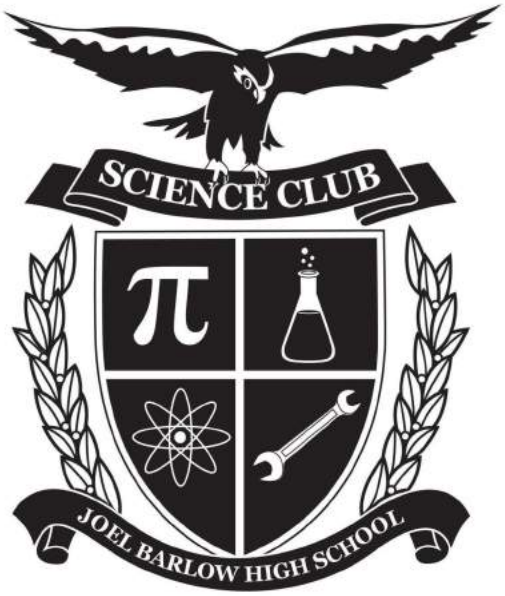
Joel Barlow High School



10th Annual Science Symposium

"Zoom in to Showcase STEM Students: Past & Present"

June 5, 2020

PROGRAM OVERVIEW

Program

5:30-6:00PM *Blast from the Past* Slideshow

6:00-6:20PM Main Zoom Room

1. Welcome – *Dr. Katherine Nuzzo*
2. Keynote Speech "Thinking with, Returning, and the Middle: An Experiment in the Midst of Change" – *Catherine Cheng Stahl*

6:20PM Zoom Alumni Breakout Rooms

1. Breakout Room 1: **Rising** Up – Facilitator Rosemary Riber
2. Breakout Room 2: **Taking Off** to New Adventures – Facilitator Paul Testa
3. Breakout Room 3: **Rocketing** Up – Facilitator Karen Sullivan
4. Breakout Room 4: **Shooting**/Shouting Out – Facilitator Julie McTague

Our Past

STEM Alumni

Libby Albanese Tufts (2021)	Mechanical and Biomedical Engineering
Melanie Ambler Brown (2019)	Fulbright Advanced Student
Samantha Ballas UConn (2022)	Allied Health Sciences and Psychology
Luca Cerbin Swarthmore (2022)	Research Assistance Collin's Laboratory
Brooklee Han Southern Methodist (2012)	German, Journalism and European Studies; Freelance Journalist and Researcher
Michael Klein Wassink UPenn (2023)	Mechanical Engineering
Jessica Lam UConn (2021)	Chemical Engineering
Jonathan Lam Cooper Union (2022)	Electrical Engineering; DevOps Intern at Cigna
Emily Lazo-Wasem Purdue (2020)	Design Engineer at VS Engineering
Michael Lin Georgia Institute of Technology (2019)	Machine Learning Engineer at Apple
Maggie Loery Grinnell College	Americorps Member at American Conservation Experience
Rachel Losacco Stony Brook (2017); Physics and Astronomy; Leiden University (2020)	Astronomy Master's Candidate
Sean Murray Susquehanna (2019)	Biochemistry; Spanish Language and Literature; NYU
Joshua Panos Purdue (2019)	Electrical and Electronics Engineer
Liam Prevelige Dartmouth (2023)	Computer Science and Economics; Entrepreneur in Technology and Private Investments
Jillian Saunders Drexel (2022)	BS/MS Biomedical/Medical Engineering; Research Assistant at Children's Hospital Philadelphia
Megan Siedman Williams College (2020)	Sociology and Mathematics
Justin Schachter University of Michigan (2020)	Systems Engineering Intern (313F) at NASA Jet Propulsion Laboratory
Ryan Wendt UConn (2019)	Propulsion Laboratory Associate Engineer at Pratt & Whitney
Melani Zuckerman Boston University (2025)	Integrated BA/MD Candidate, Minor Economics

Our Present

AP Chemistry Science Research

Eva Boyce*†‡	Machine Learning Algorithms for HAB Detection
Leyli Ghavami	The Utilization of Flavonoids for the Prevention of Paint Degradation via Exposure to Ultraviolet Radiation
Rene Itah	The Inhibition of Chlorophyll Production and Cellular Respiration of Hypnum Cupressiforme by Climate Change
Juliet Lam	Impact of Ammonia Concentration on Arthrospira Platensis Lead Absorption
Jake Lambrech	Natural Enzyme Reduction of Saline Stress in Ocimum basilicum pilosum
Emily Larkin	Potential Biofilm Disruption via Natural Enzymes
Claudia Meyer	Lignocellulosic Manuscript Models Restoration Using Neutralization Reactions
Kyle Murray	Bacillus cereus Endospores as Genome Carriers and Protective Storage Cells
Meghan Ogrinz	Removal of Micropollutants via Cornu aspersum glycoconjugates
Alexandra Popescu	Computational Analysis of Epithelial-Endothelial Cellular Crosstalk in Complex Vascularized Tissues
John (Jack) Richardson	Degradation of Polyhexamethylene 2,5-Furan Dicarboxylate in an Oceanic Environment
Noah Simons	Electronic Sealants for Moisture Resistance in IPC-B-25A Boards
Tate Tower	?
Kelly Weng	Automated Collection of Aquatic Surface Level Polyethylene (PET)
Trevor Wilkes	Pharmacokinetics of Ceftriaxone Applied to Osteomyelitis
Mitchell Worthington	Soil Anthropogenic Carbon Dioxide Sequestration Using Biochar

*Senior Passage
†CT STEM Fair
‡CT Science & Engineering Fair
§CT Jr. Science & Humanities

OUR KEYNOTE

Catherine Cheng Stahl (Barlow teacher 2013-2018)

Wellesley College
BA in Biological Chemistry and Art History
Teachers College, Columbia University
Ed.D anticipated in 2024
Curriculum & Teaching

I am an educator, lifelong learner, and wandering inquirer. I find it hard to write about myself officially, as my life, my wonderings, and my identity are in an enduring state of becoming. As a doctoral fellow in a graduate school of education, my research interests are ever evolving but rooted in students' lived experiences. Currently, I am intrigued by spaces of learning—particularly those alternative or in-between spaces of belonging outside of dominant, mainstream spaces. I have a particular interest in student voices, participation, and identity constructions; youth culture, particularly in digital spaces; affects, emotions, and feelings as they relate to the work of learning; and creative ethnographic methods for research that focus on the minute, the particular, and the everyday. Outside of research and teaching college and graduate students, I enjoy thinking about the intersections of walking, creativity, and writing. Beyond all things academic, I try to carve out time for capturing scenes of New York City (where I live), which I then write about (casually) on my Instagram blog. Pre- and post-coronavirus times, you can find me flaneuring all over the city or people-watching in coffee shops. As a perpetual "border-crosser," I am inspired to find ways of merging the arts and sciences, of blurring disciplines, and of weaving together my varied interests into a lifelong endeavor.

Awards / Scholarships / Fellowships:

- Morton T. Embree Award for Outstanding Contribution to Student Learning, 2020
- American Educational Research Association – Division B, Curriculum Studies Member
- Teachers College Doctoral Fellowship, 2018-2021
- Dorothy L. Dorman Scholarship, 2019-2020
- Teachers College Department Minority Scholarship, 2019-2020
- Diana Clark Fellowship, 2018-2020
- DEYCTP Center Scholarship, 2018-2019
- Teacher of the Year, Joel Barlow High School and Region 9 School District, 2018

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OUR PAST

Brooklee Han, Class of 2013

Southern Methodist University
BA in German, European Studies and Journalism Spring 2021
German and European Politics

After graduating from Barlow I took a gap year to focus on my figure skating career. In 2014 I fulfilled a lifelong dream of becoming an Olympian, by competing as a member of the Australian Winter Olympic team in Sochi, Russia. In the fall of 2014 I resumed my studies and started classes at Wesleyan University in Middletown, Connecticut, while still pursuing my figure skating career. At Wesleyan I studied German and International Politics. In August of 2016, I decided to make a coaching change and found myself relocating to Dallas, Texas. I again put my studies on hold and took a leave of absence from Wesleyan while I focused on my skating. During this time I interned for "International Figure Skating Magazine" and got the chance to write numerous articles published both online and in print. I also met Jeff Guinn, an author for Simon and Schuster who lives in the Fort Worth area, and I have had the opportunity to research for some of his upcoming books. In 2018 I felt the need to resume my studies and decided to try and transfer to Southern Methodist University in Dallas. I started class part-time at SMU in fall of 2018, still while continuing to train and compete internationally. My figure skating career came to an end, however, in February 2019 after I ruptured my left Achilles' tendon at the Four Continents Championships. Since ending my competitive career I have become a full time student and am on track to finally finish my bachelor's degree in the spring of 2021. In addition to my studies, I am still spending some time on the ice learning ice dance and coaching.

Awards / Special Recognition / Internships:

- SMU Honor Transfer Scholarship Recipient
- Big Y Scholarship Recipient
- Reporter Intern at "International Figure Skating Magazine" (November 2016-July 2019)
- 2014 Winter Olympian

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Website: https://brookleehan.wordpress.com

Rachel Losacco, Class of 2014

Stony Brook University
B.S. in Astronomy, B.S. in Physics
Leiden University
MSc in Astronomy (in progress)
University of Florida
PhD in Astronomy (beginning Fall 2020)

Since I graduated from JBHS, I have been pursuing a career in Astronomy and Physics, focusing on Astronomy research. This has taken me to NASA, the Smithsonian National Air and Space Museum, and the Netherlands! I am currently completing my Master's degree in Astronomy at Leiden University in the Netherlands, and I have enrolled in the Astronomy PhD program at the University of Florida for Fall 2020. I specialize in galaxy simulations, though I have also done research on exploding stars (supernovae) and finding rainbows on molten planets outside of our Solar System.

Awards / Scholarships / Internships:

- Women In Science and Engineering (WISE) Scholarship at Stony Brook University
- NASA Summer Internship 2017 - research on simulated galaxies
- Smithsonian National Air and Space Museum, Astronomy Education Intern, Spring 2018 - conducted live demonstrations in the museum and at the Phoebe Waterman Haas Public Observatory
- Appalachian Mountain Club Astronomy Guide, Summer 2018 - presented outdoor talks at night to visitors, discussing the planets, stars, and our place in the Universe

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Melanie Ambler, Class of 2015

Brown University
ScB in Neurobiology, Class of 2018.5
Université de Caen-Normandie (Caen, France)
MS in Behavioral Neuroscience, Class of 2020
Areas of Emphasis
medicine, music, neuroscience, French

Music and medicine are my two passions in life. As a cellist and aspiring medical student, I research the intersection of the arts and sciences, notably the effects of music on the brain. Upon graduating from Brown, I was selected as a Fulbright Scholar to perform a research project with a team in Caen, France. We research the ability of patients with Alzheimer's Disease to recognize new music and paintings. We found that even though some of these patients cannot recognize their spouses, they are capable of showing signs of familiarity for new artistic information. In addition to this project, I am concurrently pursuing a Master's in Behavioral Neuroscience from the Université de Caen Normandie, where all of my coursework is in French!

Awards / Scholarships / Internships:

- United States Fulbright Scholar in Caen, France.
- Magna Cum Laude; Brown University
- Honor's Thesis entitled "Heterogeneity of outcomes in intraoperative music interventions: a scoping review and evidence map."
- Master's Thesis entitled "Preserved familiarity for new music and paintings in Alzheimer's Disease and Korsakoff's Syndrome"
- International Arts + Mind Lab Research Intern at the Johns Hopkins Brain Science Institute in Baltimore, MD.
- Summer Orthopedic Surgery Pre-Medical Fellow at the Bronx Lebanon Hospital Center in the Bronx, NY.
- Emergency Medical Technician for Brown University EMS and town of Redding, CT.

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Emily Lazo-Wasem, Class of 2015

Purdue University
BS Civil Engineering, 2019, Emphasis in Environmental
MS Environmental and Ecological Engineering 2020

Since graduating from Barlow, I have spent the last five years at Purdue University. I spent four years obtaining my bachelor's degree in civil engineering before starting a one-year program to get my master's degree in Environmental and Ecological Engineering. I was very active in my extracurriculars, such as ASCE and my residence hall club. ASCE provided the all-important networking activities while the residence hall club was great for more social activities and provided a path for me to become a resident assistant in my final two years at Purdue. I was able to work every summer, which gave me great opportunities, and I am now a co-author on a scientific paper. Since I've just graduated in May, I have joined VS Engineering, a civil engineering consulting company out of Indianapolis, Indiana.

Awards / Scholarships / Internships:

- National Affiliations
  - American Society of Civil Engineers (ASCE)
  - Chi Epsilon – Purdue University Chapter
- Scholarships
  - H.K. Tony Clark Scholarship
  - Walt and Retta H. Ackerman Scholarship
  - Julie E. DePhillips Scholarship
  - Matthew Kern Environmental Engineering Scholarship
  - Donald E. Bloodgood Scholarship
  - Leonard and Margaret Wood Civil Engineering Chi Epsilon Scholarship
- Internships
  - Visiting Student Researcher — Yale University — Summers 2016 & 2017
  - Studied foram morphology and identification for paleo-oceanography proxy analysis
  - Cooperative Assistant — Consumers Energy — Summer 2018
  - Updated a system health database for 13 hydroelectric dams and 1 pumped storage facility
  - Cooperative Assistant — Consumers Energy — Summer 2019
  - Developed internal action items for new environmental compliance system
- On-Campus Jobs
  - Resident Assistant — Purdue University Residences
  - Student Researcher — Environmental and Ecological Engineering
  - Grader — Statistics Department

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Michael Lin, Class of 2015

Georgia Institute of Technology
BS in Computer Science
Software Engineering and Machine Learning

Since graduating from Barlow, I've been working as a software engineer working in machine learning and AI. At Georgia Tech I worked as a TA for a Computer Science class and was a member of the Georgia Tech Solar Racing team.

Internships:

- Software Engineer at Apple (Cupertino, CA)
- Software Engineer Intern at Datto (Norwalk, CT)

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Ryan Wendt, Class of 2015

University of Connecticut
Bachelor of Science in Engineering
Mechanical Engineering – Aerospace Concentration

While at UConn I was a member of the UConn Marching Band, Engineering Ambassadors, and the American Institute of Aeronautics and Astronautics Student Chapter. Some of the highlights of my activities were playing in the band at basketball, football, and hockey games, and volunteering at events such as the annual Science Bowl.

The summer between my junior and senior year I worked as an intern at jet engine manufacturer Pratt & Whitney in the Quality Assurance Standards Lab.

After completing my degree in the spring of 2019, I began working fulltime as an engineer at Pratt & Whitney in the Customer Technical Service organization. In this role I primarily work to answer technical questions from airlines. DESCRIPTION

Awards / Scholarships / Internships:

- Graduated Magna Cum Laude
- Member of Tau Beta Pi Engineering Honor Society
- Member of Pi Tau Sigma Mechanical Engineering Honor Society
- UConn Marching Band Unsung Hero 2018
- Quality Engineering Intern – Pratt & Whitney 2018

– Assisted lab technicians with calibrations for thermocouples, flowmeters, pressure transducers, light meters, and other electrical equipment. Additionally, completed a project to improve inventory management.

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Joshua Panos, Class of 2016

Purdue University College of Electrical and Computer Engineering
Bachelor's Degree in Electrical Engineering, Dec 2020
Emphasis in Microelectronics and Nanotechnology

I am going into my final semester of Electrical Engineering at Purdue University. In my time at Purdue I served as the President of Purdue Lunabotics and have revived a Certificate in Collaborative Leadership as well as Entrepreneurship and Innovation.

Awards / Scholarships / Internships:

- Student member of IEEE
- Weller Foundation Engineering Scholarship

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PURDUE
ENGINEERING
ELECTRICAL AND COMPUTER ENGINEERING

Megan Siedman (she/her/hers), Class of 2016

Williams College
Bachelor of Arts Sociology & Mathematics, 2020

Today is the official start of my commencement weekend and in two days I will have my Bachelors in Sociology & Mathematics from Williams College! For post-grad plans, I have been granted a Fulbright to Bulgaria; unfortunately, due to COVID-19, I won't be able to leave until January 1st. Instead, I'll be in the area pursuing remote internships until I can finally head out for what my cohort now affectionately refers to as our "Half-bright." I'm very happy to speak to the small liberal arts college experience or anything else you might be interested in!

Awards / Scholarships / Internships:

- Fulbright Award Recipient, 2020-2021
- Herbert H. Lehman Scholar, 2019-2020
- W.B. & H.M. Adsit Scholar, 2018-2019
- National Council of Teachers of Mathematics (NCTM)
- Association for Women in Mathematics (AWM)
- Education Policy Research Intern - Georgian Young Lawyers Association (GYLA); Tbilisi, Republic of Georgia - January 2020
- (MS)2 Mathematics Teaching Assistant - Phillips Academy Andover; Andover, MA - June 2019 - August 2019
- Mathematics Teaching Assistant for Undergraduates (TEU) Fellow - Brown University; Providence, RI - June 2018 - July 2018
- Math & Fairy Tales Teaching Fellow - Generation Teach; Holyoke, MA - June 2017 - August 2017

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Libby Albanese, Class of 2017

Tufts University
Bachelor of Science, 2021
Areas of emphasis
Mechanical Engineering, Biomedical Engineering Design, Engineering Education

Since I graduated from Barlow in 2017, I've been attending Tufts University for my undergraduate in Mechanical Engineering. I am also pursuing a second major in Biomedical Engineering Design and a minor in Engineering Education. While here, I've done a lot of work in robotics and engineering education. I am the president of the Tufts Robotics Club, as well as a Learning Assistant for mechanical engineering courses. I'm also a Teaching Assistant for online courses that teach elementary educators how to incorporate engineering into the classroom. I spend most of my time here working in our makerspace, helping others design and build projects, as well as working on my own. I also am involved in robotics research with one of my professors, in the Robotics, Locomotion, and Biomechanics Lab.

Tufts UNIVERSITY

School of Engineering

Awards / Scholarships / Internships:

- Tufts Nolop Fabrication, Analysis, Simulation, and Testing (FAST) Facility
  - Fabrication Specialist — Sept 2019 – PRESENT
    - Educate students in the use of 3D printers, laser cutters, & hand tools
    - Lead workshops teaching fabrication and software skills
- Tufts Mechanical Engineering Department
  - Learning Assistant, Mechanics, Electronics/Robotics — Jan 2020 - PRESENT
    - Facilitate and encourage undergraduate learning and understanding of class material
- Tufts Center for Engineering Education and Outreach
  - Teaching Fellow, STOMP — Sept. 2017 – Dec 2019
    - Develop a STEM-based curriculum & teach elementary school students
  - Teaching Assistant, Graduate Level Courses — Sept. 2018 – Dec 2019
    - Support educators in Engineering Education online courses
  - Design & Engineering Workshop Instructor — June - Aug. 2018
    - Educate students K-12 in STEM Workshops

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Jessica Lam, Class of 2017

University of Connecticut Chemical Engineering, 2021

I am a junior at UConn studying chemical engineering. In the future, I hope to pursue graduate school and continue participating in mentorship opportunities! One of the things I'm very grateful to be a part of at UConn are new efforts to encourage more students from underrepresented groups to pursue engineering and STEM degrees. I'm also lucky to have been a team member at UConn's Center for Students with Disabilities since freshman year, which has allowed me to work on developing more accessible technology for students with disabilities to succeed in their learning. My other interests include drawing, playing piano, and baking!

Awards / Scholarships / Internships:

- Society of Women Engineers Outreach Chair
- UConn ChemE-Car Team Captain
- Pratt and Whitney Quality Engineering Intern

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Jillian Saunders, Class of 2017

Drexel University
BS/MS Biomedical Engineering, 2022
Biomaterials and Tissue Engineering, Neuroscience

Ever since graduating Barlow in 2017, I have been in Philadelphia full time attending Drexel University. Currently, I am in my third (of five) year pursuing my bachelor's and master's in biomedical engineering while minoring in neuroscience. During my freshman year, I became very involved in the Society of Women Engineers and Engineers Without Borders. Through these two organizations I have attended numerous conferences and have had the chance to present in front of both organizations. Also, with EWB I had the opportunity to travel to Ecuador for an in-country project assessment trip. Outside of these organizations, I am also very involved with Undergraduate Research through Drexel and my co-op opportunities. My freshmen year I joined a neuroscience lab where we researched a genetic form of autism, Fragile X Syndrome, to understand synaptic plasticity. I also co-op ed at Charles River Labs helping to test new pharmaceuticals for the FDA. Here my research was focused on how new pharmaceuticals will affect learning and memory. I have finished classes of my third year and am in the middle of my second co-op where I work at the Children's Hospital of Philadelphia studying the Unfolding Protein Response. Overall, Drexel had afforded me so many incredible opportunities and Barlow greatly prepared me for where I am now! After Drexel, I have plans of pursuing an MD/PhD with a focus on neuroscience.

Awards / Scholarships / Internships:

- National Affiliations
  - Engineers Without Borders - President, Drexel Chapter
  - Society of Women Engineers - Vice President, Drexel Section
- Scholarship(s)
  - Dean's List, Drexel University, Fall 2017 – Present
  - 2019 Alma Kuppinger Forman, PE Scholarship, Society of Women Engineers, Fall 2019
  - STAR Scholar, Drexel University, June 2018
  - Velay Fellowship Scholar, Drexel University, June 2018
  - D. U. FIRST Robotics Scholarship, Drexel University, Fall 2017
- Awards
  - WELocal Raleigh Undergraduate Collegiate Competition – 2nd Place
  - WE19 Collegiate Leadership Institute Participant
- Internships
  - Research Assistant, Children's Hospital of Philadelphia (Argon Laboratory), March 2020 – Present
  - Research Assistant, Drexel University Department of Biology (Akins Laboratory), May 2018 – Present
  - Behavior Research Assistant, Charles River Laboratories, April 2019 – September 2019

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Samantha Ballas, Class of 2018

University of Connecticut
Bachelors of Science, Allied Health Sciences, 2022
Bachelors of Arts, Psychology, Pre-Med Track, 2022

Since graduating Barlow, I have begun my education at the University of Connecticut. After a couple of major changes and additions I have settled on pursuing dual degrees in Allied Health Sciences with a Health Sciences concentration and Psychology on a pre med track. At UConn I am in the Special Program in Medicine which has allowed me to attend workshops with medical school in Farmington as well as find support through UConn. I have been able to obtain my Wilderness EMT certification from the University of Colorado school of Medicine as well as my CPR Instructor certification which has allowed me to be able to begin teaching CPR at UConn. This past fall I got involved with research on campus through the Institute for Collaboration on Health Intervention and Policy. During the school year I was working on coding counseling sessions with HIV positive patients. Since coming home due to COVID-19 I have been working on collecting data on anti-vax attitudes in terms of COVID-19. In the fall I plan on working with another professor on research involving childhood anxiety disorders and generalized anxiety disorders. This summer I plan to work with the New England Institute for Clinical Research as an intern and volunteering with UConn health and EMS.

Awards / Scholarships / Internships:

- UConn Health Leaders Program, Farmington, CT
- New England Institute for Clinical Research, Stamford, CT
- Institute for Collaboration on Health, Intervention, and Policy (InCHIP), Storrs, CT
- CPR Basic Life Support Instructor, Storrs, CT
- EMT Volunteering, Coventry, CT
- Windham No Freeze, University of Connecticut
- Scholarships: Academic Excellence, STEM Scholars
- UConn Programs: Special Program in Medicine, Honors Program

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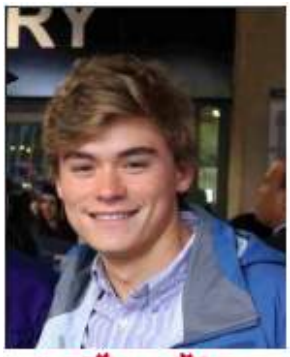
Luca Cerbin, Class of 2018



Swarthmore College
BA Computer Science Minor in Applied Mathematics
Minor in English Literature

After graduating from Barlow I began my study at Swarthmore College studying computer science, applied mathematics and English literature. I competed in track and field at Barlow and have continued to pursue my sport. My freshman season I broke the Swarthmore javelin record. I have also started writing poetry and have been published in a young poets magazine in Philadelphia.

Awards / Scholarships / Internships:

- Technical intern at SocialLadder, summer 2019 o I managed the company's database, an overseas team, and helped track issues
- Research Assistant at Collin's Laboratory, spring 2020 – present
- I wrote software to parse DNA data for specific gene markers o This summer I am working on creating a lab website and conducting automated image analysis
- Published in Moonstone Poetry Magazine

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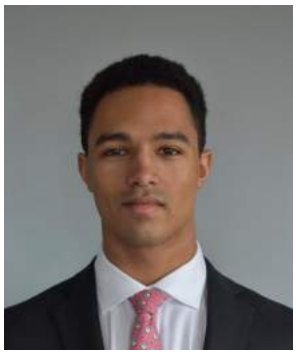
Michael Klein Wassink, Class of 2018



University of Pennsylvania
Bachelor of Science, Mechanical Engineering, 2023

In the year after I graduated from Barlow I moved to China and studied Mandarin Chinese. I lived in Shanghai with a host family for three months while I enrolled in accelerated chinese classes at East China Normal University. Later I moved to Kunming and studied even more vigorously before returning to the states and working in a chinese restaurant. In the Fall of 2019 I moved to Philadelphia where I began my career as a student at Penn where I study mechanical engineering, chinese, and finance. At Penn I routinely dance Tango and work on rockets through Penn Tango and Penn Aerospace respectively.

Awards / Scholarships / Internships:

- Hord Foundation Scholar
- Kiwanis International Scholar
- Barton Weller Foundation Engineering Scholar
- University of Pennsylvania Chinese Rap Video Project Winner

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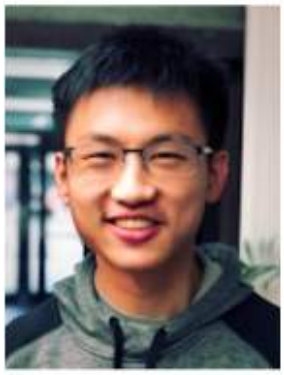
Jonathan Lam, Class of 2018



The Cooper Union for the Advancement of Science and Art
Projected B. Eng. and M.Eng. Program, 2022
Major: Electrical Engineering, Computer Engineering Track
Minors: Computer Science, Mathematics

In the two years since Barlow, my main goals have been trying to figure out how computers work, and how to spread interest and knowledge in programming and computer hardware. A large part of my free time is spent coding, tutoring, or advertising EE/CS related events as an officer of Cooper's IEEE/ACM club. Some of my other hobbies include Rubik's cubing, typing races, and bowling.

(I also marked up this document in LaTeX.)

Awards / Scholarships / Internships:

- Weller Memorial Foundation Computer Science Scholarship
- 13th place team in NY Regional International Collegiate Programming Competition (ICPC)
- Currently EOCC DevOps Engineering Intern at Express Scripts (subsidiary of Cigna)

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Melani Zuckerman, Class of 2018

Boston University, 2022
Boston University School of Medicine, 2025
Medical Science Major, Economics Minor

I'm currently going into my third year at BU and I'm using this quarantine to study for my MCAT. In my free time I tutor freelance as well as with Varsity Tutors. I also mentor younger students in my seven-year program. I'm currently looking into some research opportunities in the fall, and I won a grant to start a food pantry on my campus to deal with food insecurity at BU, particularly with off campus undergrads and grad students. I love exploring Boston and running by the Charles River!

Awards / Scholarships / Internships:

- Presidential Scholar at BU
- Dean's List x4
- NREMT Certification
- Invited to publish in BU's Writing Journal
- IDEA Cup 1st place prize

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LinkedIn: Melani Zuckerman

Liam Prevelige, Class of 2019

Dartmouth College
Computer Science Major
Economics Major Entrepreneurship, Industrial Organ., & Finance Specialty

My first year at Dartmouth has developed my interests in entrepreneurship, technology, and private investment. I have taken an active role on the student leadership board of the Magnuson Center for Entrepreneurship; my responsibilities have been centered around developing new entrepreneurship-focused programming and finding ways to connect student entrepreneurs to investors and professional guidance. I have also been active in intense entrepreneurship programs such as 3-Day Startup Dartmouth and the Venture Capital Investment Competition Workshops. I was a part of Dartmouth's first undergraduate team for the Venture Capital Investment Competition (VCIC), where I worked with a team of five other students selected from a group of trainees; we competed against other schools in analyzing several real-world startups seeking investments, and pitched investment strategies to a board of successful venture capitalists. Our team placed first at the Boston Regional Tournament and was invited to the VCIC Global Final Tournament, canceled later due to COVID-19 concerns.Next term I will be founding the Private Equity and Venture Capital Student Club, which will provide technical training, networking opportunities, and industry-specific speaker engagements. This summer, I will also be working on a new business that provides easy access to cheap custom merchandise. If you would like to learn more about any of these activities, majors, or my experiences in general, please reach out!

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OUR PRESENT

Eva Boyce (Class of 2021)

Hello! My name is Eva. I am 16 years old, and divide most of my time between robotics, swimming, and playing the harp, and my scientific interests reside in material science and engineering. Over the summer, I came across research on algae showing promising signs as a fuel source and was intrigued. After conducting more research on algae and its properties, I was then introduced to hazardous algae blooms, or HABs. When a New York Times story about the death of 3 North Carolina dogs blew up in September, the problem seemed even more impending and I decided on finding a solution as my research project.

Machine Learning Algorithms for HAB Detection

Mentor: Dr. Katherine Nuzzo

Hazardous algae blooms have been growing more rapidly and reproducing more readily due to excess nutrients caused by water pollution and warmer temperatures. The communities developed from cyanobacteria are fresh water HABs mainly populating the eastern coast and contaminating the water with cyanotoxins, causing rashes, asphyxiation, respiratory paralysis and liver failure in both marine and terrestrial animals. A user friendly application could help the general public in protecting themselves through one of the most universally owned objects of today: the smartphone. Development of an app database for smartphones to identify different types of algae, correctly determining their strand through the means of a simple photo was performed. Two tests were grown in the freshwater medium of five sample cultures including: Anabaena, Tolypothrix Distorta, Eucapsis, Merismopedia, and Fischerella. The app's database was taught to know the different species based on training from the photos of their growth. As unidentified photos were entered into the database, they were processed by the code to pick up on the color and growth patterns of the cyanobacteria. The highest predictability between the concept and the photo reads as either a positive or negative result compared to the correct strand, which is then recorded as data for frequency of correctness. The application resulted in approximately 80% accuracy but more training with more variability in strands would allow for more variability between the concepts and prove more accurate general predictability going into the future.

Research Presentation: https://youtu.be/bgmFDJJu1Ow

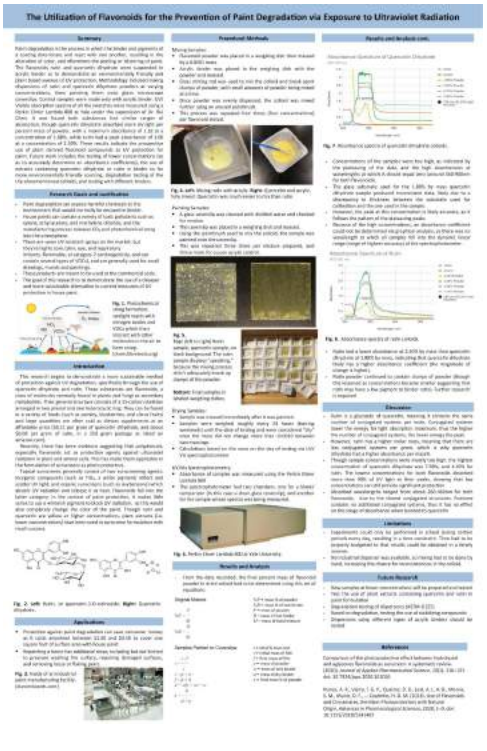
Participated In: CT STEM Science Fair; Connecticut Science & Engineering Fair (CSEF)

Awards / Special Recognition: Stockholm Junior Water Prize

Leyli Ghavami (Class of 2021)

I have always loved learning for the sake of learning, so I'm interested in a myriad of things— drawing, painting, literature, science. I hope to find a career and a college in which I can exercise my skills in all, or at least most of those areas. Outside of school, I have worked at the Easton Public Library, interned in the office of Congressman Jim Himes, and participated in the National Charity League (NCL). I chose to pursue this particular avenue of research because of my interest in art. I began by reading articles on paint, which led me to the topic of paint degradation. Because UV radiation is a prominent cause of paint degradation, I made an immediate connection to sunscreen. After all, our main concerns regarding UV exposure are related to its effects on our skin. I'm also (very) aware of the environmental concerns of modern science, so I was sure to look into environmentally friendly photo protectors, which led me to the flavonoids I used in my research.

The Utilization of Flavonoids for the Prevention of Paint Degradation via Exposure to Ultraviolet Radiation



Mentor: Dr. Katherine Nuzzo

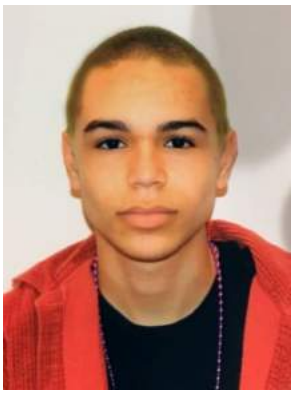
Paint degradation is the process in which the binder and pigments of a coating deteriorate and react with one another, resulting in the alteration of color, and oftentimes the peeling or blistering of paint. The flavonoids rutin and quercetin dihydrate were suspended in an acrylic binder to demonstrate an environmentally friendly and plant based avenue of UV protection. Methodology included mixing dispersions of rutin and quercetin dihydrate powders at varying concentrations, then painting them onto glass microscope coverslips. Control samples were made only with acrylic binder. UV/Visible absorption spectra of all the swatches were measured using a Perkin Elmer Lambda 800 at Yale under the supervision of Dr. Rui Chen. It was found both substances had similar ranges of absorption, though quercetin dihydrate absorbed more UV light per percent mass of powder, with a maximum absorbance of 1.32 at a concentration of 1.88%, while ruth had a peak absorbance of 1.00 at a concentration of 2.30%. These results indicate the prospective use of plant derived flavonoid compounds as UV protection for paint. Future work includes the testing of lower concentrations (so as to accurately determine an absorbance coefficients), the use of extracts containing quercetin dihydrate or rutin in binder to for more environmentally friendly sourcing, degradation testing of the the aforementioned colloids, and testng with different binders.

Research Presentation: https://youtu.be/5ZwUFdb7FpM

Participated In: Connecticut Science Technology Engineering and Math Fair (CT STEM); Connecticut Junior Science and Humanities Symposium (CT JSHS); Connecticut Science and Engineering Fair (CSEF)

Awards / Special Recognition: Connecticut Junior Science and Humanities Symposium (CT JSHS) – Poster Presenter, 3rd Place

Rene Itah (Class of 2021)



I plan on studying political science in college to eventually become a politician. I am passionate about social and environmental justice. I chose this topic for my project because I believe that the issue of climate change is extremely important and that the effect of pollution and climate change on bryophytes like moss is severely under-studied.

The Inhibition of Chlorophyll Production and Cellular Respiration of Hypnum Cupressiforme by Climate Change

Mentor: Dr. Katherine Nuzzo

Moss absorbs 14bn tons of CO_2 annually. Acid rain, a product of air pollution, is extremely destructive to plants, with the power to destroy forests in a matter of decades. Though studies have indicated that acid rain can damage moss, there have been no scientific studies regarding the effects of acid rain on moss' cellular respiration. In order to establish a more firm understanding of the environmental effects of acid rain, hypnum cupressiforme, a common type of moss, is grown in two sealed tanks: one whose conditions mimic acid rain conditions, and one control. The tank simulating acid rain uses a 4.6 pH H_2SO_4 solution, while the control uses distilled water. Levels of CO_2 in each tank will be measured with CO_2 monitors twice a day for two weeks, after which the chlorophyll leaf content of each moss will be measured using a spectrophotometer. Since previous studies have shown that acid rain is detrimental to moss' health, it's expected that the moss exposed to simulated acid rain conditions will absorb CO_2 at a slower rate, and will have a lower chlorophyll leaf content, than the moss exposed to neutral rain conditions.

Research Presentation: https://youtu.be/ZSlD6MH5ZCo

Participated In: CT STEM Fair

Juliet Lam (Class of 2021)

I enjoy reading, drawing, and playing the piano. And eating. I picked this project topic because I knew trash was a big deal, so I might as well try to solve a part of it.

Impact of Ammonia Concentration on Arthrospira Platensis Lead Absorption

Leachate is effluent produced from all landfills and has high levels of ammonia (over 2.0 mM) as well as lead, a toxic heavy metal, and it can seep into groundwater from landfills. High ammonia content is also toxic to many organisms including species of algae used for bioremediation, like Scenedesmus Obliquus. The potential of the cyanobacterium Arthrospira platensis to be used as a tool for bioremediation for its ability to absorb lead has been studied but not its ability to do so in the presence of ammonia, which could impact its ability to absorb lead. A. platensis will be determined if it can biologically remove aqueous lead in relatively high concentrations of ammonia, which other bioremediation algae are incapable of. The original concentration of lead will be compared to the end concentration of lead after growing A. platensis in four solutions containing 50 ppm dissolved lead ions obtained from lead acetate for two weeks, filtering out the A. platensis which has already absorbed a quantity of lead, then precipitating the remaining lead in the solution using phosphate as the titrant, and filtering the precipitate out.

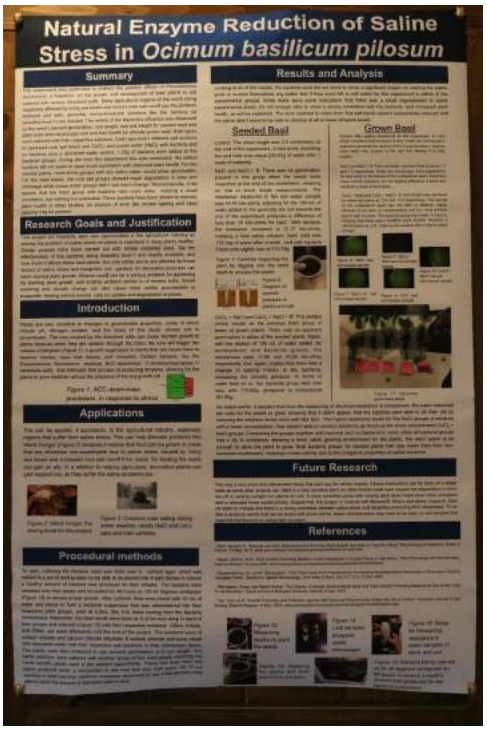
Research Presentation: https://youtu.be/VyYeaRd42vw

Participated In: Connecticut STEM Science Fair; Junior Science and Humanities Symposia (JSHS); Connecticut Science and Engineering Fair (CSEF)

Jake Lambrech (Class of 2021)

When looking towards the future, my interests lie in atmospheric sciences as I've loved weather from a young age. Doing extracurricular activities like joining the Science Bowl team and Sikorsky STEM Challenge allow me to enjoy those interests along with other scientific ones. I definitely want to go to college in the meteorology field, as meteorology programs at schools like Penn State, Oklahoma, and Texas A&M look like good fits for me. After that? Who knows? College can change people but now, my eyes are set on storm prediction and analysis down the line. That may be a surprise, seeing how my project is biology centered, but I wanted to branch out of my comfort zone to try and learn how research in other science fields works and learn something new. I love gardening and botany, so a project looking at a specific problem those fields face was where that initial spark for this project came from.

Natural Enzyme Reduction of Saline Stress in Ocimum basilicum pilosum



Mentor: Dr. Katherine Nuzzo

This experiment was performed to analyze the positive effects of Pseudomonas fluorescens, a halophile, on the growth and development of basil plants in soil watered with excess dissolved salts. Many agricultural regions of the world being negatively affected by rising sea levels and excess road salt runoff see this problem firsthand and safe, generally noncontroversial solutions like this bacteria (at biosafety level 1) are needed. The extent of the bacteria's influence was measured by the seed's percent germination, root length, and soil weight for seeded basil and plant color and microscopic root and leaf health for already grown basil. Both types were watered with their respective solutions. Each type had 2 different salt sections to represent rock salt (NaCl and CaCl2) and ocean water (NaCl) with bacteria and no bacteria, plus a deionized water control. 1.25g of bacteria were added to the bacterial groups. During the time this experiment this was conducted, the added bacteria did not seem to show much correlation with improved plant health. For the seeded plants, none of the groups with any saline water, would show germination. For live basil plants, the rock salt groups showed equal degradation in color and shrinkage while ocean water groups didn't see much change. Microscopically, it did appear that the NaCl group with bacteria held more water, implying a small correlation, but nothing too noticeable. These bacteria have been shown to improve plant health in other studies, so sources of error like certain lighting and seed spacing may be present.

Research Presentation: https://www.youtube.com/watch?v=7HsPo5xyuIk

Participated In: CT – Stem Fair; Junior Science and Humanities Symposia (JSHS); Connecticut Science and Engineering Fair (CSEF)

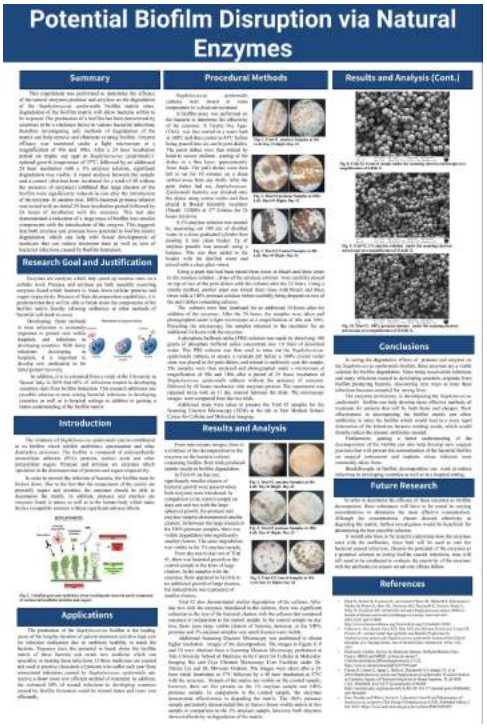
Awards / Special Recognition: JSHS – Backyard Scientists Award Winner 2020

Emily Larkin (Class of 2021)

My interest in the medical field as a possible career led me to this project. It was during my research of the hospital environment that I discovered the problematic nature of Staphylococcus Infections which sparked my curiosity to learn more about them. It was during this period of exploration and understanding that I devised my research projects. I plan on pursuing a career in STEM although I am still debating whether I will choose a career in the medical field or a career in business. I currently participate in the Sikorsky STEM Challenge where I have learned about flight technology and the engineering design process. My participation has taught me about the design process of engineering and how to more effectively pitch ideas. I am also a member of the Science Bowl Team where I enjoy answering science trivia questions from various branches of science! Through my involvement in these various STEM clubs, I have realized my excitement and interest in STEM and I wish to continue my education as I finish my high school career and transition into college.

Potential Biofilm Disruption via Natural Enzymes

Mentor: Dr. Katherine Nuzzo



This experiment was performed to determine the efficacy of the natural enzymes protease and amylase on the degradation of the Staphylococcus epidermidis Biofilm matrix since degradation of the biofilm matrix will allow bacteria within to be exposed. The production of a biofilm has been determined by scientists to be a virulence factor in various bacterial infections, therefore investigating safe methods of degradation of the matrix can help remove and eliminate existing biofilm. Enzyme efficacy was examined under a light microscope at a magnification of 40x and 100x. After a 24 hour incubation period on tryptic soy agar at Staphylococcus epidermidis's optimal growth temperature of 37°C, followed by an additional 48 hour incubation with a 1% amylase solution, significant degradation was visible. A visual analysis between the sample and a control (that had been incubated for a total of 48 without the presence of enzymes) exhibited that large clusters of the biofilm were significantly reduced in size after the introduction of the enzyme. In another trial, 100% bacterial protease solution was tested with an initial 24 hour incubation period followed by 48 hours of incubation with the enzymes. This test also demonstrated a reduction of a large mass of biofilm into smaller components with the introduction of the enzyme. This suggests that both amylase and protease have potential in biofilm matrix degradation, which can help with future developments of medicine that can reduce treatment time as well as cost of bacterial infections caused by biofilm formation.

Research Presentation: https://www.youtube.com/watch?v=Q98TM5hrWjM

Participated In: CT STEM Fair; Junior Science and Humanities Symposium (JSHS); Connecticut Science and Engineering Fair (CSEF)

Awards / Special Recognition: CT STEM Fair – Research Proposal Health and Medical, Second Place

Claudia Meyer (Class of 2021)

Inspired by my longtime interest in genealogy, I chose to research the preservation of historical records to make sure this information is available for generations to come. Outside of science research, I'm also co-captain of the Joel Barlow Debate Team and Treasurer for the Class of 2021, as well as a competitive fencer. Additionally, I am a volunteer archery coach, and have an interest in music, playing both piano and violin.

Lignocellulosic Manuscript Models Restoration Using Neutralization Reactions

Mentor: Dr. Katherine Nuzzo

Historical records serve as crucial sources of information for historians. These documents naturally deteriorate over time due to interactions with the environment that gradually decrease pH. The increased acidity of the documents, in turn, causes the degradation of the paper. This process is expedited by the presence of iron-gall ink, widely used in European writing between the 4th and 20th centuries, due to the ink's acidity. To preserve these items of cultural heritage and historical relevance for future generations, the degradation of historical documents must be countered through chemical means. This can be achieved via the conservation process of deacidification, which decreases the acidity of records, and as a result slows degradation. Calcium propanoate, calcium carbonate, and magnesium oxide have been previously tested as deacidification agents and determined to be successful at elevating pH; however, each substance has been tested under different conditions. To determine which substance is the most effective, conditions such as paper preparation and ink formulation must be equalized in order to determine relative success. Groundwood paper with iron-gall ink was designed to simulate historical records. Before and after the application of a deacidification agent, measurements of pH were taken using a pH meter. The deacidification agent that, on average, increases the pH of the paper most significantly is most applicable to future historical record preservation study.

Research Presentation: https://www.youtube.com/watch?v=nWVjD34L36c

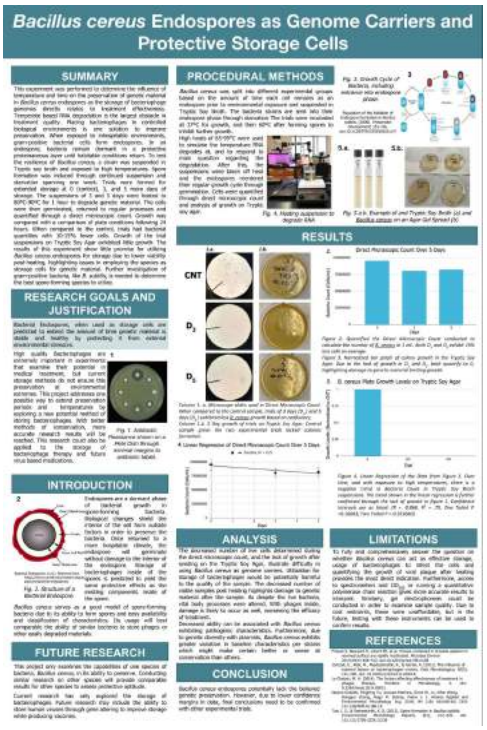
Participated In: Connecticut STEM Fair (CT STEM Fair)

Kyle Murray (Class of 2021)

After a research internship the summer before my junior year, I was extremely excited to conduct my own scientific research at Barlow. A lover of the life sciences, my project was inspired by a general curiosity with microorganisms and their applied use. When I'm not in the classroom I can usually be found in the auditorium as stage manager for Barlow's theatre productions or working with my teammates on the debate team. Additionally, I serve as the Class President for my grade, and am a member of Redding's local Boy Scout troop.

Bacillus cereus Endospores as Genome Carriers and Protective Storage Cells

Mentor: Dr. Katherine Nuzzo



This experiment was performed to determine the influence of temperature and time on the preservation of genetic material in B. cereus endospores as the storage of bacteriophage genomes directly relates to treatment effectiveness. Temperate based RNA degradation is the largest obstacle in treatment quality. Placing bacteriophages in controlled biological environments is one solution to improve preservation. When exposed to inhospitable environments, gram-positive bacterial cells form endospores. In an endospore, bacteria remain dormant in a protective proteinaceous layer until habitable conditions return. To test the resilience of B. cereus, a strain was suspended in Tryptic soy broth and exposed to high temperatures. Spore formation was induced through continued suspension and starvation spanning one week. Trials were formed for extended storage at 0 (control), 3, and 5 more days of storage. The suspensions of 3 and 5 days were heated to 80°C-90°C for 1 hour to degrade genetic material. The cells were then germinated, returned to regular processes, and quantified through a direct microscopic count. Growth was compared with a comparison of plate conditions following 24 hours. When compared to the control, trials had bacterial quantities with 10-15% fewer cells. Growth of the trial suspensions on Tryptic Soy Agar exhibited little growth. The results of this experiment show little promise for utilizing B. cereus endospores for storage due to lower viability post-heating, highlighting issues in employing the species as storage cells for genetic material. Further investigation of gram-positive bacteria, like B. subtilis, is needed to determine the best spore-forming species to utilize.

Research Presentation: https://youtu.be/8UUNqJWxy3Q

Participated In: CT STEM Fair Science Fair; Junior Science and Humanities Symposium (JSHS); Connecticut Science and Engineering Fair (CSEF)

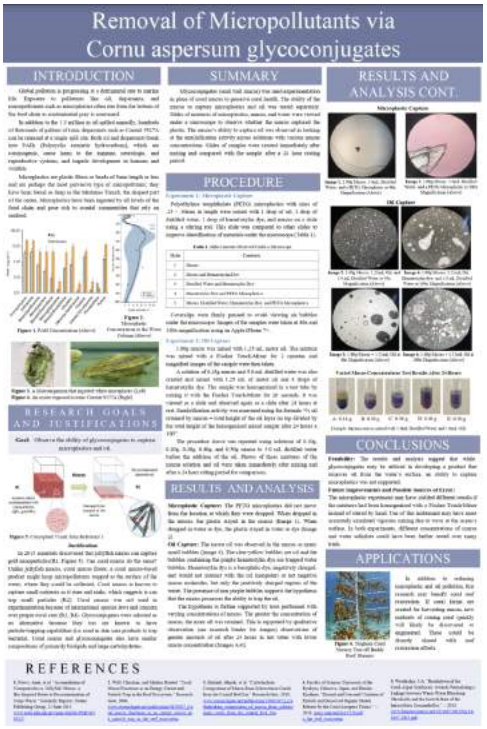
Awards / Special Recognition: Connecticut Science and Engineering Fair (CSEF) – Life Science Second Honors

Meghan Ogrinz (Class of 2021)

I chose this project because I am concerned for our environment - in particular our coral reef systems, which are very fragile and disappearing quickly. I hold a PADI Advanced Open Water Diver certification with a specialty in reef restoration and over the past several years have been volunteering as a gallery ambassador at the Maritime Aquarium. I also completed an internship at the Beardsley Zoo. I'm on the Maker Faire Connecticut organizing committee, which we've worked to make a zero waste event. I believe in the importance of eco-conscious innovation. In school I participate in the CAD Science Bowl competition and am co-captaining the Sikorsky STEM Challenge. I would like to major in biomedical engineering and minor in computer science in college.

Removal of Micropollutants via Cornu aspersum glycoconjugates

Mentor: Dr. Katherine Nuzzo



This research looked at the ability of Cornu aspersum glycoconjugates (Moroccan snail trail mucus) to capture micropollutants. In one experiment, its ability to trap PETG (Polyethylene terephalate) microplastics was tested by viewing samples of the mucus, plastic, and water under a microscope. Further testing with a more accurate simulation of wave motion at the ocean surface should be conducted to determine the ability of mucus to capture microplastics. The mucus's ability to capture oil was tested in a separate experiment. Results suggest that the higher the concentration of mucus in solution, the greater the amount of oil retained over a 24 hour period. Future tests could be done to determine the optimal mucus concentration for micropollutant capture. If tests with coral mucus are conducted and show similar results, a coral mucus-based product could be created for cleaning the surface of the ocean. The product would be spread at the surface at an oil spill site, capture microplastics, and then be collected by skimmer boats.

Research Presentation: https://youtu.be/5PTvJZeQRSY

Participated In: Junior Sciences and Humanities Symposium (JSHS); Connecticut Science and Engineering Faire (CSEF)

Awards / Special Recognition: JSHS - Presidential Scholar Nomination; JSHS – Speaker, Special Recognition; CSEF - Stockholm Water Prize Regional Nomination

Alexandra Popescu (Class of 2021)

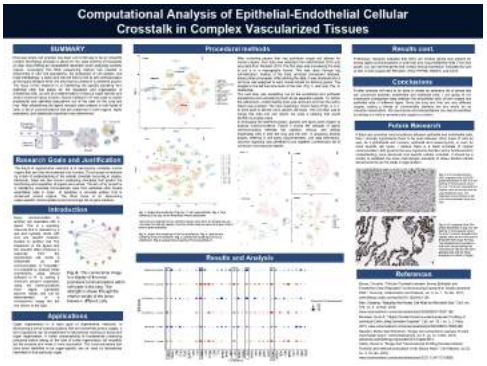
I am a current junior, finishing up a long and hard year. Outside of being a dedicated student, I am also a synchronized ice skater. I am on Team USA at the junior level and in a normal season, I travel to several international competitions which then culminate in the Junior World Championships in March. In ten years of skating, I have spent two at this advanced level and plan on a third one for my upcoming senior year.

I plan to attend college, although I can't say yet what I will be studying for sure. I am leaning heavily in pursuing a STEM-related major that will fulfill premed requirements, as I am almost positive I want to enter the medical field, currently as a surgeon but that is subject to change. However, I do have very varied interests and will be equally open to a career related to business, finance, law, and computer science. Clearly, I have not made up my mind on anything.

Last summer, I began an internship at a bioengineering lab at Yale that focuses on lung regeneration. In spending just two weeks studying with my mentor, I realized not only my fascination in the work the lab was doing, but my capacity to explore the world of cellular biology at the genetic level using the coding platform of R that I completed a small project on. After my mentor demonstrated interest in a project that he as a PHD student did not have the time to investigate and related to me that he'd be delighted if we could work on it together, I found myself with an internship for the year as I frequented the lab weekly to work on this project which became my AP chemistry science research project as well.

Computational Analysis of Epithelial-Endothelial Cellular Crosstalk in Complex Vascularized Tissues

Mentor: Sam Raredon, Yale Medical and PhD Student

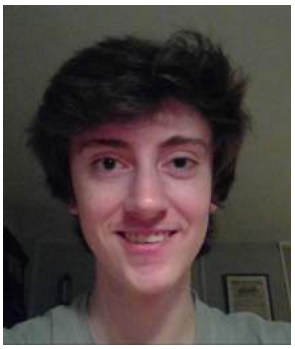


This project was conducted to determine whether there is a conserved pattern of microvascular cues from epithelial cells towards endothelial cells across organs since evidence has been presented of this kind of communication in the lung. This specific type of cellular crosstalk was examined computationally using Seurat software in R and a comparison was drawn between the lung and the liver. Published single cell data was taken from online for the lung and the liver and was clustered down into specific cell types. Epithelial and endothelial clusters were then subsetted and refined. Crosstalk between Type I epithelial cells and capillary cells in the lung and hepatocytes to capillary cells in the liver were chosen based on their physical proximity and similarity in function between the organs. Differential expression tests were run on the most prominent communications, determined by a threshold expression value, and it was found that an insignificant number of communications were conserved between the two organs. While the hypothesis was disproved, a valuable list of organ-specific cellular communications was put together that will further the understanding of lung and liver function.

Research Presentation: https://youtu.be/CQ4zerUTeWQ

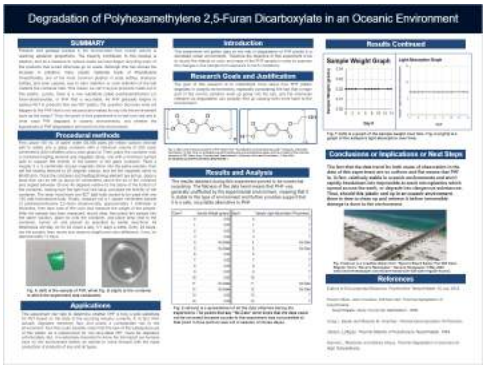
Participated In: Connecticut STEM Fair 2020 (CT STEM)

Jack Richardson (Class of 2021)



I like mostly to work with my hands, making wood projects, fixing cars, and figuring out how things work mechanically. I am looking to go to UCONN as a college, but I haven't settled on that yet. Other than working on stuff, I just generally enjoy being outside and kinda hate pollution and garbage as a result. If I had to list one reason I chose this project, I guess it would be because I want to protect the environment.

Degradation of Polyhexamethylene 2,5-Furan Dicarboxylate in an Oceanic Environment



Mentor: Dr. Katherine Nuzzo

Pollution and garbage buildup in the environment from human activity is reaching epidemic proportions. The majority contributor to this buildup is plastics, and as a measure to reduce waste we have begun recycling many of the products that would otherwise go to waste. Although this has slowed the increase in pollution, many plastic materials made of Polyethylene Terephthalate, one of the most common plastics in soda bottles, shampoo bottles, and even carpets, due to odor retention or color retention of the last material the container held. This means we can't recycle products made out of this plastic. Luckily, there is a new substitute called polyhexamethylene 2,5 furan-dicarboxylate, or PHF that is recyclable. As PHF gradually begins to replace PET in products that use PET plastic, the question becomes what will happen to the PHF that is not recycled and makes its way into the environment such as the ocean? Thus, the point of this experiment is to test how fast and in what ways PHF degrades in oceanic environments, and whether the byproducts of PHF degradation are harmful to the environment.

Research Presentation: https://www.youtube.com/watch?v=gKcowa1JG6U

Noah Simons (Class of 2021)

Currently, I am ending my junior year at Joel Barlow High school where I have been heavily involved both academically and with extracurriculars. During my time at Joel Barlow, I have played three sports of wrestling, football, and lacrosse. Ultimately becoming football captain my senior year. While I have remained active physically, I have also been heavily dedicated to my academics, focus on taking a rigorous course schedule. In pushing myself through college I hope to be a competitive applicant in my future college search. I have not locked in on any particular studies of the future but it is most likely that it will be in the STEM field. The reason I chose my project is more due to my exposure since my dad works heavily with printed control boards as they are used in the manufacturing of joysticks. Over the summer I worked on the floor of his company putting together these joysticks and I wanted to see if there was a possibility to improve the business. I thought of the use of sealants because it is the main component in the protection of the boards and is the reason for the long lifespan. So I focussed on making my project cater towards determining if the silicone sealants were, in fact, the most effective sealant that the company could use.

Electronic Sealants for Moisture Resistance in IPC-B-25A Boards

Mentor: Dr. Katherine Nuzzo

Machinery is seen as durable and long-lasting, but in fact, many parts are quite fragile. One part of the machinery needing protection is the PCB that provides the code for all the machinery. Any movement or signals run through these boards before any action being completed. A danger to these boards is moisture since it has the ability to corrode and cause short circuits in the boards. This is especially vital in today's world where extreme environments are being shown every day to these machines. A common defense against moisture is a sealant, typically silicone. In this experiment, Electronic Sealants for Moisture Resistance in IPC-B-25A Boards, silicone sealants were tested opposite of epoxy resin sealants in research to find if the epoxy resin is more efficient than the standard silicone. This experiment was done through coating PCBs using the following sealants: epoxy resin, silicone, and no sealant at all then submerged in a 20% mass saltwater solution. After 3 days of experimentation, six of the uncoated, 4 of the epoxy resin, and none of the silicone coated PCBs showed physical signs of corrosion.

Due to these results and that buying silicone is 13 times less per fluid ounce than purchasing epoxy resin, silicone is more cost-efficient to a company attempting to protect the PCBs. Further research should look into different forms of silicone and epoxy resin to see if any other sealants could outperform the common practice silicone sealant in protecting PCBs.

Research Presentation: https://youtu.be/2Ak9EOMCgEA

Participated In: Junior Science and Humanities Symposia (JSHS); Connecticut STEM Fair (CT-STEM Fair); Connecticut Science and Engineering Fair (CSEF)

Kelly Weng (Class of 2021)

After learning about plastic pollution for a school science project, I wanted to use my knowledge of robotics to do something that could help positively impact the environment. This project has helped me realize my love for robotics and computing that I plan to study computer science in college. I specifically wish to pursue artificial intelligence in the future. I enjoy spending my free time drawing, 3D printing, and running. My interest in computer science has also led me to join the robotics team where I obtained the title of head of outreach in my sophomore year and captain and head of electrical my junior year. I hope to one day use my computing skills to positively impact both the community and environment.

Automated Collection of Aquatic Surface Level Polyethylene (PET)

Mentor: Dr. Katherine Nuzzo

With the growing plastic epidemic, about 22 million pounds of plastic is entering the Great Lakes and about 12.7 million tons of plastic is entering our oceans every year. While clean up is happening, collection is slow. This is due to only passive methods of collection being implemented, like nets and "bins" in the water, this is not only manually exhausting and inefficient, but time consuming as well. In order to clean up past build ups effectively, this is an automated way for surface level plastic collection. That way, the robot will autonomously travel to the plastic instead of depending on plastics to travel to it. The robot has a mounted net and uses propellers to travel in the water, collecting pieces of plastic of surface level plastics through the use of a joystick powered by Arduino. For the sake of time and money, the robot is only a 3D prototype of the larger scale robot that would be put into the oceans. The robot is printed in PLA, which is a form of recyclable plastic. The electronic components are in a sealed, watertight box to ensure that they don't short circuited if water splashes onto it. If used in conjunction with passive methods of collection, this robot could bring us one step closer to complete plastic removal of our waterways.

Research Presentation: https://youtu.be/xate46Q_zj8

Participated In: Connecticut Science, Technology, Engineering, Mathematics Fair (CT STEM Fair); Connecticut Science and Engineering Fair (CSEF)

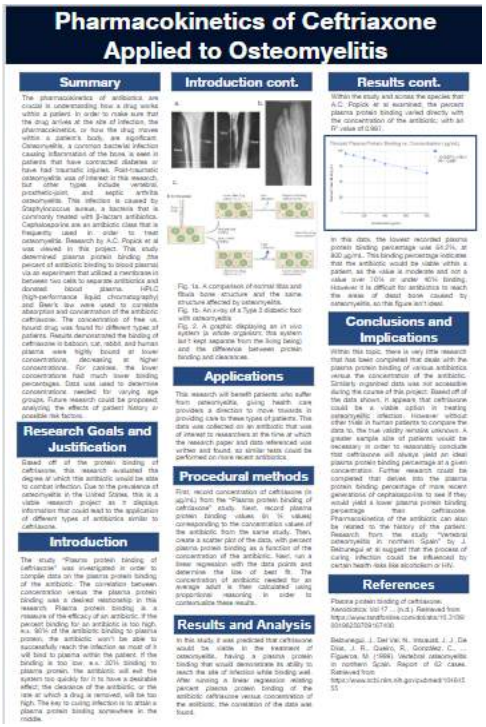
Awards / Special Recognition: CSEF – Special Award, Awarded by Southeastern New England Marine Educators (SENEME) - 1st Place Senior

Trevor Wilkes (Class of 2021)

I enjoy acting, singing, and the outdoors in addition to the STEM field and participate in an acapella group, the theater program at my school, and my local Boy Scout troop. As of now I don't have any specific plans for colleges, but I would still like to be able to pursue my current interests as I continue my education. I chose this project because it was very personal to me, since it happened to my father, and I wanted to research a topic that I was actually interested in, something I felt connected to. This way I would be able to cultivate my interest in STEM while looking at something that engages me.

Pharmacokinetics of Ceftriaxone Applied to Osteomyelitis

Mentor: Dr. Katherine Nuzzo


Pharmacokinetics of Ceftriaxone Applied to Osteomyelitis

Summary

Introduction cont.

Results cont.

Research Goals and Justification

Introduction

Procedural methods

Applications

Results and Analysis

Conclusions and Implications

References

The pharmacokinetics of antibiotics are crucial in understanding how a drug works within a patient. In order to make sure that the drug arrives at the site of infection, the pharmacokinetics, or how the drug moves within a patient's body, are significant. Osteomyelitis, a common bacterial infection causing inflammation of the bone, is seen in patients that have contracted diabetes or have had traumatic injuries. Post-traumatic osteomyelitis was of interest in this research, but other types include vertebral, prosthetic-joint, and septic arthritis osteomyelitis. This infection is caused by Staphylococcus aureus, a bacteria that is commonly treated with β-lactam antibiotics. Cephalosporins are an antibiotic class that is frequently used in order to treat osteomyelitis. Research by A.C. Popick et al was viewed in this project. This study determined plasma protein binding (the percent of antibiotic binding to blood plasma) via an experiment that utilized a membrane in between two cells to separate antibiotics and donated blood plasma. HPLC (high-performance liquid chromatography) and Beer's law were used to correlate absorption and concentration of the antibiotic ceftriaxone. The concentration of free vs. bound drug was found for different types of patients. Results demonstrated the binding of ceftriaxone in baboon, cat, rabbit, and human plasma were highly bound at lower concentrations, decreasing at higher concentrations. For canines, the lower concentrations had much lower binding percentages. Data was used to determine concentrations needed for varying age groups. Future research could be proposed; analyzing the effects of patient history or possible risk factors.

Research Presentation: https://www.youtube.com/watch?v=9ZNphsHPCTI

Participated In: Connecticut Science, Technology, Engineering, & Mathematics Fair (CT STEM Fair); Connecticut Science & Engineering Fair (CSEF)

Mitchell Worthington (Class of 2021)

I have been on the Joel Barlow Golf Team for two years, which would have been three if it weren't for the 2020 school closings, and I was on the Science Bowl team for one year. Also, I play on the tennis team at Fairfield Tennis. As for college, I am unsure of where I want to go exactly but one of my dream schools is Notre Dame because my brother goes there and I'd like to continue his legacy.

I chose this project because carbon dioxide is currently the leading cause of global warming which causes disturbances in animal habitats. Therefore, I wanted to find an easy way for farmers and individuals passionate about diminishing the effects of global warming to slowly decrease their carbon footprint.

Additionally, four years ago my brother performed similar research on the use of the enzyme carbonic anhydrase on soil to see how it would diminish concentrations of carbon dioxide. So, I wanted to conduct this research to expand on his research by instead testing biochar, a cheaper substance also capable of trapping carbon dioxide in soil.

Soil Anthropogenic Carbon Dioxide Sequestration Using Biochar

Mentor: Dr. Katherine Nuzzo

Carbon dioxide is a harmful greenhouse gas that causes climate change which creates extreme weather conditions. Biochar, a common soil fertilizer made by pyrolyzed organic matter, can sequester carbon dioxide in soil to decrease its atmospheric concentrations. This study carried out a 24-hour experiment examining high and low surface area biochars, measuring to be 353 mm2cg-1 and 228 mm2cg-1 respectively, and the addition of 4 mL of water on carbon dioxide to determine their effects on biochar's ability to sequester carbon dioxide in soil. Results showed that high and low surface area biochar amendments without water increased atmospheric carbon dioxide concentrations by 198.6% and 360.2% respectively. Carbon was possibly deposited due to the turnover of soil labile carbon from adding biochar to soil. The high and low amendments with water showed significantly higher concentrations of 1260.5% and 1010.5% increases respectively. Water possibly drove carbon dioxide out of the soil. Tests showed a steady decrease in carbon dioxide concentrations in the last 12 hours of testing, so further research examining these variables over a longer period of time could show that biochar eventually sequesters carbon dioxide instead of depositing it. This study suggests biochar amendment is not an effective material to mitigate carbon dioxide emissions in soil. This research is for the lay consumer looking to decrease their carbon footprint.

Research Presentation: https://youtu.be/-_yvY8nPWbA

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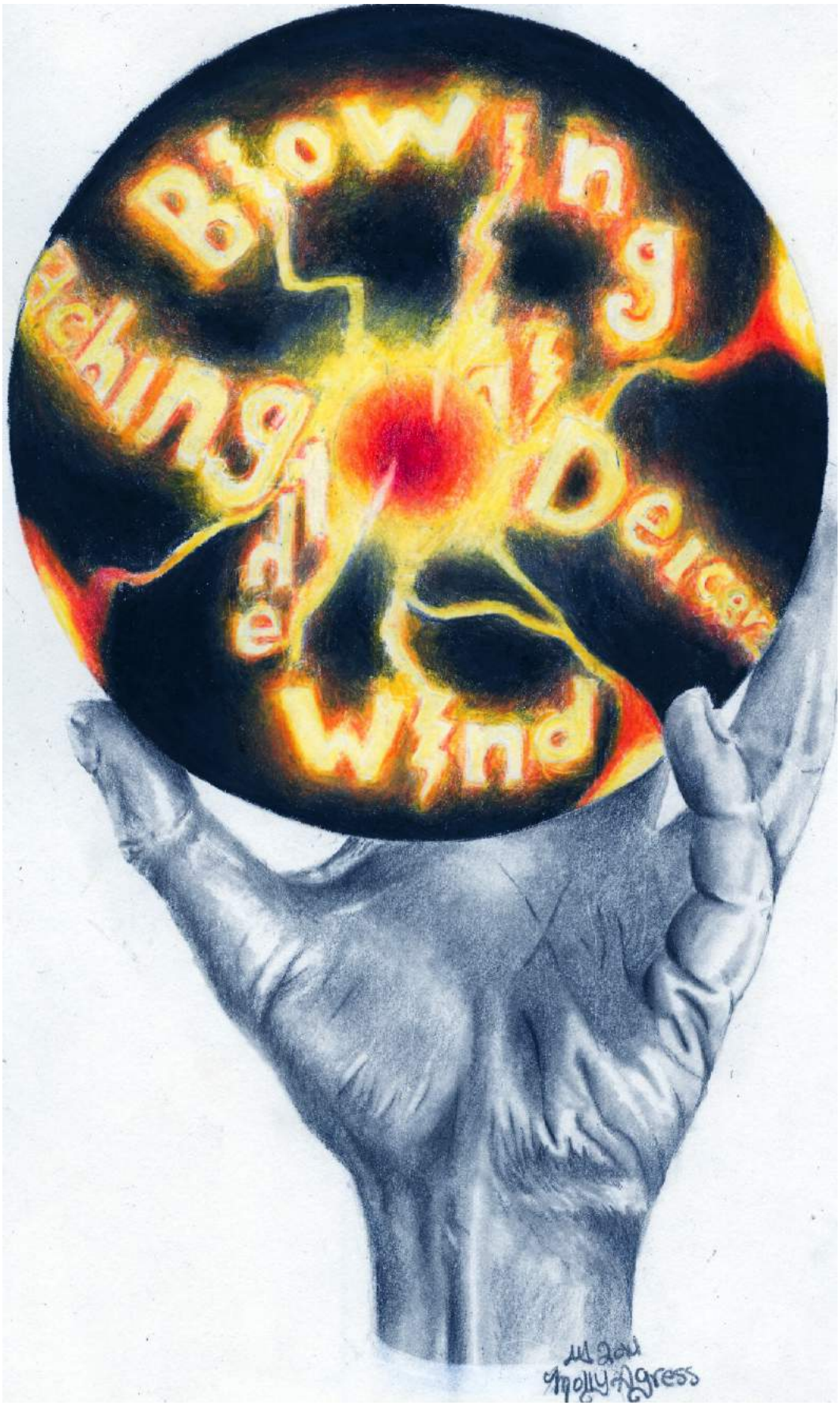
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