials, and time. However, intricate and systematic fabrication is observable in nature, notably the collective behavior of ants building their nests. Ants communicate using pheromones and rely on their antennae to smell. Pheromones help distinguish what tasks ants are doing. Despite being excellent builders, ants are highly underutilized in the current fabrication schemes. I

decided to design an experiment that worked to harness ant behavior. Using Solidworks, I created two mazes of different difficulties that were 3D printed with biomed clear. I then 3D printed cubes, cylinders, and cones in three different sizes: 500, 1000, 1500 μm . The ants were placed in one corner of the maze and cubes were placed in the other. I coated the boxes in three different concentrations of oleic acid: 100, 500, 1000 $\mu\text{g ml}^{-1}$. I ran different trails with different concentrations, sizes, and shapes. The ants ended up having no reaction to the oleic acid covered boxes which could be explained through further experiments. Though the results, to date, are inconclusive, the methods I designed are an important step in understanding how to harness ant behavior. Implications of such work may help other researchers build off of what I have set up.



Developing Cryptochrome Optogenetic Mutants to Optimize Protein Recruitment in Cell Migration

Stephanie Providence

Mentor: Dr. Peter Devreotes **Lab Manager:** Dr. Dhiman Pal
Department of Cell Biology - Johns Hopkins University



Cell migration involves the movement of cells throughout the body. Previous research has used optical tools to promote changes in cell morphology and migration. Researchers use these tools to recruit a protein of interest to the plasma membrane, and, using confocal microscopes, collect visual data, to study the chosen protein's function in the cell's migratory process. The protein Cryptochrome 2 (CRY2) activates in response to specific wavelengths of light and recruits proteins from the cytosol to the cell membrane

expressing the N-terminal domain of CIB1 protein (CIBN). In the absence of light, CRY2-CIBN deactivates, allowing the protein to return back to the cytosol. However, there are limitations to this optical system: 1) Upon exposure to light, CRY2 proteins tend to cluster in the cytosol resulting in much movement to the membrane, and 2) When light is switched off, it takes recruited CRY2 a lot of time to get back to the cytosol. In my study, I worked on making technical improvements to the existing CRY2 protein such that they were able to overcome these issues. I found that Cry2tdtomato, a fluorescent protein, was the fastest to recruit proteins to the membrane. In further experimentation, Cry2tdTomato was paired with various effector proteins to see which pair would recruit proteins to the membrane the fastest. Inp54p was the most promising effector protein when combined with Cry2tdTomato construct. My research has the potential to find solutions to diseases such as immunodeficiency, cancer, and fetal deficiencies within a smaller time frame.



Analyzing Blue Crab Diets to Understand Biodiversity in the Inner Harbor

Cecelia Reichelt

Mentor: Dr. Eric Schott

Supervisor: Olivia Pares

Schott Laboratory - Institute of Marine and Environmental Technology

Baltimore's Inner Harbor used to be incredibly clean, clear, and biodiverse; it was full of oysters, crabs, and other organisms that benefitted Baltimore's economy. However, as Baltimore industrialized, the harbors' health deteriorated, negatively impacting biodiversity. To remedy this, it is essential to study biodiversity, urban estuaries, and pathogen transmission amongst economically important species, specifically blue crabs. Blue crabs are a trademark in Baltimore, so they must be studied and protected. *C. Sapidus Reovirus 1 (CsRV1)*, a pathogen commonly found in blue crabs was the focus of the research. To gain a better understanding of the virus, we searched for a potential disease transmission link between mud crabs, a common prey of blue crabs, and blue crabs using DNA barcoding of blue crab stomach contents. The presence of mud crabs in the majority of the sample indicates that the pathogen was potentially transmitted from mud crabs to blue crabs at that location. Results from this study can inform where *CsRV1* comes from and how it is transmitted. DNA metabarcoding was used to analyze and sequence blue crab stomach contents to gain an understanding of their diet. The results of the metabarcoding will inform us on the overall biodiversity of the Inner Harbor. If the blue crab diet is diverse, this implies multiple food sources were available. If not, we can conclude that they did not have a diverse prey community. The results of the study can give important information on how to improve the biodiversity in the Inner Harbor.



Examining Sociodemographic Disparities in Preventive Measures Against COVID-19

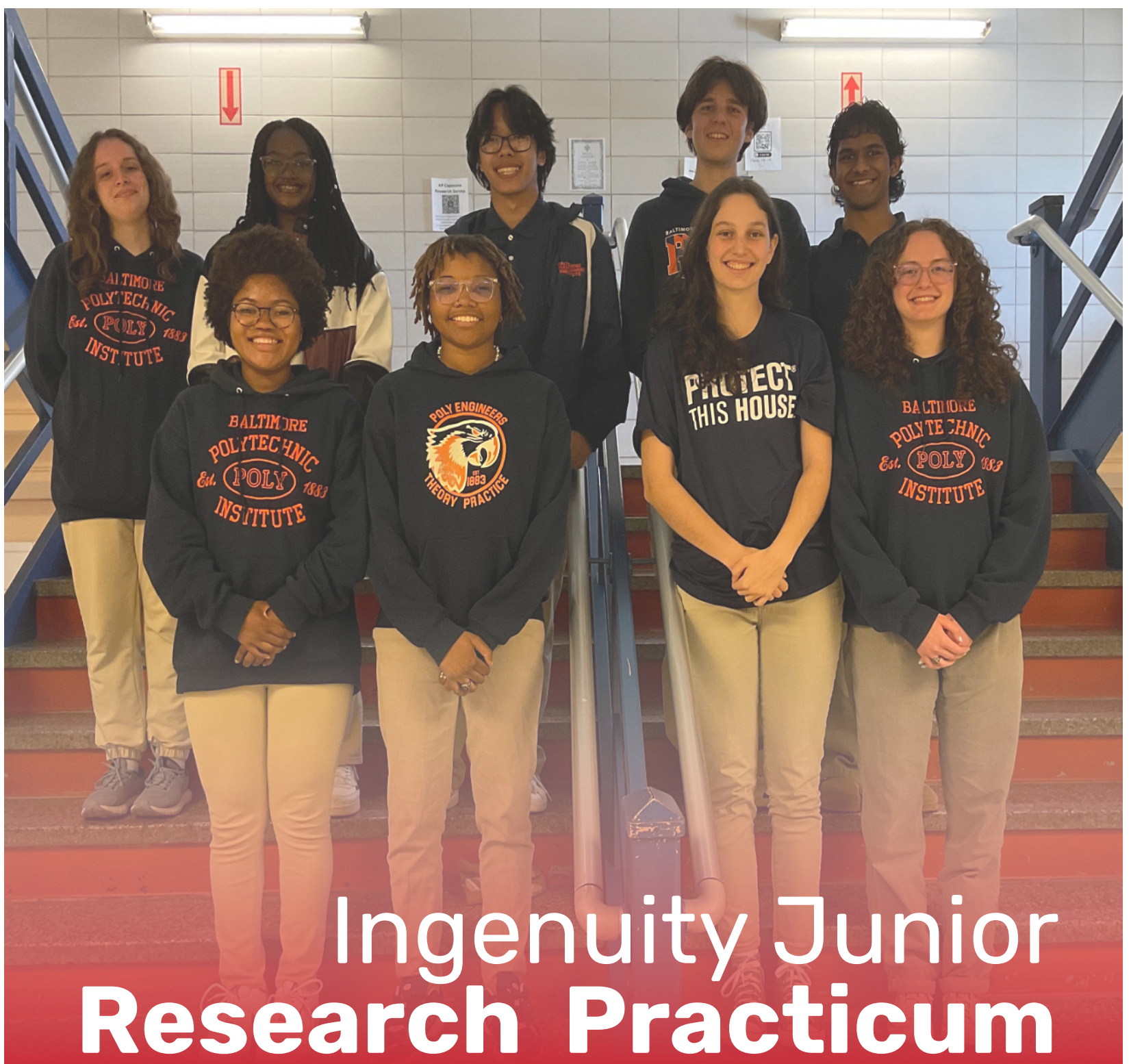
Penelope Schenkel

Mentor: Dr. Jacky Jennings

Supervisor: Alexander Mueller

Department of Pediatrics - Johns Hopkins University

The COVID-19 pandemic became a global public health concern in 2020, necessitating effective public health prevention and control measures such as testing and vaccination to combat disease transmission. This paper investigates the degree to which there were sociodemographic disparities in COVID-19 testing and vaccination in a population representative study in one mid-Atlantic city. The parent study was a randomized clinical trial to compare COVID-19 testing modalities, and the current study used baseline data from the parent study. Statistical testing including Chi-squared, Fisher's Exact, and Student's t-tests were used for hypothesis testing. Results showed high rates of testing and vaccination; there were differences in testing and vaccination by sociodemographic factors. Testing and vaccination were associated with younger age and older age, respectively, higher education, private health insurance, and higher household annual income. Testing was also associated with higher agreement with ease of testing experience, caregiver status, and increased COVID symptom score; vaccination was associated with non-Hispanic, non-Black ethnicity, and White race. Persistent racial disparities during disease outbreaks have been a challenge to public health response. Further research is needed to conclude how future test and vaccine distribution and implementation methods can be combined and altered to reduce disparity.



Ingenuity Junior Research Practicum

About Ingenuity Junior Research Practicum:

The juniors are entering the final phase of their Research Practicum placements. Throughout the previous summer and current school year they have worked with their mentors on their independent research projects. They will continue their work this summer to complete their projects. The posters on displays represent recent progress. Juniors submit their work to local competitions, including the Morgan State University Science-Mathematics-Engineers Fair and Maryland Junior Science and Humanities Symposium. The juniors, together with seniors, are also responsible for organizing the Symposium event.

Pictured in photo from left to right

Top: Alyssa Goldenberg, Nadiat Adedoyin, Bryan Hijam, Jack Serpick, Aydin Mokaddem

Front: Gabriella Washington, Lia Brown, Mia Sproge, Lillian Adams

Not Pictured: William Allen, Pierre Vignes, Sawyer Benhart



Impact of Bed Net Use on Malaria Prevalence in Low vs. High Transmission Settings

Lillian Adams

Mentor: Dr. Amy Wesolowski **Supervisor:** Dr. Emily Gurley
Bloomberg School of Public Health - Johns Hopkins University



Malaria is a disease that kills around half a million people per year. This disease is caused by a parasite of the Plasmodium genus and is transmitted to people via the bite of a female Anopheles mosquito. In some areas, transmission rates are so high that children do not survive into adulthood without developing some form of immunity against the disease. Insecticide-treated bed nets are a cheap and non-invasive method to lower malaria transmission rates since they keep mosquitoes from feeding on sleeping humans

and kill mosquitoes that land on them. Using the R statistical environment, I will investigate how bed net usage impacts the proportion of people diagnosed with malaria via rapid detection test (RDT) across age groups. I will compare the relationship between a high transmission area (Zimbabwe and Zambia from 2012 to 2019), and a low transmission area (India from 2012 to 2014). After accounting for population differences in age, I will use statistical tests, such as odds ratios and logistic regression analysis, to determine if there is a significant statistical association between bed net usage and malaria prevalence in either high or low transmission settings. My study will assess if bed net use is more effective in certain transmission settings or age groups, over others. It is possible, however, that bed net usage in one or both transmission settings may not be common enough to draw a definitive conclusion about its impact on transmission.



Decoding the Brain: How Does the Brain Define Social Intelligence in Primates?

Nadiat Adedoyin

Mentor: Dr. Connor **Supervisors:** Julie Hwang & Lydia Hopper
Zanvyl Krieger Mind and Brain - Johns Hopkins University



Whether greeting a friend with a handshake or a professor with a polite, 'Hello', social intelligence has defined the social structure and hierarchies amongst several species of primates, ranging from humans to macaques. Interestingly, social intelligence is heavily intertwined with familiarity and memory function in the brain. Though individuals spend their entire lives collecting social knowledge to navigate their perspective of the 3D world, there has yet to be a comprehensive analysis of the human brain through a coding

scheme. Our team of researchers has worked to observe the social hierarchies in rhesus macaques, a closely related ancestor to humans, through an intensive video-logging video metric. Our observational data shows possible implications of how subjects prioritize close affiliate and high dominance relationships. I hypothesize that the social distribution across two primate groups will vary by (or a similar term) kinship and the number of female monkeys present. Overall, we hope to find a way to decode the brain's abstract neural system and better understand how social intelligence presents itself in primate social groups. Therefore, we can learn to which extent rhesus macaque monkeys perceive animals across different levels of familiarity and how far social relations play into their memory. These efforts will lead to the development of brain representations that encode social relationships, behavioral histories, and social understanding. This places the novel creations of sensory technology or advanced AI technology into the foreseeable future.



Optimizing Capillary Circuits For SARS-CoV-2 Antibody Quantification

William Allen

Mentor: Dr. Claire Hur

Supervisor: Harrison Khoo

Department of Mechanical Engineering - Johns Hopkins University

During the COVID-19 pandemic, one serious issue was accurately determining populations at higher risk of infection. While guidelines identifying certain groups at risk of infection based on age, weight, etc. were helpful, there were more accurate methods. Tests that quantify patient SARS-CoV-2 antibody levels are a more precise method of identifying higher-risk groups, however, this test is expensive, not readily available to the public, and subject to human error. One solution to this is capillary circuits, which can manipulate the flow speed and direction of volumes of fluids on the nano-milliliter scale,

in desired orders. Adding cells and microbes to these fluids gives us greater control over their environment. My research focuses on making antibody quantification more efficient and available to the public by first automating SARS-CoV-2 antibody quantification inside capillary circuits. Making antibody quantification more readily available could help inform the public of their risk of infection. Although COVID-19 is not as impactful as it once was, proving that SARS-CoV-2 antibody quantification can be automated inside capillary circuits allows this concept to be applied to future viruses. This could lead to policymaking that implements our method of accurately identifying at-risk groups, in vaccination efforts and quarantining guidelines to mitigate the spread of future and current viruses.



Identifying Urban Heat Island Severity via the Analysis of Temperature Data from Multiple Networks within Baltimore and Its Surrounding Areas

Sawyer Benhart

Mentor: Dr. Darryn Waugh

Department of Earth and Planetary Sciences - Johns Hopkins University

The Urban Heat Island is a phenomenon in which urban communities experience higher air and land surface temperatures when compared to their surrounding rural and suburban counterparts due to several factors, such as heat-absorbing manufactured materials, overpopulation, a lack of vegetation, or an abundance of urban pollution. This increase in temperature and heat intensity can spark and intensify significant health risks

among individuals living within the confines of the city. A substantial portion of the world lives in densely populated urban environments, and it is necessary to assess the risk each person is exposed to as a result of various heat intensity and severity. Baltimore is an important city to study because of how it is laid out due to a history of redlining, specific urbanization, and different intensity levels between neighborhoods. For this reason, we need to analyze temperature data from multiple sensors of diverse sources such as Earth Networks, BSEC weather stations, and iButtons to provide evidence and reasoning for the varying intensity of the urban heat island within Baltimore.



Orbital Fitting of White Dwarves using Radial Velocity

Lia Brown

Mentor: Dr. Julien Girard
Space Telescope Science Center

In hopes of better understanding the patterns and problems not only on Earth but also on the planets in the solar system, we have to study those beyond our solar system's reach. However, the first step in studying those planets is being able to locate them. In this research, the radial velocity method is used to identify exoplanets within the cosmos. This method relies on observing subtle changes in a star's velocity induced by the gravitational pull of an orbiting exoplanet. The resulting periodic shifts in the star's spectral lines, known as stellar wobble, provide valuable insights into these distant

worlds' presence, characteristics, and orbital dynamics. The research focuses on the different measurements found from radial velocity and determines which combinations or parameters provide the best results. The data from JWST combined with previsions from other space missions have allowed the production of precise orbital fittings and characteristics. The RV method can provide these results for not only planets orbiting stars but for any two celestial bodies, and in this particular research, the bodies are



Early Detection Methods of Glaucoma: Automated Versus Manual Cell Tracking

Alyssa Goldenberg

Mentor: Dr. Osamah Saeedi **Supervisor:** Amrik Gill and Saige Oechsli
Department of Ophthalmology and Visual Sciences - University of Maryland

Glaucoma is a vision loss disease caused by elevated eye pressure damaging the optic nerve. However, studies have shown that some glaucoma patients have normal eye pressure. This led researchers at the University of Maryland Baltimore to theorize that changes in ocular blood flow could be a potential marker for glaucoma detection. In this study, a scanning laser ophthalmoscope was used to capture high speed and high resolution angiograms (X-ray scans showing blood flow in the veins and arteries) of the

retinal vasculature in healthy and glaucomatous eyes under standard conditions and induced hyperoxia (increased levels of oxygen). The aim of this project is to validate current automated cell tracking methods by comparing the blood flow velocity metrics collected during this cell tracking process with those found by a manual grader. If the metrics for each cell tracking method are similar, then the automated cell tracking technique has been verified. On the other hand, if results show consistently differing values, then the automated cell tracking method needs to be more accurate. In addition to proving the efficiency of the automated cell tracking method, this comparison can help further investigate how changes in blood flow velocity (or erythrocyte speed) can be used as a biomarker for earlier detection of glaucoma.



Targeting The CD47/SIRP α Axis For Prostate Cancer Immunotherapy

Brian Hijam

Mentor: Dr. Jelani Zarif

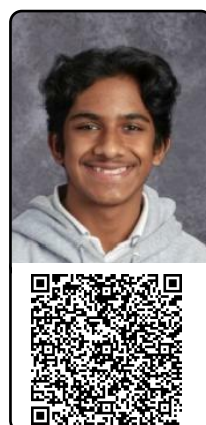
Supervisor: Dr. Fan Shen

Sydney Kimmel Comprehensive Cancer Center - Johns Hopkins School of Medicine



With approximately 1.6 million new cases and 366,000 deaths annually, prostate cancer remains one of the world's most prominent and dangerous diseases among men. Cancer that has metastasized remains largely incurable, however, immunotherapy is a novel method of cancer treatment that has shown significant promise. The protein CD47 is expressed ubiquitously across various cell types in the human body to maintain homeostasis. One of its primary functions is to bind to innate immune cells to inhibit the immune cell from performing phagocytosis (consumption of bacteria and other material).

SIRP α is a receptor that is expressed on myeloid innate immune cells and functions as the receptor for CD47. When CD47 binds to SIRP α , the immune cells halt phagocytosis, essentially telling the immune cell "Don't eat me". This CD47-SIRP α pathway is often taken advantage of by tumor cells, upregulating CD47 to mediate escape from consumption by innate immune cells. Targeting the CD47-SIRP α axis is a promising therapeutic target and serves as a druggable innate immune checkpoint. To target this pathway, we utilized an anti-SIRP α blocking antibody to block the binding of CD-47 and SIRP α to enhance the phagocytosis of tumor cells. The ultimate goal of this project is to test the efficacy of this anti-SIRP α blocking antibody by harvesting bone-marrow-derived macrophages from 6-8-week-old mice along with PC3 prostate cancer lines, coculturing them with the antibody, and observing phagocytosis levels. Observing enhanced phagocytosis of tumor cells could have significant implications for prostate cancer immunotherapy and can serve as a stepping stone for cancer treatment.



The Mystery Behind Life and Survival of Bacteria After a Freezing of Earth

Aydin Mokaddem

Mentor: Dr. Kelsey Moor

Department of Earth and Planetary Sciences - Johns Hopkins University



Studying an unknown period in the past is no easy task, and it can lead to an entirety of other issues. Studying the mysterious period of extreme Earth Snowball glaciation we can understand past and current bacterial life forms. This time period of intense glaciation has a direct tie to the Cambrian Explosion, our first view at complex life forms, however, there is little evidence to support a link between the two events. I am attempting to show that there is a possible rope keeping the cambrian explosion connected to the bacteria from the Snowball Earth.

Using a physical approach, I can attempt to delve into how older micro-bacterial forms found in fossilized rocks can be cross-compared to current micro-bacteria using a scanning electron microscope, furthermore, seeing how they are able to survive and evolve against a glaciation to become complex. Finding other existent forms of this micro-bacteria in these old rocks can completely change how we view this period of time and build upon evidence to support the Earth snowball event's connection to evolution. Finding other bacteria proves that it's more likely that there was less of an effect on the Cambrian from the snowball than we thought, while finding less would make it seem as though it's much more possible that there was an incident of "pressure making diamonds". This means a variation of forced evolution occurred during the Earth Snowball Effect in an attempt for the bacteria to survive.



Investigating the Sulfate Chloride Anomaly to Understand Sulfur Cycle Recovery in Microbial Mats

Jack Serpick

Mentor: Dr. Maya Gomes

Supervisor: Jackie Dodd

Department of Earth and Planetary Sciences - Johns Hopkins University

It is well known that climate change has had some extreme effects on ecosystems and the natural world. One such ecosystem is the microbial mat. Microbial mats are dynamic ecosystems that contain complex element cycles and trophic groups (Visscher 2004). They often grow in coastal environments that are very vulnerable to the effects of climate change (Lingappa 2022). The microbial mats are split into functional groups and microbial communities that rely on and work with each other to create a functioning ecosystem.

Elements cycle through these layers and exhibit reactions that affect precipitates and dissolutions in microbial communities. When the cycles are disrupted, these precipitates and dissolutions are altered and recover at different rates. The rates of their recovery depend on many factors. These factors include the recovery of other microbial communities, properties of the element cycle, and severity of the element cycle disruption. One example of an element cycle disruption is one particular hurricane that struck Turks and Caicos in September, 2017. This hurricane flushed out a lot of sulfide. However, the sulfide should be able to recover with the help of other microbes. Sulfide reducing bacteria are able to change sulfate into sulfide through a series of reactions (Visscher, Stoltz). Luckily, there is a lot of available sulfate for these reactions to take place. My research hypothesizes a link between a dip in sulfate and the recovery in sulfide after these disruptions. To make this correlation, microbial pore water samples from different points after the hurricane have been extracted and prepared for sulfate concentration analysis. Once a dip in sulfate is identified, the sulfide concentrations will be measured. With this correlation, further research can be done to determine optimal methods of protecting microbial mats, and other significant ecosystems from the adverse effects of climate change.



Helping Cells Dissolve Protein Crystals

Mia Spruge

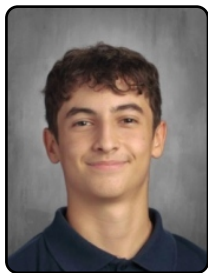
Mentor: Dr. Takanari Inoue

Supervisor: Willow Rock

Department of Earth and Planetary Sciences - Johns Hopkins University

Cells are known as the building blocks of life, so it makes sense to know them as the building blocks of disease. Daily, Cells degrade foreign material that could be dangerous or unnecessary. Organelles known as lysosomes are responsible for degrading this material to break it down into macromolecules that may be recycled. This is the process for most materials, however, lysosomes fail to dissolve protein crystals. This stresses lysosomes out, and they send distress signals to cells, which can amplify into an inflammatory response that manifests as inflammation within tissues, including the brain.

To try and correct this process proteins like F4132, iPak4, and xpa will be edited to include a switch. The switch will either be drug or pH inducible to trigger the dissolution of protein crystals. The goal is to create this dissolvable crystal and use it to run tests and make determinations about crystal-induced damage to lysosomes, and when in the autophagy process that cell response is triggered. Future research could use this work as a basis or a tool for working with and understanding lysosomes and autophagy better.



Investigating Factor B and C Expression During Horseshoe Crab Embryo Development

Pierre Vignes

Mentor: Dr. Chung J. Sook
Institute of Marine and Environmental Technology

Horseshoe crabs have captivated researchers with how they have evolved and lived over millions of years to how they are important to medical research - because they have an immune system with no antibodies. This research project aims to investigate the expression of Factor B and C genes in the blood during horseshoe crab embryo development, showing how their genes work and how their functions correlate with their embryonic growth stages. Additionally, the study looks at the expression of immune-related genes that have helped the horseshoe crab survive for millions of years. We hope to discover more about the important genes involved in horseshoe crab embryonic development by collecting horseshoe crab embryos at various developmental stages, RNA extraction, and qPCR analysis. By understanding the expression patterns of Factor B and C genes, we know more about the aspects that contribute to the horseshoe crab's ability to survive without producing antibodies. The results of this study contribute to studies in horseshoe crab biology, evolutionary adaptations, and immune response. Moreover, it will provide insights into how to harvest their blood ethically. By proposing sustainable practices, this study aims to understand more about this formidable animal, which has lived for millions of years.



Investigating the Effect of Dog Size and Coat Length on Bacteria Prevalence

Gabriella Washington

Mentor: Dr. Meghan Davis **Supervisor:** Dr. Sharmaine Millier
Department of Environmental Health and Engineering - Johns Hopkins University



Animal-assisted interventions (AAI) have been shown to positively affect humans with benefits including lower levels of stress, anxiety, depression, and perceived pain. The use of AAI has not been limited to hospital patients undergoing treatment and has seen increased use for students, healthcare workers, and individuals living in assisted living facilities. However, the ability of animals, like therapy dogs, to carry and spread potentially pathogenic bacteria to patients and the hospital environment is not well understood. This unknown risk of pathogen transmission prevents animal therapy programs from reaching people who could most benefit from animal therapy after long hospital stays and difficult or painful treatments, such as immunocompromised hospital patients. To investigate this, data on bacteria present, size, and coat length will be obtained from an ongoing therapy dog study. An exploratory data analysis and statistical analysis will be performed to interpret associations with data. Researching how therapy dogs affect the spread of pathogens within healthcare settings will build a better understanding of the transmission risk of therapy animal programs and allow infection control procedures to be developed to address these risks. With increased understanding and standard infection control policies, more people can access the benefits of animal-assisted interventions.



About Ingenuity Junior Research Innovation

The Innovation Practicum is a one-year and one summer sequential in-school and off-site research curriculum for 11th grade Ingenuity students. Students gain hands-on experience in Applied Mathematics, Computer Science, Machine Learning, Data Science, and/or Statistics and learning coding languages and/or statistical analysis programs. Juniors submit their work to local competitions, including the Morgan State University Science-Mathematics-Engineers Fair and Maryland Junior Science and Humanities Symposium.

Pictured in photo from left to right

Top: Tyler Harris, Anis Ahmed, Noah McNally,
Middle: Victoria Pitt, Da'Mario Bunch, Sawyer Ross, Matthew Yaccobucci
Front: Jaidy Amador, Maxwell Hunt, Leo Micah-Jones
Not Pictured: Brandon Faison



Disparities Across Baltimore City Looking at Crime in Baltimore Through a Statistical Lens

Anis Ahmed

Mentor: Dr. Nicole Shoenberger
Department of Sociology - Loyola University



The city of Baltimore has struggled with social inequality issues since its establishment in 1792. The effects of Red lining, Jim Crow, and other early racist laws still linger today. The most notable example of this disparity issue is the Black butterfly phenomenon, a phenomenon here in Baltimore that shows the drastic disproportionality between communities that are more densely populated with African American or White citizens.

My research focuses on Crime Disparities in Baltimore from community to community. In my project, I used the BNIA or Baltimore Neighborhood Indicators Alliance, a reliable non-profit organization based in Baltimore, to get data that targets specific neighborhoods and communities. The variables studied include crime rates, the number of vacant lots per community, median household income, and specific demographics (race, age, etc). Using this information, I created a master data set that includes all variables, and other specific data from 56 Baltimore communities spanning five years (2017-2021). Using R, a statistical analysis coding language, my research uses regression tests to compare the data between neighborhoods and identify the relationships between these variables. This research is significant because the findings may identify the specific variables that directly contribute to high crime. I believe this research has the potential to inform policies and find solutions to these deep rooted issues that have existed in Baltimore for decades.



Code Red: Game Day Chaos - Simulating a Smart Traffic Light Cyber Attack

Jaidy Amador & Brandon Faison

Mentor: Dr. Edna Reid
Department of Cyberintelligence - James Madison University



Due to the everlasting growth and expanding complexity of smart cities, a component that has to evolve with them is their traffic light systems. Imagine you are down the road, and suddenly the traffic lights malfunction, causing chaos like an accident at an intersection, all because of a malicious hacker. This attack could happen but at a much larger and more impactful scale, for example, an attack on a traffic light at a nearby ongoing football game. As traffic flow continues to peak as the surge of cars floods the city streets, our goal is to expose the lack of security of smart traffic light systems, and the ramifications on public safety, and the chaos that a successful cyber attack could cause. We will be simulating a DDoS attack on the traffic light system using the Eclipse Mosaic simulation software, using the M&T Stadium in Baltimore, Maryland. We will simulate traffic flow during a major sporting event like a football game and show the major catastrophes that can ensue if smart traffic light systems are compromised. To understand how Cyber Threat Attacks (CTAs) operate, we used the MITRE ATT&CK Framework to unravel the tactics, techniques, and procedures (TTPs) that could be used

to execute our attack successfully. A limitation of our research is that it is almost impossible to simulate the behavior of humans accurately. Therefore, we will adjust for different factors such as parking areas, car sizes, traffic flow patterns, geographical layout, and diverse human behaviors while driving.



Functionality and Innovation of Autonomous Systems

Damario Bunch & Matthew Yacobucci

Mentor: Dr. Corey Oses

Department of Material Science & Engineering - Johns Hopkins University



As time goes on, machine learning and artificial intelligence are being integrated into everyday life more than ever. Due to the high prevalence of these disciplines, new technologies must be developed to suit the new needs that arise. LEGO-based Low-Cost Autonomous Scientist(s) (LEGOLAS), a low-cost autonomous system based on Lego components, is essential for this task because its low cost allows it to be used in a classroom setting. This increased accessibility will allow students to be more easily introduced to these fields in classes more suited to the sciences. Some solutions to improve this accessibility are implementing code to improve the overall consistency and reliability of LEGOLAS and the introduction of autonomous photovoltaic analysis of materials of known composition. Through these actions, we intend to improve the overall consistency of LEGOLAS and expand its current capabilities to include a broader field to drive engagement with the topic. These factors will contribute to the success of teaching students about machine learning by appealing to a wider group as well as allowing for more examples of autonomous research in the classroom.



A Profiling Map: How Demographics Affect Health Insurance

Tyler Harris

Mentor: Dr. Juliana Jaime

Department of Physics and Astronomy - Johns Hopkins University



Health Insurance is relied upon by millions of people in the U.S., but what if your insurance wasn't as reliable as you thought? Health Insurance is an important asset to have, as it helps cover the momentous cost of healthcare in the U.S. With a variety of people relying on health insurance to sustain themselves, it is important to understand how potential differences in insurance plans may be affected by varying factors such as race, sex, age, or location. These potential differences may negatively impact specific social groups that are historically marginalized, such as ethnic/sexual minorities, and women. My research aims to understand the disparities in health insurance based on various factors like demographics. I plan to create user personas that represent the average of a set demographic and then utilize a standard health insurance plan estimator to formulate artificial plans. The artificial plans would be compared and contrasted to see how they vary in price coverage and other factors. This topic is significant as health insurance remains a pivotal point in many people's lives and can be used to create a compare-and-contrast network between differing demographics. My research may highlight discrimination and/or a pattern in the way health insurance plans are formulated based on varying factors adding to the existing knowledge of this field. By understanding the differences between these plans, we could examine why these differences exist, leading to equitable access to health insurance

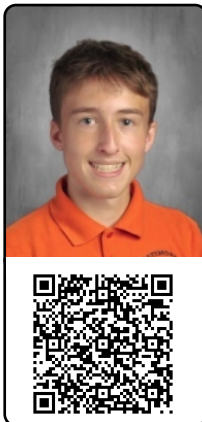


Investigating the Benefits of Smart-Farming Solutions

Maxwell Hunt

Mentor: Ms. Leafia Sheriden
The Ingenuity Project

The issue of World Hunger plagues different parts of the whole world and is an issue that needs to be better addressed. Implementing Smart Farming solutions is the best way to help solve this global crisis. Implementing Smart Farming solutions implies creating a more efficient farming strategy using computers, machine learning, and large scale datasets. For my research specifically, I want to create a better fertilization system for farming. This system will be more efficient and provide more control over the fertilization of the plant, thus increasing plant growth. This automatic fertilization system uses an NPK (Nitrogen, Phosphorus, & Potassium) sensor to tell an Arduino mini-computer when to fertilize the plants automatically. When the Arduino receives the signal to fertilize the plants, it will send a signal to a servo motor to turn and release fertilizer spray. Alongside this system, an identical plant will be grown the same, except for the way it varies is fertilization. There will be a set rate at which the plant is fertilized, and it will not be automatic. I believe that this system will lead to better plant growth



Imaging Exoplanets Using Astronomy & Photometry with JWST Coronagraph Data

Noah McNally

Mentor: Dr. Julien Girard
Space Telescope Science Institute

Exoplanets are any planet located outside of our Solar System. Using images captured from telescopes like the James Webb Space Telescope (JWST), we can use different types of methods to spot Exoplanets orbiting around all different types of stars. Direct imaging is one of the many ways to image an exoplanet; others include transit, astrometric, microlensing, and radial velocity. Direct imaging is like solving a big subtraction math problem with stars and planets. You take the data image you are observing with the star and potential exoplanets, then subtract the data image from a similar data image with a similar star in it with no detected exoplanets. You then are left with data showing only exoplanets, other objects, or nothing. Contrast curves are how astronomers graph a light curve that tells us what distance from the star we can see potential exoplanets or existing exoplanets. Contrast curves are used in simulated data to help researchers propose why they should observe certain stars and the possibilities of finding an exoplanet. Sometimes, you can tell where the exoplanet is orbiting the star as there will be a spike of luminosity in orbit of the star, which we can see through contrast curves. When comparing simulated stars to real stars, we can expect the simulated star to show us accurate possibilities of where exoplanets are. Still, we can't estimate them as far into depth as we could with real star data. The next steps in this research will be to target habitable planets like Earth in hopes of discovering life beyond humans.



Using Motion Analysis to Understand Frailty

Leo Micah-Jones

Mentor: Dr. Ryan Roemmich

Physical Medicine and Rehabilitation - Kennedy Krieger Institute

Frailty is described as a state of increased vulnerability due to a decline in function across multiple anatomical systems which impacts day to day life. Even though it is considered a cornerstone of geriatric medicine, there is still no consistent method for diagnosis of frailty. Currently, diagnostic criteria are broad and subjective; there is a need for new tools that can improve our understanding of frailty by providing more quantitative and objective assessments of human movement. This study aims to improve frailty assessment by using computer vision technology called Pose Estimation. Pose estimation software automatically tracks how different parts of the human body (for example, knees, elbows, hips) move using only digital videos recorded from household devices like smartphones and tablets. Here, we will study older adults at three different stages along the frailty spectrum: robust (not frail), pre-frail, and frail. We will use pose estimation software called OpenPose to automatically track the movements of these older adults as they walk across the floor. We will then use the movement data from the tracking and calculate different measurements about each person's walking that we think may be important for helping to distinguish participants with frailty vs. pre-frailty vs. no frailty. It's expected that, through the video-based walking analysis, we can find consistent measures to diagnose frailty by finding specific movement patterns. Using this data, we aim to develop and implement a more conclusive way to diagnose frailty in older adults.



Affordable and Fair Pricing in Auto Insurance

Victoria Pitt

Mentor: Dr. Candice Marshall

Department of Actuarial Science - Morgan State University

Roughly 82% of all Americans drive, and 92% of them have some form of auto insurance. Insurance can cost thousands of dollars, and it is vital that people paying for it can afford it. Auto insurance is typically priced based on certain factors – common ones including age, credit history, and driving record. Newer GPS simulation technologies offer a way to track each individual based on their live driving behavior, but these have been shown to be inaccurate at times. Consequently, I will be using programming language R to investigate trends in car insurance based on less commonly used factors – a customer's insured location, marital status, and age – in hopes of increasing awareness of what to look out for when choosing insurance plans. Regression analysis will allow me to compare the insured location, marital status, and age against the claim amount or annual premium. Ideally, this research will promote awareness of components that influence insurance prices and help consumers to ask the right questions when looking for coverage. My findings will hopefully encourage safer driving, help customers better understand what goes into the rates that they pay, and advise them on what they may be able to do in order to lower the premiums.



Building a Deep Learning Model for Breast Cancer Detection

Sawyer Ross

Mentor: Dr. Michele Mancusi
Musixmatch AI Department

Breast cancer is widely considered one of the most commonly occurring forms of cancer, predominantly in women, and found all over the world. Due to the common nature of breast cancer, more precise and efficient methods for early detection must be found. We can use different deep-learning techniques to get early detection which may save thousands of lives. While we can use several methods for cancer detection, such as Support Vector machines (SVMs) and Recurrent Neural Networks (RNNs), one of the most common forms is a Convolutional Neural Network (CNN). We will run different mammograms through our neural network and alter the different parameters of the algorithm to determine the ideal configuration and the best possible outcomes. The variations will be continuously tested in order to see which is the most accurate. As deep learning has continued to improve, so have the neural networks used for image detection. As research continues, neural networks will continue to improve, and even more lives will be saved.



About the Sophomore Introduction to Research Class

This class is the foundation of Ingenuity's signature research sequence, which dedicates 25% of 10th grade chemistry to developing students' research skills. Sophomores identify topics of interest and spend the year researching STEM solutions to a social problem that inspires them. Those continuing with on-site and off-site Research Practicum begin work on their future Independent research projects over the summer.

Ingenuity Sophomore Introduction to Research

Sophomore Social Responsibility Projects

Titles with an asterisk are students participating in Junior Research Practicum

James Addo - How Food Insecurity Affects School Children's Performance and Focus*

Layomi Adedeji - The Impact of Positive Affirmations on Americans*

Nabil Aime - Addressing Biases in Youth Education: Leveraging Machine Learning and AI Solutions

Laila Allsberry - How Has Inflation Impacted Food Deserts

Josh Amper - The Life of a Person with ADHD: How it Develops With Environment and Time*

Brayton Anderson - Solitary Confinement: Its Psychological Effects and its Well Needed Reconstruction Through Engineering*

Arman Ataei Kachoei - Climate Change, Heat Waves, and the Increasing Temperatures of the Earth's Effects on the Human Cardiopulmonary System*

Armin Ataei Kachoei - Disconnected Youth: Unveiling the Truth Behind Political Apathy and Voter Turnout Among Today's Youth*

Morris Auerbach - Fossil Fuels and the Production of Carbon Dioxide: Health Effects and Possible Solutions*

Faiber Balanfa-Cabezas - Climate Change: Understanding How Climate Change Causes Genetic Mutations Among Humans, Animals, and Plants Using Biology and Chemistry*

Tara Bass - How Can Aerospace Technology and Civil Engineering Better the Internet for Central African Schools in Conflict?*

Chonan Bell - The Study of Gacha Gaming Systems and Their Effect on Mental and Physical Health *

Donnovan Bey - The National Football League's Negative Impact on Health

Mykhi Brooks - The Psychological Effects of The 2022 Roe V. Wade Decision

Jerome Brown - The Effects of AI and Plastic on Climate Change*

Ka'Ren Brown - How Does Postpartum Depression Affect the Relationship Between the Mother and the Infant?

Kaii Bushyager - How Can Neuroscience Understandings and Machine Learning Improve the Child Protective Services System?

Phineas Caiola - How Can we Use Environmental Sciences and Biochemistry to Control Spotted Lanternfly Populations in the United States?*

Noah Carter - How Does Systemic Racism Impact High School Kids Based on Technology, their Anatomy and Physiology?*

Arvin Chen - How Can Machine Learning and The Biology Behind Vaccines Help Increase Vaccination Rates?*

Marshall Civin - Future Cities: A Method for Humans to Combat Climate Change*

Marisa Coleman - How Are Various Diseases Influenced by the Diverse Racial and Ethnic Backgrounds of Individuals?*

Bianca Crainiceanu - How Lack of Sex Equity in Clinical Trials Negatively Impacts the Health of Women: A View Through Biology and Statistics*

Julia Crainiceanu - Impact of Parental Cancer on Adolescents: A Study of Statistics and Neuroscience*

Lyric Daniels - Mental Health and its Effects on Team Sport Athletes

Nurjhan Daniels - Race Based Wealth Disparities in the Education System

Christopher Davis - Ocean Pollution and how it Affects Selachimorpha Activity

Cassidy Drummond - Health Disparities Among Minority Homeless Populations and How Statistics and Neuroscience Can Reverse the Disparities*

Wilka Eggert - The Effects of Marine Debris: Potential Solutions Through Civil and Electrical Engineering

Katherine Engelke - How Lack of Research on Female Biomechanics Affects Risk of Injury in Female Athletics*

Khadim Fall - Unveiling The Resilience: Understanding Acculturation Challenges and Academic Success Among Immigrant Youth in the U.S.

Ethan Fetsch - The Use of Cloud Seeding To Combat Climate Change*

Hayden Filipovitz - Big Data and AI: How Machine Learning and Computer Science Plays A Role in Modern Cybersecurity*

Esmeralda Flores - Space Exploration: The Effects on Earth and its People*

Paige Gantert - Air Pollution's Impact on Human Brains: How Environmental Science and Public Health Can Shed Light on the Problem*

Andrew Gao - Healthcare Inequities: Unveiling the Socioeconomic Divide and its Consequences on Medical Accessibility*

Maelle Girard-Tsuru - Exploring The Effects of Our Changing Climate on Glacial Microbial Communities

Fernando Gonzalez - The Reliability of AI in Cars Using Technology and Machine Learning

Maia Grantz - Are Mental Health Illnesses Genetic?

Cormac Hennessee - Toxic Masculinity and Its Effects on Mental Health and Substance Abuse

Emily Hijam - Anxiety: How Neuroscience and Public Health Work to Explore Effects on the Human Body

Daniel Hong - Opening The Door To Innovation: Impacts of Artificial Intelligence on Researching

Donajah Hooker - Time After Time Again: How the Cycle of Intergenerational Trauma Affects Black Families

Niyah Howard - What Effects Does Stress Have on Your Body and How Does it Affect the Generations After?

Deborah Hyun - How Can we Better Understand Gentrification Using Machine Learning and Statistics?

Elijah Isbell - Understanding the Positive Effects of Running Through Neuroscience and Public Health

Jaylin Jacobs - Classy Sophisticates Shall Not Bring Down the Homeless

Kinshawn Jones - A Look Into Different Foods and How They Affect Us

Anjali Kane - None Submitted

Malak Kardiss - Utilizing Biology and Biomedical Engineering to Understand Tobacco's Impact and Design a Solution

Nevaeh King - A System of Systems

Arlina Lamichhane - Breaking The Cycle: Identifying Abusive Behaviors in Men, Causes and Solutions

Thomas Lapp - Nuclear Propulsion and Reusable Launch Vehicles to Reduce Space Travel Pollution

Julian Lardner - Exploring How Social Media Affects the Brain: Investigating the Connection to Public Health

Mark Laury - AI's Growth Into Our Workspaces

Carley Layton - Current Abortion Laws and Their Negative Effects on U.S. Society

Wesley Leith - Connecting Rising Obesity Rates in American Children to External and Internal Factors

Colin Lilley - Analyzing The Impacts of Climate Change on Vulnerable Populations: Understanding the Risks and Resilience Factors

Fan Lin - Covid-19's Lockdown Impact on Youth: How Developmental Science and Statistics Can Offer Insight

Kali Love-Stancil - Animals and Medical Technology: A Step to Limiting the Symptoms of ADHD

Sokoro Lumumba - The Effects of Substance Abuse and Ways to Treat It

Jerrel Lyle - Substances are the Real Employees

Jordan Manley - The Effects Different Video Game Genres on The Brain

Johnacele Marquez - The Neurophysiological Effects of Drugs: Addiction and Damage on the Human Body

Lucas Masotta - Using Kinesiology to Determine The Impacts of Stress on Running Performance

Noah Mayifuala - How does Technology and Ecologically Enhanced Behavioral Studies Help Mitigate the Environmental Effects of Invasive Insect Species?

Gabriel McMahon - Diagnosing the World's Dangerous Intersection Problem Through Statistics and Engineering

Adelaide McMurray - Using Technology and Biology to Understand How Social Media's Beauty Standards Impact Young Women

Frank Mei - Saving Lives and Minimizing Risks, with CRISPR

Ana Melissa Miguel - The Consequences of Stress and Trauma on the Brain, and How to Counter Them

Michael Mokaya - Unraveling The Effects of Technology on Society and Other Human Institutions

La'Marteze Moten - Gender Disparities in Automotive Accidents: Advancing Safety Through Advance Automotive Innovations

Amir Muhammad - Feeding the Mind: Using Machine Learning Solutions to Understanding the Neurological Impact of Food Deserts

Benjamin Paglinauan-Warner - The Impact of AI on Music and its Contrasts with Human Creativity*

Alexander Pietrzak - Music and Physical Activity Effects on Dementia Patients

Carter Pisano - Poverty and the Impacts on Educational Growth

Lucy Quaerna - The Effects of Discrimination on Queer People and Those Around Them

Rohan Raut - AI in the Workplace: Helpful Tool or Human Replacement?

Sylvie Rehr - The Reduction of Agricultural Methane Emissions Through Altered Diets*

Luca Rodrigues - Effects of Gender-Affirming Healthcare on Mental Health

Alice Scott - The Role of Early Life Environment in Childhood Development

Irene Scott - The Expansion of the Food Production Industry and Its Environmental Impacts*

Nia Sewell - The Effect of Depression and Anxiety on College Aged Students

Aliana Shrum - The Long-Term Mental Effects of PTSD on the Human Brain of U.S. Veterans

Zaron Silver - The Gradual Biological and Environmental Behavioral Analysis of Crack-Cocaine Dependent Demographics

Isaiah Smith - Unclean Drinking Water in Certain Communities

Carter Sparks - Exploring the Process of De-Extinction

Max Surkan - Strategies for Learning Muscle Memory Faster

Jabari Taliaferro - Electric Vehicles and How Their Effects May Hurt the Environment

Abdullah Ubaydullaev - Genetic Engineering and Nanotechnology, a Dual-Approach to Mitigate Agricultural Losses From Rising Temperatures Related to Climate Change*

William Underwood - The Biological and Societal Impacts and Implications Rising Sea Levels Have on Coastal Communities

Malaya Victor - Is Music the Key to Easing Youth Stress While Studying?*

A'Jhani Whitaker - None Submitted

Chelsea Zellous - The Long-Term Effects and Consequences of Childhood Trauma*



About Advanced Placement Capstone Research:

In its eighth year at Poly, The AP Capstone Research Program is serving 120 students in grades 10 through 12. The program's core focus is on facilitating access to supportive and process-driven academic research outside of the laboratory. Students begin in the 10th grade (Introduction to Research Methods) with a combination of textual analysis, analysis, and synthesis skills. In the 11th grade (AP Seminar), students complete 3 papers to support an academic argument. Lastly, in the 12th grade (AP Research) students conduct original research studies on topics of their own choosing. As the program continues to expand, the goal remains the same: to increase student access to an academic research program and expand access to advanced academic opportunities for the betterment of the entire school community.

AP Capstone Senior Research



Hormonal Contraceptives and Teen Girls' Academic Success

Tylah Allen

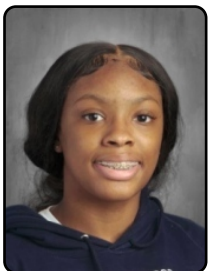
Hormonal contraceptives have been a topic with little research as far as individual impacts. Many women use them and it has become more common in young teens. Teen girls are already undergoing puberty which can have drastic effects on one's mood and motivation. Hormonal contraceptives typically also do so on their own. There could be a possible hormonal impact on teen girls who are going through puberty and on hormonal contraceptives. This study takes a glance into the connection between the use of hormonal contraceptives in teen girls, its possible influence on mood and mood disorders, and their connection to academic success at Baltimore Polytechnic Institute. Through a correlational study, this inquiry observes different contraceptive experiences to find an overall interrelatedness. A survey was the best option to investigate said inquiry further. Beginning with a survey to ask general questions about the topic, I followed up with an interview to gain some personal experiences. I am now at the point of continuing my interviews and have not yet reached the point of reviewing all of my data.



Unhealthy Eating Among High School Students Within Fast Food Restaurants

Cameron Atkins

In my study, I aim to find the reason for unhealthy eating habits among teens and find a correlation between both. I conducted this study to address the lack of awareness in America's society regarding the fast food industry resulting in teens being perceived as targeted audiences causing a threat to their own health; the public view sees the way fast food and prioritizing food over school. The methodology of correlational research looks at the relationship between variable A: causes of teens' eating habits, and variable B: health effects. Asking a survey of multiple-choice, open-ended, and rating questions leads to the individual being asked what they do; have done in that moment; and their personal views. This enables the surveyor to find a strong or weak relationship to better understand whether teens' health is being affected. Additionally, case studies were conducted to find similarities and differences presented among teens and how they feel, whether it is an emotional, physical, or a good or bad resp mental response about eating fast food and any changes after eating, regardless of whether it onse. For my results so far, I am still examining the connection between both variables and have not concluded. However, there was a link between the convenience of getting fast food among teens, whether that being affordability, time-saving, or accessibility, which was made clearly that could further lead to more research.



Unveiling the Healthcare Struggles of Single Parents vs. Dual Parent Households

Makayla Biles

In my study I planned to unveil the Healthcare Struggles of Single Parents vs. Dual Parent Households and potentially find a link or causation. I conducted this study using a causal research method, to determine a link between households and the treatment received or the struggles to receive treatment. The first thing I did was create a survey with a series of questions asking about one's experience accessing healthcare. For example, their interpretation of the barriers their parent(s) face accessing healthcare. Which varied between affordability to availability, household size, and more. This survey was open to students in a single OR dual parent household. Establishing a link was difficult since I didn't have a large sample size. Most respondents were in dual parent households, but of the small number who lived in single parent households, only half said their family had troubles within the healthcare system. So, what this meant is that there was a correlation, but not causation; Therefore, there was no apparent link between single parent households and treatment received. But the link between financial stability and receiving healthcare was made apparent, and could lead to further study.



"I'm not bad, I'm just drawn that way" - The Visual Portrayal of Disney Princesses and their Corresponding Villains Throughout the Seven Eras of Disney Filmmaking.

Amelia Blackman

The importance of Disney movies stems from the vast number of people who watch them. It is a large part of many childhoods while influencing media and consumerism. Viewing Disney movies could influence children's behavior toward others and how they see themselves, depending on the movies they watch and what they glean from them. The goal of this study was to analyze the visual appearance of Disney princesses and their corresponding villains across the seven eras of Disney's history. All thirteen Disney princess movies were analyzed using the content analysis methodology. Each feature of the character's body and face was examined and compared among the other movies for similar trends, differences, and possible changes as the movies get more recent. It was found that the princesses tended to have identical characteristics such as perfect skin/makeup, straight/white teeth, luscious hair, good posture, and a slim body type. As the movies got more recent, their eyes got larger, eyebrows got thicker, noses got larger, and body shapes gained muscle. However, these subtle changes did not take away from their irrefutable beauty. As for the villains, they didn't have identical traits like the princess did, but the majority possessed characteristics that are immediately off-putting. Overall, most villains had unnatural hairstyles, unappealing body shapes, imperfect skin, large or strange looking noses, and asymmetrical facial structures. As the movies progressed, the villains did start to look more natural with less dramatic physical traits.



The Progression and Importance of Music as an Artform

Jarvis Blatche

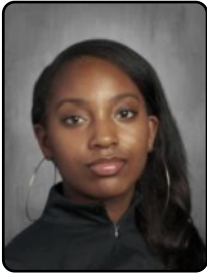
Music, since its creation, has been an artform of social expression. From its roots as a purely religious creative medium, to a more personal one; being crafted for the creator's (and sometimes others') enjoyment. Now that it has risen as the most consumed artform, it's important to understand its impact socially and emotionally on the people. Almost any study pertaining to music is going to be deeply rooted in a methodology of phenomenology; the study of the human experience. Since music was created via human manifestation, that makes it the most viable option by default. One of the earliest confirmed discoveries about music (besides their religious origin) is Pythagoras' that "rhythm is nature's means of carrying principle to its infinite manifestations, reacting on us as forms, sounds, motions". Pythagoras also is credited with the diatonic scale, which is paramount to the foundation of music itself and is still used three thousand years later. It was also noted by Halbert H. Britan that music's importance is purely dependent on the "relation to the individual", which causes the individual's preferred music to more likely affect them in aspects such as social issues.



Gambling Addictive Behavior in Adolescents

Jaelyn Bolden

Gambling addiction as a whole is a very overlooked, neglected form of addiction. However, its prominence is only increasing and is now beginning to significantly affect adolescents due to the rise of online gambling and online behavioral advertising. This new and generally under researched phenomenon is important to understand for our own safety, the safety of our peers, and the safety of our children. To further emphasize the dangers of these newly implemented methods, the researcher chose phenomenological methods to best capture and analyze the vulnerability adolescents possess while indulging in gambling activities, and to what extent gambling industries target these adolescents through advertisements. Phenomenology creates an intimate environment between the interviewer and the subject, ultimately causing a psychologically in-depth perception of how the circumstance affects behavior. Through a short survey and six interviews, the researcher found that adolescents are indeed vulnerable to these gambling methods and advertisements, and are somewhat aware of the risks associated with them. However, some adolescents did not understand the dangers of online behavioral advertising, and have failed to realize that it is the basis of why these habits start. These results prove that there should be deeper restrictions in the online gambling industry.



Arts Education Amongst Baltimore City Public Schools

Trishele Bratton

There is complexity presented in the learning processes that students undergo and coordinating teaching procedure (s) that are used to both educate and engage students' attention in traditional classroom settings. Traditional curricula dating back to the 1800's, have presented a lack of arts education, instead presenting a curriculum that encourages fluidity of thoughts and the use of creativity to acquire knowledge through standard subjects such as math, reading, and history. This comparative case study was conducted specifically on high school students attending both Baltimore Polytechnic Institute and Baltimore School for the Arts, in hopes of identifying commonalities and differences presented within the students' emotional and academic behaviors, related to the respondent's participation in an artistic outlet. Case studies allow for a closer view into the participants' thought process through concise questioning, whilst providing results in a shorter length of time. Through a questionnaire, participants identified their demographic and selected statements that they felt most closely aligned with their performance and motivation in school, as a result of being involved/not being involved in an art. The study's results showed evidence of a link between those who are involved in an art and higher levels of motivation than those who weren't involved in an art compared to those who don't use an art as an emotional outlet, presenting lower levels of motivation and subsequently lower academic performance. These results prove an apparent need for arts education within Baltimore city public schools, as it could elevate student progress and intellectual ability.



A Father's Childhood Trauma

Kiara Byrd

Many studies have explored the impact of childhood experience on adulthood, acknowledging the crucial role that early life plays in shaping individuals. However, it's notable that a large amount of research tends to emphasize the influence of mothers, while neglecting the contribution of fathers. It's important to understand that a father's mental health not only influences his daily life aspects but also plays a crucial role in shaping the emotional and physical experience of his child(ren). Recognizing and addressing the connection between the effects of childhood trauma on mental health and examining how it can deteriorate the relationship between a father and his child(ren) can help create a future healthy family environment. To create an accurate study approach, phenomenology was the best method for the inquiry, because phenomenology studies one's individual experience and gives results that are in an in-depth analysis on how a father's childhood trauma can affect his relationship with his child(ren). With interviewing 3 pairs of a father and child, asking questions that connect to their relationship and the mental health of the father, the majority of the results have linked childhood trauma to adulthood trauma responses within the father's present day household. The results help conclude that in order to create a healthy family environment and break the generational cycle of trauma, it is important to focus on the father's mental health, and create an atmosphere where they are comfortable to acknowledge it and move forward with treating their traumatic experience to better their relationship with their child(ren).



Hispanic Students and the Correlation Between Household Expectations and Education Goals

Alejandra Diaz-Maldonado

While extensive research has been conducted on dropout rates among Hispanic high school students across the United States, very few have examined the Hispanic student population in the Baltimore City Public School system. Previous studies identified family dynamics as a key dropout rate factor. This study examines deeper into the expectations and circumstances of Hispanic families that might affect a Baltimore City public school student's educational aspirations. Five Baltimore City high schools participated in a correlational study, receiving a survey in English and Spanish (for non-English-speaking students). The survey covered demographics as well as family details. Students were then asked about their high school experience, perception of education, post-high school plans, and how caregivers' expectations influence their decisions. According to the preliminary analysis, 46% of students said their family makes between \$20,000 and \$50,000 annually, 27% between \$0 and \$20,000 and \$50,000 and \$100,000, and 0% \$100,000 or more. 81% of the respondents said that their education was impacted by their family's finances. The majority of participants, 16%, selected 1 on a scale of 1 to 10, representing how active their caregivers are, 1 being rarely involved. 36 out of the 37 respondents stated they would attend a post-secondary institution or trade school, while the remaining indicated they were unsure. Even though a large number of respondents said they had aspirations beyond high school, the findings show a lack of family participation and how family income influences students' education in one way or another.



Visual Arts and Culture: How Culture Informs our Understandings of Superhero Comics

Kourtney Douglas

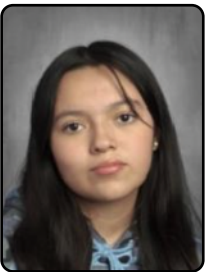
The discussion of culture and visual arts is based on the popular culture of the past which influences the current culture. Many researchers focus on multiculturalism and visual art inside the classroom, seeking how it could benefit kids in an educational setting. This research would move beyond this point in seeing the idea behind why people most connect with a certain character or piece of art through a cultural perspective. While previous research looks at how culture affects the perspective and formation of biases and popular culture, it does not look at how teens in Baltimore use those biases to interpret visual arts through comic books. This research will add to the previous knowledge through a popular form of media. By going through the avenue of comic books, an easily accessible form of media, especially in today's society, we can synthesize how all perspectives are needed to better encourage diversity in the classroom and everyday life. This study will use correlational study, a design of study to find the relationship between two or more variables, to find the relationship between a person's culture and how it influences their interpretation of visual art. The study will use the sample of three comic books and ask participants questions based on their content (art, characters, emotions, language), using this data to create a general understanding of how visual art is understood through cultural perspectives.



Foster Care Workers and Their Ability to Identify Mental Health Issues in Female, African-American Juveniles

Jhamari England

Children coming from broken homes lack life skills, basic needs, safety, self-esteem, and self-actualization, making these factors effective recruitment methods. Growing up without one or more of their basic needs causes them to look for them elsewhere- in turn, their recruiters fill this gap by exploiting them, causing them to lose their identity. The three common themes of recruitment are lures; money, friends, boyfriends, vulnerabilities; lack of basic needs, familial support, drug exposure, and deceptive recruitment; online danger. It is easier for a trafficker to access a child when they have previous drug exposure, trust issues, violence, and financial deficiencies because they do not care about the girls, only the benefits they can provide for them. This study examines vulnerabilities in sexually trafficked African-American juveniles by highlighting the potential coping mechanisms of the survivors and the overall efficiency of social workers in identifying mental health disorders and symptoms. The method for this inquiry is need-based case study, analyzing why there is a greater chance of African-American juveniles in foster care that are more likely to become involved in sex trafficking when their mental health is neglected by social workers. The purpose of case study is to formulate a conclusion and collection of needs based on an observation of a specific group in order to identify why a certain situation exists. Although informal, the researcher hypothesizes that social workers are not properly trained to identify mental health disorders in African-American children residing in foster and group homes.



Investigating The Immigrational Stance And Identity of Minors in the U.S

Lindsey Funes

In the time period between migrating from a foreign country and entering the U.S. a number of researchers have concluded Undocumented Immigrant minors are placed in hostile conditions and are subject to a lifestyle of disparity. This study addresses the concerns with the narratives of deservingness that are perpetuated by American society resulting in immigrant minors being perceived as a threat, economic burden, and an additional weight. The substantial body of results in this study reveals the difficult ways that being an immigrant in the United States has its effects. The methodology of qualitative survey research looks for a relationship between Variable A: Identity, and Variable B: Stance. 78% of immigrant minors in Baltimore City responded that they have had an effect in understanding their identity. Additionally, 82% agreed that they felt an effect in understanding their place in American society. Although a conclusion can not be finalized due the still active research, preliminary analysis points towards immigrant minors feeling their stance in American Society has had a greater effect on them than identity.



Mental Strain and Resilience Within Baltimore Polytechnic Institute Students.

Esmeralda Gonzalez

This study dives into the psychological impact students experience at BPI and the mental toll change as a result - in hopes to understand the underlying factors that may result in a student's distress during their high school career. This study advocates both inside & outside factors that may be contributing towards a student's mental toll. Although the main purpose of this study is to delve into negative impact on the student's mental well-being, the research hopes to bring awareness to how the student's struggles at BPI may result in an endurance & skill in resilience. Methodologically, the study uses case study. The choice of the case study method for this study is grounded in its ability to provide a holistic understanding of the phenomena under investigation, and allows the researcher to delve deeply into the lived experiences of students. By focusing on individual cases, the researcher can capture the nuances and intricacies of students' experiences, including the unique challenges they face, the coping mechanisms they employ, and the support systems available to them. Students at Poly face a variety of external factors impacting their academics. Extracurricular activities, family issues, mental health concerns, and societal pressures all play a role. Additionally, stressors like college applications and personal beliefs about work further affect their performance. These findings highlight the need for comprehensive support to address the multifaceted challenges students encounter outside of school.



Investigating the Openness at Poly for its Multicultural Students

Chantelle Hockaday

Dating all the way back to the infamous case of Plessy v. Ferguson the discussion of implementing students of different backgrounds has been a heated debate, one that is still happening to this day. In modern times the overall negative reception by people towards multicultural people has created feelings of exclusion. To address how this has affected Baltimore Polytechnic Institute (Poly), interviews have been conducted with multicultural students regarding their experiences at Poly. This study explores the extent to which Poly has a welcoming environment for its multicultural students via interviewing multicultural students at Poly. The results from this study show a nuanced view of the welcomeness of Poly, while Poly is welcoming there are still people who are ignorant. Showing that despite people being open to people of various backgrounds, people still have bias and ignorance which affects the way they interact with multicultural students.



The Effects of Targeted, Sexualized Ads on Teen Girls

Kelcie Jacobs

Advertisements are prevalent in every aspect of an individual's life, especially on social media. Ads have historically presented women in a stereotypical way such as perfect skin and thin. These portrayals have been ingrained in the minds of many young girls as the algorithm targets their vulnerabilities. Through a use of phenomenology and content analysis, this study aims to find the potential link between low self-esteem in teen girls and the ads they view on Instagram and TikTok. Girls from ages 14-18 at Baltimore Polytechnic Institute were surveyed and interviewed to learn about how their self-perceptions have been changed by the portrayals of women in ads. The initial survey asked for common depictions of women to be given, which shaped the questions asked in the additional interview. The results thus far have shown that teen girls are comparing themselves to unrealistic ideals and felt less than because they don't believe they are "stereotypically pretty". The group of interviewees indicated that the products they have bought from ads revolve around changing their appearance like leggings to enhance parts of their body and tools to reduce the fat in their faces. This study hopes to find a way to expose the subliminal messaging and explore ways to reduce the sexualized image of women in ads.



Investigating the Impact of Gender Inequality on Education

Daiyon Jenkins

This study looks into the nuanced impact of gender inequalities on academic achievement in educational settings, hoping to understand its multifaceted implications. This study advocates the launch of gender diversity programs to promote inclusive and equitable learning environments, based on the urgent need to address widespread gaps in opportunity, ingrained biases, and lower self-assurance. The overall significance of this endeavor is underscored by its commitment to fostering educational equity and challenging ingrained stereotypes. Methodologically, the study combines phenomenology and trend analysis. Phenomenological inquiry allows for the examination of individuals' subjective experiences, providing insights into the emotional components of gender inequality. Concurrently, trend analysis offers a longitudinal study of the long-term effects of gender differences on academic success. The findings of the study demonstrate a universal acceptance of the need for increased awareness of gender inequality in educational settings. While a large proportion of the studied population may not have directly experienced gender-based discrimination, there is a clear link between experiences of inequality, decreased motivation, and poor academic performance among impacted individuals. In conclusion, this study adds a new perspective to the scholarly debate on gender inequality in education. By clarifying the intricate dynamics at work and arguing for proactive interventions, it hopes to influence specific activities aimed at promoting gender equality and holistic development in educational settings.



The Retraumatization of Black Students in the Classroom

Ruby-Rose Kumodzi

In recent years, there has been more of an incentive to include discussions of race into the classroom. The current rise in legislation that bans 'Critical Race Theory', or any material that pertains to the history of racism in the United States has further justified this shift. However, in an attempt to educate students on Black history, teachers and faculty often neglect what is appropriate to showcase to Black children, and the environments that they foster in their classrooms. Most content featuring Black characters shown in the classroom involves depictions of police brutality, sexual assault towards Black women and girls, and other forms of racial violence. Black women in particular find this content to be disturbing, as they often see themselves in the victims. Non-Black students will socially isolate Black students and use lessons concerning race as ammunition to be anti-Black. When this occurs, teachers do not correct the behavior and the responsibility is placed on Black students to stand up for themselves and educate their peers. In response, these students are further isolated from the group. While Black male students reported the most microaggressions overall, Black female students reported anti-Blackness from non-Black peers, and misogynoir from Black male peers. The lack of protections for Black students, and the unwillingness of teachers to correct anti-Black behaviors fosters environments that leave students feeling drained, depressed and anxious. If measures are not taken to protect Black students in class, their social and academic performance will decline over time.



Effects of Physical Health on Jobs

Jason Lewis

This study aims to examine the effects of physical and mental health on an individual's work and personal life. The goal is to help those who do not know how to stay healthy in daily life and show why negative health effects could occur. The method used was a case study. The purpose of this form of research is to study a specific group of people and see why a set problem occurs. The specific group studied was working adults in America. The problem that was focused on was the potentially unhealthy workplace conditions. This data was gathered by spreading Google Forms surveys to those who met the requirements for the study. So far, the results seem to conclude that the original hypothesis was correct. Negative mental health in jobs seems to have a trend alongside a lack of proper physical health in jobs and vice versa. Finally, we can see how the effects of fitness can have a great impact on the emotional and physical health of others. This shows that working adults should put in an effort to help themselves by incorporating exercise into their lives.



American Perceptions of Environmental Sustainability – The Link Between Racial Culture & the Pursuit of a Sustainable Society

Assata Makonnen

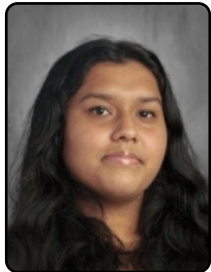
In light of unprecedented damage to the environment due to human activity, the need for climate reform in society's technological, industrial, and educational aspects has never been more imperative. Within the global community, the United States is unique in two aspects: its racial climate, and its vast ecological influence. Implementing a viable, long-term solution to climate change will require an understanding of its cause, in all of its nuances; to state that climate change is a global issue requiring global solutions reveals only one layer of the matter at hand. As one of the countries with the greatest GDPs, the US is significantly more responsible than other nations for reversing environmental harm. Perhaps the country could have no greater contribution than to slowly – yet significantly – reform public attitudes, practices, and overall sustainability culture to produce a mindset reflecting positively on building towards a sustainable future. Such a culture shift, however, requires a deeper understanding of the cultural influence within the US than academia currently holds. Democracy and racial politics have furthered subcultures that have mixed with broader American ideals to produce an identity unique in its composition. Understanding this composition is integral to beginning its reform. As such, with a qualitative study rooted in ethnographic methods, Assata Makonnen investigates the societal aspect of American culture in its respect to climate reform, surveying participants on the basis of their racial background, sustainability beliefs, sustainability practices, and their overall receptiveness to a global future rooted in environmental sanction and welfare.



Collaboration and Climate Justice: Developing Holistic Activism in the Climate Movement

Riven Myers

Sustained collaboration is widely regarded to boost the potential impact of activism, and is being integrated into various social movements more and more to address complex issues. The ways in which cooperation is utilized in the fast growing climate movement, as well as how it has and has not been successful, however, is understudied. Given the dire threat and time sensitive nature of the climate crisis, it is essential to understand how the climate movement is effective, where it is failing, and the ways in which it could improve. As societies struggle to execute solutions to this crisis, activism--an avenue to pressure governments, corporations, and the public towards change--is an ideal area of focus to advance discussion and action. Through a qualitative meta analysis on academic and public conversation around collaboration, climate activism, and climate justice, key ideas that have yet to be well explored are synthesized into a new discussion. Ultimately, climate activism is terribly underdeveloped in its ability to: (1) function at different scales (i.e. global, national, local), (2) center and prioritize the most affected groups, and (3) address the role of societal systems in causing as well as exacerbating the climate crisis. Not only must the climate movement adopt an intersectional and interconnected approach to the problem for broad alliances to be possible, but it must integrate the concept of climate justice into its foundation in order to recognize and challenge the often ignored systemic issues at play.



Young Girls In Politics

Aunusha Nath

The purpose of this study is to explore the phenomenon of how the younger generation of girls interact with politics. Social media is used as a tool to spread information regarding political topics and hold discussions about current issues. It is common to see this field be dominated by men even when the topic of women's rights are brought up. These political spaces can often be challenging for young women to view and interact with, which compelled this researcher to choose this specific topic in order to better understand how social media's political spaces affect the views of teenage girls. This researcher chose phenomenology due to it best fitting the study because to answer the selected inquiry it would require the researcher to explore the experiences of the target population. The researcher interviewed teenage girls at Baltimore Polytechnic Institute and asked them questions about the use of social media and their personal feelings revolving around political spaces. At the moment, this researcher is currently in the process of coding and analyzing their collected data in order to come up with a conclusion.



Teenage Reception to Adult Animation

Lamine Niang

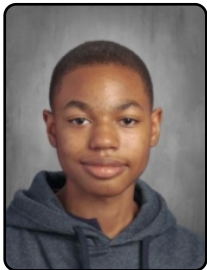
Despite being perceived initially as a raunchy, adult-oriented genre, animation as a form of entertainment has undergone changes since the early 20th century, with it now being regarded as a genre mainly meant for children. As a result of that notion, adult animation has been disregarded as a potential source for mature storytelling while utilizing the visual storytelling correlated with so many animated projects. This study aims to understand how the target audience of most adult-animated programs (teenagers and young adults) perceive the medium and how the notion of animation being a genre meant for children has affected that perception. After having focus groups watch multiple different adult-animated programs, it became apparent that, while the preconceived notion of animation has damaged the reputation of most adult-animated programs, the lack of proper storytelling and influx of comedy at all times has made it difficult for adult-animated programming to be perceived as mature content similar to it's live-action counterparts. These results indicate that a shift must be made in how adult-animated content is produced, putting more effort into the writer's room in order to create programming that goes beyond just raunchiness.



The Undiscovered Perspectives of the School Nurse Role

Oluwadarasimi Gabriela Obafemi-Ajayi

The role of the school nurse has been plagued by a deficiency in effectiveness due to an overlooked factor in healthcare development - the consideration of the student experience. Young adolescents and teen students are often treated as unaware of what's best for them, with decisions made for them, resulting in their lives being built around predetermined structures until they're capable of discerning what would've uplifted a displeasing visit to the school nurse. This capability is crucial to their overall behavioral skills and performance in social settings. Despite this, studies evaluating the effectiveness of the school nurse role have failed to examine the interactions between students and their nurses, thus neglecting the importance of the student-nurse relationship. Therefore, constructing a study using a phenomenological approach to determine the undiscovered perspectives of this relationship through the experiences of the visits retained by the students will highlight areas of the profession that require immediate improvement and attention. The findings have revealed that high school students are becoming unacquainted with their school's nurse due to the unsatisfactory experiences of their peers, thus demonstrating detachment from the students to the nurse. It's time to emphasize the importance of a strong student-nurse relationship in educational institutions by ensuring that school nurses are supportive and devoted to caring for the health of growing individuals, which ultimately enriches their academic performance.



The Dark Side of Media

Isaiah Richardson

Since the start of modern media, there has always been an attempt to understand how the media we watch, read, and view shape our world and influence the masses. So, there is no confusion that media has the potential to guide thinking to the point that civilians understand that viewing media impacts our way of thought, a proposition backed by a plethora of research and data seeking to understand how the human brain reacts to scenes. With hyper-focus on ages 8-13 where the initial spark is formed, however, the researcher's paper aims to rework the way that the mass majority collect data on this area of research although it is an interesting attempt to understand how their brains initially react by bumping the target age from 8-13 to 15-18 the participants who can now better access the drugs and alcohol that is present coupled with age that will allow for the maturity and intelligence to articulate the impact that media has had on them. However, by using data, there is a much better way of breaking down human opinions and beliefs by actually having an actual conversation. Therefore phenomenology was a natural choice as it is a method focused on basing one's research findings on listening to the participant's opinions, emotions, and testimonials. The two scenes that were selected demonstrated the latter depicting underage drug practice, deriving from the respected shows (Euphoria 2019) created by Sam Levinson, and Paul Abbott (Shameless). These two clips allow the researcher to limit the inherent sense of bias by showing media on both sides of the spectrum. One where the director depicts the harms and effects of drugs on undeveloped minds coupled with another that shows the positive use of drugs as an escape from your problems. Selecting both sides allows the participant to form their own opinions versus spoon-feeding and guiding them to a side that would be more favorable to the researcher. Based on the data that has been acquired so far the initial hypothesis was backed by the data.



Gender and Sex In Sports

Miller Rogers-Tetric

Sex and gender are evolving. We must not hide from this conversation. If we can address what sex and gender have come to mean and affect athletes nowadays, this study can only offer a helping hand to those who need it—for all those athletes who want to express themselves in and out of the field but feel like they can't. The method for this inquiry is a case study method. A case study is a research approach used to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context. During the interviews, I've come to find that student-athletes are being heavily influenced by sex and gender, especially when it comes to their access and sense of belonging around the sport. There is also a constant demonstration of wanting to bring change as some athletes feel like they are changing, but their surrounding sports aren't doing so.



Feelings Surrounding Gender and How That Affects Sports Viewership

Paige Schweitzer

For centuries sports have consistently been male dominated both in participation and viewership. This commonly gives women the feeling of being unwelcome and estranged from sporting events. Therefore, this study aims to pinpoint if, why, and how women feel uncomfortable in traditionally male-dominated sporting events. This is important, because female viewership is just as important as males, and it contributes both mentally to females and economically with the addition of sporting events in their lives. This research seeks to identify the gender gap in sports that continues to be prevalent to this day and examines the way females feel uninvolved in both the sports industry and environment, which affects their participation when it comes to sporting events. I used the comparative case study methodology to interview different groups of people. For example, my study requires information from two different generations and gender. To gather this information I sent out a survey to people apart of Generation Z and Generation X. This survey gathered initial interest for a potential interview and background information from each gender, which I used to formulate questions.



The Repetition of History and its Current Impact on Global Politics

Lance Shrum

The escalation of Chinese territorial assertiveness in the South China Sea has led to a resurgence of regional instability, affecting not only the governments in the region but also posing a threat to the integrity of a crucial global trade artery. In response to these developments, the United States and other nations have strategically deployed military assets in an attempt to deter China; however, these efforts have thus far proven ineffective. Current scholarly investigations primarily rely on mathematical data and probability analyses. While this approach has demonstrated considerable success, it fails to account for the large amount of historical evidence spanning centuries, revealing discernible patterns. Recognizing the limitations of a purely statistical methodology, the researcher is currently employing a nuanced blend of case study and hermeneutic analysis. This interdisciplinary approach aims to discern patterns embedded in history, offering invaluable insights into the complex dynamics at play in the South China Sea. In the preliminary stages of analysis, the researcher identified a recurrent historical pattern spanning the past millennium. This ongoing investigation strives to integrate historical context with contemporary geopolitical developments. Through a fusion of quantitative and qualitative methodologies, the researcher aims to illuminate the potential trajectory of the Chinese-American military build-up/conflict in the South China Sea. These early assumptions, though preliminary, offer a glimpse into the broader implications of the current geopolitical landscape, fostering a more nuanced understanding of the intricacies at play in this pivotal region.



Consistent Alcohol Use: The Devastation of Families in the Mid-Atlantic Region

Ava Stello

As mental health is a newly prioritized subject in American society, many unhealthy coping methods are easily accessible to the general public. One of the most popular 'coping' methods is substance use, which can quickly escalate from use to abuse. The presence of consistent alcohol use (CAU) is common among older generations causing a perpetuation of mental and emotional problems in their children. Therefore, this study aims to establish a causal relationship between CAU in the home and long-term effects, specifically maladaptive behaviors, in adult children of these environments. Through the use of a case study with causal-comparative research and mixed methods, I distributed two surveys to a total of 29 participants. My first survey focused on demographics and the level of drinking that the participants' parents participated in. In my follow-up survey I provided questions that addressed emotional loneliness, maturity, and intimacy. Based upon all of my responses I began comparing the two groups and coded individual responses for instances of specifics, emotions/qualities of the participants, and long-term impacts. After analyzing data and completing tables comparing the nonCAU to the CAU group, I found that exposure to CAU worsened the stability of adult children and increased the likelihood of long-term consequences from trauma.



A Gendered Analysis of Discrimination on Black Female Pediatricians in Medicine

Ariana Stephens

Discrimination against black female pediatricians in Baltimore City and County poses a significant challenge within the medical field, involving a deeper understanding of its implications and the urgency for change. This study employs a phenomenological methodology to explore the lived experiences of black and white female pediatricians, shedding light on the systematic disparities and challenges faced by black women in this profession. Through interviews conducted with both black and white female pediatricians, this research seeks to explain the different perspectives and experiences within the medical community. After interviewing, the findings reveal a distressing reality: black female pediatricians encounter pervasive discrimination and lack of support from colleagues, patients, and superiors. The absence of support systems and professional acknowledgment increase their challenges, hindering their ability to thrive in their careers. The significance of this study lies in its illumination of the persisting racial disparities and biases that permeate the medical field, particularly impacting black female pediatricians. By bringing attention to these injustices, this research underscores the imperative for systemic change within medical institutions. It underscores the need for proactive measures to address unconscious biases, provide equitable support systems, and foster an inclusive environment for all healthcare professionals especially pediatricians.



Bridging Creativity and Business: An Evaluation of AP Art's Preparation for Its Students

Shayla Stephens

Within the fine arts community, there is an inadequate amount of opportunities for artists to have room to develop their craft in spaces where learning is encouraged. Art entrepreneurship is a phenomenon in which artists are developing ways to profit from their art. While conducting an understanding, there was an influx of information pertaining to the impact of (specifically) college curriculums refraining from including the idea of entrepreneurship within the course; more specifically networking skills, marketing, curating an audience, etc. Baltimore Polytechnic Institute offers their students a chance to be introduced to college course classes, with the AP Art program curated by College Board. An evaluation research was executed, to assess the effectiveness of the AP Art program, pertaining to its preparation for students interested in having a career in the arts, and perhaps inspire those who have other ambitions. During interviews where both teachers and students were questioned about their experience thus far (given students are only 75% complete of the course), they were asked a series of questions, and depending on their experience; follow up questions were administered. Thus far, the course has been deemed a well-rounded experience, where it prepares students well for careers in the arts, irrelevant to the arts, and a mesh of both. As the research is still ongoing, a preliminary analysis gauges AP Art being beneficial towards students, though there is a lack of entrepreneurial skills being taught. Final conclusions will be published by May 2024.



The Overlooked and Undermined Mental Health of Young Boxers

Alexander Strickland

Young fighters are constantly putting themselves through rigorous & violent training in order to better themselves so that they may succeed in the boxing world and succeed in being an entertaining athlete. Despite our dedication to the sport and being the best we can be, our physical and mental health is constantly being overlooked and undermined and has been for years. It is my goal to bring the mental health of young fighters to light and to give our psychological state the attention that it deserves and needs. I used phenomenology when conducting my research. I did so in order to collect data on the interpersonal experiences and lives of young fighters in regards to what their personal experiences are like climbing the professional ladder and advancing their skill in the boxing world. I decided to gather some of my personal sparring and training partners for this study as I knew they would all likely provide me with a variety of different answers. I interviewed them all with a set of questions that I believed would warrant some deep and in depth responses and then categorized the response by the question asked. I've found that the rigorous and violent nature of the sport actually has more of a positive effect on the mental health of young fighters as the sport gives them a strong sense of confidence and achievement whenever they participate in it. The violent aspects of the sport inspire them to improve and better themselves for their own sake.



East Baltimore Redevelopment Processes and Their Residential Impact

Tsion Tariku

This study investigates the impact of recent gentrification and redevelopment on largely minority populations in East Baltimore, with a particular emphasis on the East Baltimore Redevelopment Initiative. The research aims to contribute to the development of equitable housing systems for minority populations, advocate for the unheard voices of affected communities, and educate corporations and entities involved in redevelopment on optimal services and policy measures to reduce negative residential impacts. The research not only addresses the specific circumstances in Baltimore but also provides valuable insights applicable to other urban areas facing similar challenges regarding large-scale redevelopment processes. The researcher uses meta-data analysis to assess the available literature on options like CBAs and inclusionary zoning. Furthermore, Repertory Grid Analysis is used in interviews with five (subject to change) East Baltimore residents, providing a personalized perspective on the impact of redevelopment and potential solutions within the context of the community. In line with the absence of social cohesion in East Baltimore, the research has shown that investing in community initiatives and organizations and involving locals is the most effective option.



A Study on Student's Well-being After Using AI

Jadon Thomas

This study examined whether there was any correlation between the use of AI and a student's well-being. It would show how AI could be used to aid students in their educational journey throughout college along with how students already use AI to help them with their ongoing problems that some human figures can't resolve. I employed a case study methodology to examine how certain college students used AI to help them with their studies. Using a case study was the best method for me because it gives a holistic view of my inquiry and answers the "how" and the "why" within my research study. And through this people could better understand the phenomenon I was looking at where there's only so much research available. I found that most students used AI already to help them with their school work and that most students did indeed feel less stressed after using AI to assist them in their work. This could mean many things, but this mainly means that AI could be employed in schools to help students with special needs or needs that can't be tailored by a teacher, it can only benefit the educational environment.



The Impact of Social Media on Adolescent Well-Being

Henry To

The recent introduction of social media has contributed to various impacts on adolescents' well being. The effects of social media are not fully understood, particularly when dealing with those who are still developing. Social media is an outlet for social comparison, which has previously been shown to have an effect on one's self esteem and general belongingness levels. This study surveyed high school students on their general well being, social media use, and habits of social comparison. Correlational analysis, which is designed to establish a relationship between variables and determine the impact they have on each other, was used to analyze the data. The results were imported into a spreadsheet and used to create pie charts, which currently point towards a negative correlation between upward social comparison and self-esteem, and a positive correlation between social media use and general belongingness. This reveals that social media is not intrinsically bad for adolescent's well-being, as it tends to increase feelings of general belongingness, and self-esteem levels are only decreased if the individual makes upward social comparisons as opposed to downward.



The Effect of Sacrifices on Chess Accuracy

Ignatius Tower

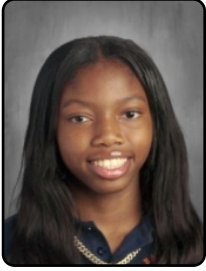
Today, Chess is a respected and popular game, played by professionals and amateurs alike. Despite its complexity and worldwide appeal, Chess has seldom been researched. Most research on Chess focuses on the long-term effects of playing on intellectual functions including memory, processing speed, and pattern recognition. The psychological effects of moves within games, though heavily speculated on, are unstudied. The common motif of Chess sacrifices, the act of giving up pieces for those of lesser value (or nothing), was used as a lens to examine how players perform under an increase in perceived pressure. When one's opponent plays a sacrifice, it is hypothesized that the quality of play will decrease. This is because of the tendency of sacrifices to complicate the position and require strong responses. To test this, twenty games by elite players that featured sacrifices were examined. The performance of the player on the receiving end of the sacrifice was measured in centipawn loss for twenty moves (or less, if the game ended) after the sacrifice was played. To evaluate how much better or worse the player performed when a sacrifice was played, their centipawn loss for those twenty moves was compared to their centipawn loss across the event where the game was played. While the average centipawn loss for the twenty games was well over the event performance (mean excess=5.851), this came almost entirely from successful sacrifices (mean=11.5) rather than unsuccessful ones (mean=0.15). The data rejects the hypothesis.



Exploring Time Perception; A Comparative Analysis of A-theory and B-theory

Chinomso Ugwuoke

This research paper delves into two contrasting ideas about time: the A-theory and B-theory. A-theory posits a linear progression of time, while B-theory views time as a static block where the past, present, and future coexist. The purpose is to understand how individuals' perceptions and experiences influence their understanding of temporal reality. To achieve this, a thorough review of literature from fields such as philosophy, neuroscience, psychology, and so on will be conducted and formulated. To give a better idea, literature reviews on A-theory and B-theory, deception of senses, and other related sources will be used to gain a deeper understanding of temporal reality and its relation to sensory perception. Gathering data on different viewpoints allows for a better understanding of sensory experiences in relation to A-theory and B-theory. During the review, it was found that proponents of the A-theory often emphasize the immediate and personal nature of time, arguing that sensory experiences play a big role in validating the dynamic passage of time; conversely, supporters of the B-theory challenge the subjective nature of time perception, questioning the reliability of sensory experiences. This study highlights the significance of sensory experiences in the evaluation of theories of time, particularly the A-theory and B-theory. The findings contribute to the ongoing discourse on time perception and emphasize the importance of considering sensory experiences in the evaluation of contrasting views of temporal reality.



The Effectiveness of Dance as a Coping Mechanism

Ky'laysha Womack

For hundreds of years people have struggled with mental health and had a difficult time finding a coping mechanism that works for them. The first difficulty being that mentally ill patients were seen as "social defiants" so they were put in insane asylums and treated like criminals. It was eventually proven that these patients weren't actually crazy and they started to get the help they needed, such as medication and therapy. This study examines the extent of how real life dancers use dance as a coping mechanism for anxiety and anger issues. Furthermore, looking at their usage to determine if dance is an effective coping mechanism. The methodology that I am using for my study is phenomenology. I chose this method because it allows me to go in depth on dancers' lived experience with the ways in which they cope. This was the best choice for me because with mental health you cannot realistically come to a synthesis because an individual's effect on their mental health is not the same for everyone. Within my results at this time all of my participants use dance to cope with either anger or anxiety and have found this to be effective. They have also shared how dance brings people together and helps with self-esteem and expression of your personality. Showing how dance can help alleviate some of the social isolation symptoms that come with anxiety. My findings will contribute to the ongoing search for coping mechanisms for adolescents that struggle with anxiety, anger issues and depression, hopefully giving people awareness and a new coping mechanism for their mental health issues.



Class of 2024



Nimah Aime



Kimathi Ankobia



Felisha Atkins



Evan Beauvois
Ransome



Sophia Bender



Matteo Berninzoni



Cosima Billotte
Bermudez



Yasmine Blanchard



Leo Boehringer



Jasmine Boykin



Cristofer Castelan



Maria Chen



Levi Clark



Camille Coffey



Markell Davis



Alexander Dickens



Madison Drummond



Jackson Dungee



Finneus Dyer



Ethan Eblaghie



Jhamari England



Antonio Erdas



Henry Fancher



Kendall Felder



Sara Freeman



Vladimir Gapeev



Dean Gedansky



Ira Geller



Reid Glaros



Ellen Griffin



Kai Grigsby



Lavender Hall



Abigail Hartman



Cenae' Hastings



Aram Hayrapetyan



Kayla Holly



Zoe Hong



Brandon Isbell



Hudson Langkammerer



Louis Lapp



Caleb Lawson



Christian Leith



Katelyn Lemon



Alvin Lin



Ryan Lindsey



J'Zanae McCalla



Eliza McKenna



Kei Leigh Mese-Jones



Miya Mese-Jones



Maya Molina



Anthony Odeh



Oluyinka Ojolayo



Amelia Overton



Ava Pevsner



Ruby Polansky



Stephenie Providence



Cecelia Reichelt



Liam Reilly



Toni Roach



Antonio Romerio



Penelope Schenkel



William Schmelyun



Margaret Schmitz



Reuben Schreier



Susan Schulman



Krrish Shrestha



Noah Simcox

Ta'Quory Singleton

Jaiden Smith

Kayla Stanton

Kierra Stanton

Anson Stine



Josh Tagle

Gavin Tantleff

Henry To

Erick Torres-Hernandez

Bowen Valery

Charles Vey



Zari Wheeler-Oluwagbenga

Cerenity Wilcox

Mahalia Williams

Vahe Zaprosyan

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Lillian Adams

Nadiat Adedoyin

Anis Ahmed

Christopher Ajayi

William Allen



Jaidy Amador

Sawyer Benhart

Tamarra Berger

Samuel Boldon

Teddy Bridgeford

Lia Brown



Mina Brunelle



Da'Mario Bunch



Aidan Carter



Josue Castelan



Sophia Chacko



Myron Crowder



Pierre Dugan



Brandon Faison



Canaan Fitzgerald



Leonardo
Franco-Martinez



Tuck Gauvin



Madeleine Gedansky



Salloni Gill



Francis Gittens



Alyssa Goldenberg



Maya Goodwin



Jazmine Green



Leia Griffin



Tyler Harris



Bryan Hijam



Ayanna Hill



Kassia Hughes



Maxwell Hunt



Kaila Jenkins



Emily Kelly



Mckenna Lam



Bee Lipson



William Malone



Kennedy McCray



Hafid McIntyre



Noah McNally



Leo Micah-Jones



Aydin Mokaddem



Brian Muher



Chidubem Okoronkwo



Bennett Okororie



Joseph Okororie Mekhi Onque Margaret Paulk Wryen Pender Marquell Perry Victoria Pitt



Sukarno Richardson Jade Riddick Yamely Rodriguez Amber Roller Sawyer Ross Aiyana Savage



Kaitlyn Seldon Jack Serpick Rishi Shah-Nelson Malik Singh Brazil Smothers Helena Solefack



Mia Sproge Niko Stevenson Caleb Streat Aidan Talley Samuel Valcarcel Pierre Vignes



Lorenzo Vizachero Gabriella Washington Matthew Yacobucci Kevin Zimmer



Khadim Fall

Ethan Fetsch

Hayden Filipovitz

Esmeralda Flores

Paige Gantert

Andrew Gao



Maelle Girard-Tsuru



Fernando Gonzalez



Maia Grantz



Cormac Hennessee



Emily Hijam



Daniel Hong



Donajah Hooker



Joseph Horwitz



Niyah Howard



Deborah Hyun



Elijah Isbell



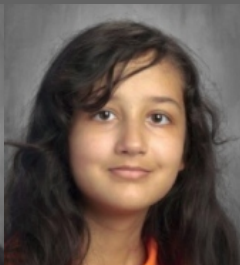
Jaylin Jacobs



Kinshawn Jones



Malak Kardiss



Anjali Kane



Nevaeh King



Eli Lamichhane



Thomas Lapp



Julian Lardner



Mark Laury



Carley Layton



Wesley Leith



Colin Lilley



Fan Lin



Kali Love-Stancil



Sokoro Lumumba



Jerrel Lyle



Jordan Manley



Johnacele Marquez



Lucas Masotta

Class of 2026



James Addo



Layomi Adedeji



Nabil Aime



Laila Allsberry



Josh Amper



Braylon Anderson



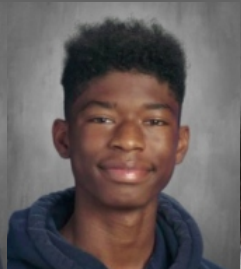
Armin Ataei Kachoei



Arman Ataei Kachoei



Morris Auerbach



Faiber
Balanta-Cabezas



Tara Bass



Chonan Bell



Donovan Bey



Mykhi Brooks



Ka'Ren Brown



Jerome Brown



Kaii Bushyager



Phineas Caiola



Noah Carter



Arvin Chen



Marshall Civin



Marisa Coleman



Julia Crainiceanu



Bianca Crainiceanu



Lyric Daniels



Nurjhan Daniels



Christopher Davis



Cassidy Drummond



Wilka Eggert



Katherine Engelke



Noah Mayfuila



Gabriel McMahon



Adelaide McMurray



Frank Mei



Ana Melissa Miguel



Michael Mokaya



La'Marteze Moten



Amir Muhammad



Benjamin
Paglinauan-Warner



Alexander Pietrzak



Carter Pisano



Lucy Quaerna



Rohan Raut



Sylvie Rehr



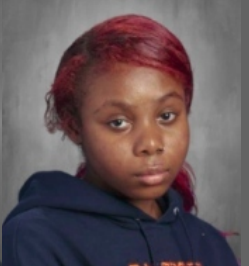
Luca Rodrigues



Alice Scott



Irene Scott



Nia Sewell



Aliana Shrum



ZaRon Silver



Isaiah Smith



Carter Sparks



Max Surkan



Jabari Taliaferro



Abdulla Ubaydullaev



William Underwood



Malaya Victor



A'Jhani Whitaker



Chelsea Zellous

Class of 2027



Hafsa Abonti



Elliot Andersen



Michaia Arcillo



James Ash



Naim Azaz



Clara Bachman



Aldrin Badiola



Nathaniel Barry



Jack Basl



Sebastian Baylor



Peyton Beach



E'Ryan Benefield

Not
Pictured

Nancy Berry



Khalira Bolden



Daniel Bowden



Ainsley Breidegam



Cara Brunelle



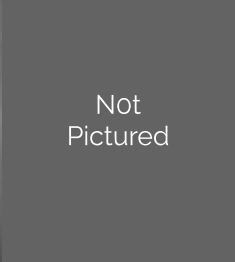
Daje Byers



Wyatt Carpenter



Rosalie Chadeayne



Tomas Cleves



Antonio Coates



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Boudicea Cooney

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Grant Daniels



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Nia Lewis



Cameron Lincoln



Paul Liu



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Reagan McCray



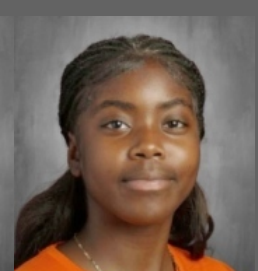
Suzanna McCullough



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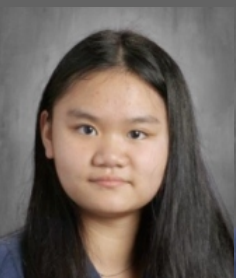
Colin Sanders



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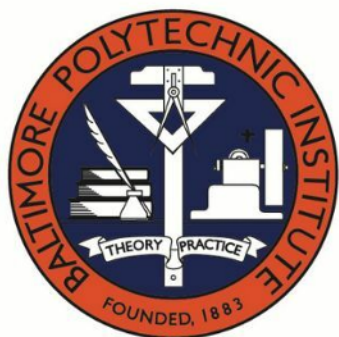
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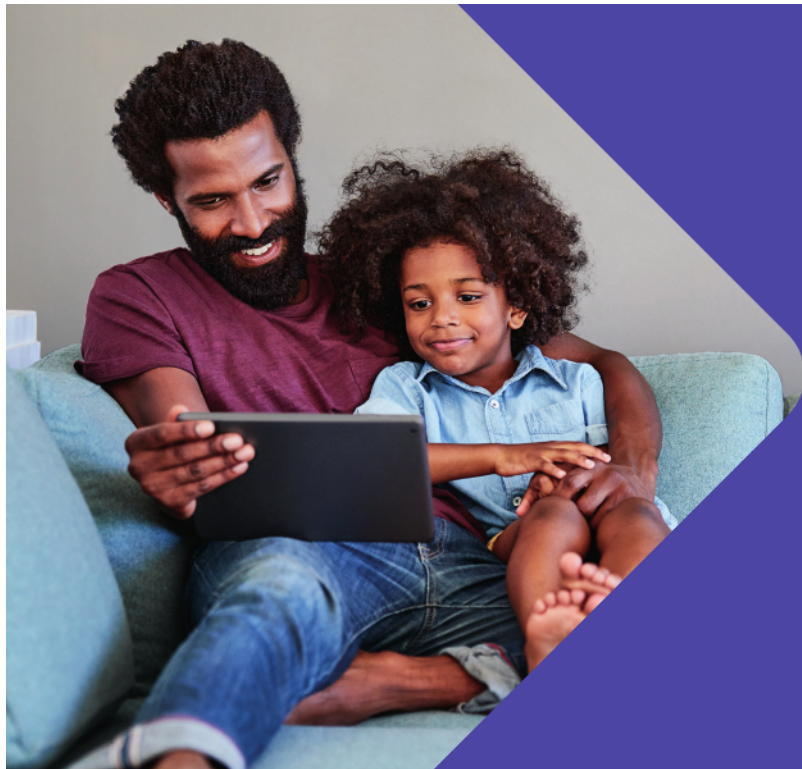
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