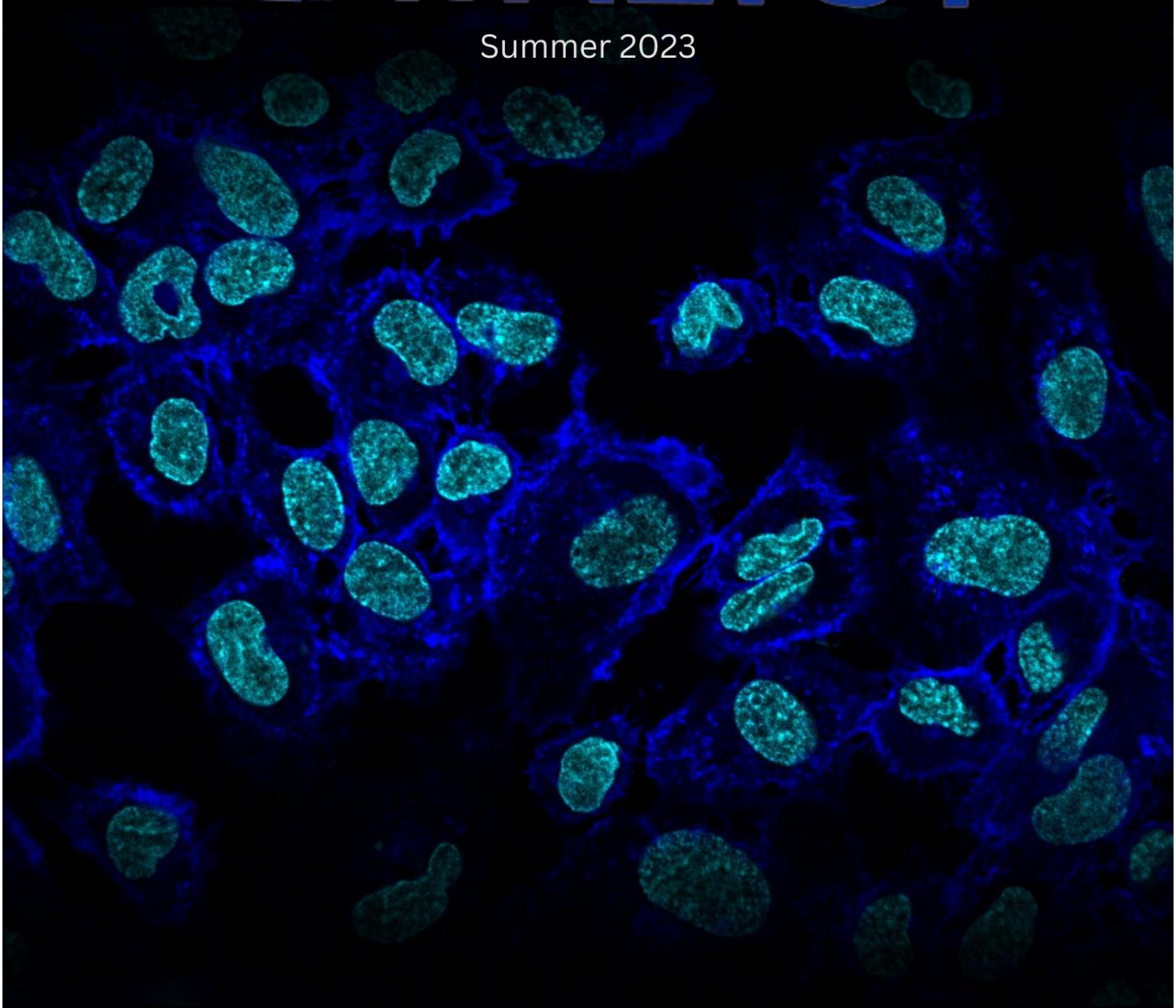




THE

CATALYST

Summer 2023



Fischell Department of Bioengineering
A. James Clark School of Engineering
University of Maryland

*Cover - Immunohistochemistry stained
Human Umbilical Vein Endothelial Cells
(HUVECs) (courtesy of Pieper Holeman)*

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Dear Catalyst Reader,

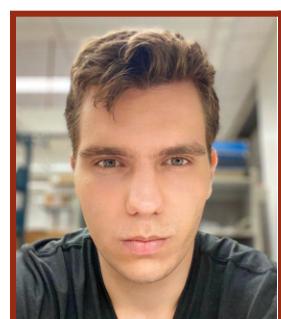
It is with great pleasure and anticipation that I welcome you to the reinvigorated edition of The Catalyst, the undergraduate journal highlighting biomedical engineering research that has been reawakened following a five-year hiatus. I am honored to share with you this publication, one that is dedicated to fostering stronger connections between students, research, and the exciting proceedings within the Fischell Department of Bioengineering.

In the pages that follow, you will find a unique collection of articles that encapsulate the essence of our ambition for research. From insightful interviews with esteemed faculty and passionate students to highlights regarding diversity and inclusion, our fundamental goal has been to connect you with research on a more personal level. Moreover, we are thrilled to showcase the exceptional research contributions from experienced faculty members in order to acknowledge and celebrate a remarkable dedication to advancing science and society.

This new edition stands as a testament to the incredible amount of teamwork, dedication, and resilience that has been poured into its creation. Our exceptional editorial team has worked tirelessly to ensure that each article within these pages is of the utmost quality, engaging, and academically rigorous. The collaborative efforts of our team have been instrumental in shaping this renaissance of our journal, and I extend my deepest gratitude to everyone who has contributed their time, expertise, and unwavering support.

As the new editor-in-chief of The Catalyst and an undergraduate student entering my third year at the University of Maryland, it is my sincere hope that through this revitalized platform, we will continue to inspire and empower current and future generations of researchers alike, fostering a spirit of curiosity and ambition within our community.

Best regards,
Emre Derin
Editor-in-Chief of The Catalyst



Meet the Team



Name: Duy Le

Position: Assistant Editor-in-Chief, Director of Finance

Year: Class of 2025

Major(s): Bioengineering and Neuroscience

Career Goal: Physician

BIOE Involvements: President of Alpha Eta Mu Beta

Hobbies: Hiking, biking, martial arts, playing video games

Interest in The Catalyst: From my 2 years at UMD, I have determined that our BIOE department is the best department with the most amazing people, faculty, and events. I hope to share these great aspects with the rest of the department and connect with everyone in the process!



Name: Matthew Ensign

Position: Director of Operations

Year: Class of 2025

Major: Bioengineering (Biotechnology and Therapeutics Engineering Track)

Career Goal: Professor of Biomedical Engineering

Research Involvements: BIOE Honors student in Maisel lab at UMD, Research Assistant in Parikh lab at JHU

BIOE Involvements: Vice President of Academic Affairs for Alpha Eta Mu Beta, member of the Biomedical Engineering Society

Hobbies: Cooking and baking, reading, walking around cities, trying new restaurants, playing video games

Interest in The Catalyst: The department supports many initiatives that are usually not discussed by students, especially events and programs developed by the DEI committee members, who consistently work to improve inclusion within our department and the university. Writing pieces on affairs within the department through The Catalyst is a great way for students to grow more aware of all the things that professors, administrators, and other bioengineering students accomplish!



Name: Anika Dasgupta

Position: Director of Human Resources

Year: Class of 2025

Major: Bioengineering, Biotechnology and Therapeutics Track

Career Goal: For now, I'd like to pursue a Ph.D., but we'll see what the future holds beyond that! Would love to stay involved with research.

Research Involvements: BIOE Honors student at Huang Lab at UMD, previous summer ORISE fellow at the FDA

BIOE Involvements: President of BMES, VP of Internal Affairs for Alpha Eta Mu Beta Biomedical Honor Society

Hobbies: Outside of academics, I like to cook/bake (@pigirleats on Instagram!) and create things with my hands (through media of crochet, embroidery, and most recently ceramics). I'm a novice mushroom hunter and love learning new things, traveling, and meeting people!

Interest in The Catalyst: I am a strong believer that while science is powerful, the ability to effectively communicate that science to a wide audience is a primary source of that power. Through the Catalyst, I hope to engage deeply with the research, activities, and people of the bioengineering department and - alongside my fellow board members - showcase what makes us UMD BIOE!



Name: Sarah Han

Position: Director of Public Relations

Year: Class of 2025

Major: Bioengineering

Career Goal: Clinical researcher

Hobbies: Skateboarding and baking egg tarts. Going on a solo trip in the woods

BIOE Involvements: Undergraduate researcher in Fisher lab at UMD, BIOE Honors Program, VP of Academic Affairs of Biomedical Engineering Society

Interest in The Catalyst: As a person from a low-income community with a lack of exposure to the research field, I found it extremely hard to break into research and identify my interests. I am excited to help other undergraduate students like me by highlighting research opportunities and sharing research conducted by other students to encourage their interest in research.



Name: Patrick Scott

Position: Lead Web Developer

Year: Class of 2025

Major(s): Computer Science and Economics

Career Goal: Software engineering or economist

Other Campus Involvements: Work at the adventure program, run learn to code

Hobbies: Climbing, reading, and biking

Interest in The Catalyst: To have a great website that works intuitively to reach the audience



Name: Jeffrey Luo

Position: Web Developer and Staff Editor

Year: Class of 2025

Major(s): Bioengineering

Career Goal: Currently, I am aiming to attend medical school with interests in orthopedics, anesthesiology, and dermatology.

Other Campus Involvements: AEMB, GSO, Kuo Lab

Hobbies: Playing flute, building/tinkering with computers

Interest in The Catalyst: I'm really excited about its potential to highlight the different kinds of research being done and discoveries being made across the department.



Name: Chelsea Neumann

Position: Lead Graphic Designer

Year: Class of 2025

Major(s): Bioengineering, Biomedical Instrumentation Track

Career Goal: To develop medical devices that can improve quality of life or save lives; would love to apply this to military medicine

Other Campus Involvements: BMES Vice President of Competitions

Hobbies: Drawing, painting, researching paleontology, and riding horses

Interest in The Catalyst: Strengthen community within BIOE and to showcase the important and fascinating research that is happening on UMD campus

The Fischell Department of Bioengineering – A Glimpse into the Past & Present

Author: Emre Derin

In the heart of academic excellence, the Fischell Department of Bioengineering stands as a beacon of innovation and collaboration. Over the years, it has evolved into a trailblazer, merging life sciences and engineering to shape the future of biomedical research. The Fischell Department of Bioengineering was established in 2006 within the esteemed A. James Clark School of Engineering at the University of Maryland, College Park. It owes its name to Dr. Robert E. Fischell, a visionary engineer and inventor whose generous donation was instrumental in the establishment of the department. Dr. Fischell's pioneering work in biomedical devices, such as the rechargeable pacemaker and drug-eluting stents, became the inspiration for the department's core mission: bridging the gap between engineering innovation and scientific advancements in the pursuit of enhanced quality of life for millions.

In the subsequent years, the department experienced steady growth, attracting top faculty and forging partnerships with leading industry partners and other institutions. In recent history, the Fischell Department of Bioengineering has made significant strides in groundbreaking research. The department has seen tremendous successes in the fields of tissue engineering, nanotechnology, biomechanics, synthetic biology and more. Between 2017-2018, a total of 30 novel inventions came to fruition from faculty as a testament to the significant advancements that have moved the field into a new era of inquiry and exploration.

In addition to its research prowess, the department has also excelled in providing high-quality education to the next generation of bioengineers. Through an array of rigorous undergraduate and graduate programs, students receive hands-on training and mentorship from leading experts in the field. With more than 500 undergraduate and graduate students enrolled in 2021, the department's commitment to student empowerment and experiential learning continues to nurture researchers who contribute to academia, industry, and healthcare.

The Fischell Department of Bioengineering's dedication to excellence has been recognized with numerous awards and accolades. Several faculty members have been honored with National Science Foundation (NSF) Career Awards for their exceptional contributions to research and many have won numerous awards from institutions such as the National Institutes of Health and the U.S. Food & Drug Administration. Though the list continues, the Fischell Department of Bioengineering's achievements underscore the department's commitment to research excellence and its pivotal role in advancing the frontiers of bioengineering research.

This journey which began less than two decades ago has been a remarkable tale of transformative innovation, collaboration, and educational excellence. From its inception to the present day, the Fischell Department of Bioengineering has been at the vanguard of pioneering research, producing critical technologies, and empowering the next generation of bioengineers and academics. As it continues to make a profound impact on research and society, the future of departmental research remains boundless, perpetuating its legacy of innovation for generations to come.

BMES Chapters Unite for the Mid-Atlantic Research Day

Author: Matthew Ensign

The University of Maryland and the Johns Hopkins University chapters of the Biomedical Engineering Society hosted their 13th Annual Mid-Atlantic Research Day Conference at the JHU Homewood Campus on May 6th, 2023. At this all-day conference sponsored by AstraZeneca and hosted in Hodson Hall, biomedical science students from both universities participated in poster sessions and engaged with various panels, workshops, and oral presentations. All five of The Catalyst Executive Board officers attended the event and appreciated the efforts of both BMES chapters in organizing this extensive event.



SCHEDULE

Time	Event(s)	
9:20 am - 10:00 am	Check-in and light breakfast THB bagels and juice available	
10:00 am - 10:50 am	Opening Keynote Speaker: Dr. Xingde Li Hodson Lecture Hall	
11:00 am - 11:50 am	Poster Session A Faculty and AstraZeneca judges	Option 1: Short Session One AstraZeneca Seminar "Innovation and Research in Industry" -Ryan Gilbreth
12:00 pm - 12:50 pm		Option 2: Short Session Two AstraZeneca Research Seminar "CAR T-cells: From the Bench to the Bedside" -Nina Chu,
1:00 pm - 1:50 pm	Lunch Chipotle burrito bowls on Decker Quad	
2:00 pm - 2:50 pm	Poster Session B Faculty and AstraZeneca judges	Option 1: Short Session Three AstraZeneca Research Seminar "AZD7442: AstraZeneca's Long-Acting Ab Combination for the Prevention and Treatment of COVID-19" -Sarah Rajan
3:00 pm - 3:50 pm		Option 2: Short Session Four AstraZeneca Roundtable Discussion -Ryan Gilbreth, Nina Chu, Maria Braggi
4:00 pm - 5:00 pm	Closing Keynote Speaker: Dr. Scott Wilson Hodson Lecture Hall	
5:00 pm - 7:00 pm	DJ Mixer Insomnia Cookies, Great Hall (optional)	

PRESENTED BY:
Johns Hopkins University and The University of Maryland

SPONSORED BY:
AstraZeneca

INSTAGRAM: @jhu.bmes
LINKEDIN: @The Johns Hopkins Biomedical Engineering Society
WEBSITE: <https://jhbmes.wixsite.com/home>

The Research Day began with a light breakfast and an opening keynote speech given by Dr. Xingde Li, a professor of biomedical engineering at JHU, who presented his work in translational biophotonics imaging. His lab uses cutting-edge technologies to improve disease detection at the earliest stages and guide possible interventions for improving patient health. For example, the Li lab has used its expertise for noninvasive cancer detection and preterm birth assessment. We greatly appreciated Dr. Li's time, and his presentation was an excellent start to the event.

The next two hours were dedicated to the first poster session and two seminars led by Dr. Ryan Gilbreth and Dr. Nina Chu. Dr. Gilbreth earned a Ph.D. in Biochemistry and Molecular Biology, and he currently uses his expertise in protein engineering, scaffolds, and nanotechnology to focus on delivery aspects of CAR-T therapy as a Director in Biologics Engineering at AstraZeneca. His seminar titled "Innovation and Research in Industry" detailed how his role fits into the research pipeline and the process that AstraZeneca uses to complete its projects. During the last hour of the poster session, Dr. Chu, who uses her immuno-oncology expertise to develop CAR-T agents for solid tumors as an Associate Principal Scientist in Cell Therapy, led her seminar on "CAR T-cells: From the Bench to the Bedside". In this seminar, Dr. Chu comprehensively provided the background that the audience needed to understand how CAR-T cells are used in immunotherapies: the hallmarks of cancer, types of immune cells and their roles, and how CAR-T cells are uniquely effective for treating cancer. Both seminars were informative and engaging and we enjoyed learning about AstraZeneca's exciting research.

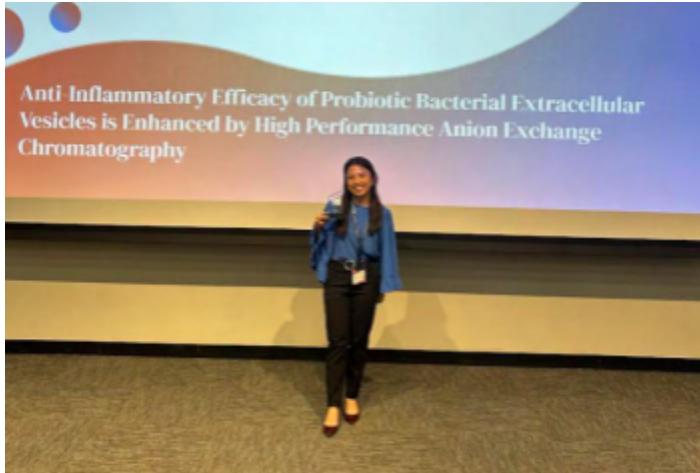
During the last poster session, Dr. Sarav Rajan led the final research seminar titled "AZD7442: AstraZeneca's Long-Acting Ab Combination for the Prevention and Treatment of COVID-19". Dr. Rajan is a Director of Biologics Engineering specializing in antibody discovery and his team employs multi-disciplinary approaches that combine molecular biology, microfluidics, computer science, and automation to identify new antibodies. He explained that during COVID, AstraZeneca teams were forced to accelerate an already sprint-based development process and deal with the challenges associated with short schedules, which has helped them establish precedents for rapid vaccine development in the future. Then, Dr. Maria Broggi, a Director and Translational Medicine Lead within AstraZeneca's Oncology R&D department who leads strategies for CART and oncolytic viral therapies, joined Dr. Gilbreth and Chu to host a roundtable discussion during the last hour of the poster session. During the discussion, students were free to ask any questions and Broggi, Gilbreth, and Chu shared their experiences within academia, their reasons for transitioning to industry after completing their graduate work, and their advice for students trying to identify their post-graduation plans.

Dr. Scott Wilson, an Assistant Professor of Biomedical Engineering affiliated with the Translational Tissue Engineering Center at JHU, closed the event by sharing his research on immunomodulatory biomaterial therapies that encourage immunity and tolerance. His initial explanations of the adaptive immune system were extremely comprehensive, and he made sure to link the research his lab performs back to these basics, which helped



Members of the third place team: Andrew Chan, Muhaymin Chowdhury, Pavan Bhat, and Nana Annan

contextualize his work on topics such as encouraging immune tolerance in individuals with autoimmune diseases.



Laura Reus, the first place winner, with her award

Overall, we enjoyed the time we spent learning about research from student presenters and scientists from AstraZeneca and we thought that the two BMES chapters coordinated the event well. We are especially proud of the UMD students that earned awards for their poster presentations and were impressed with their knowledge, enthusiasm, and confidence. Nana Annan, Pavan Bhat, Andrew Chan, Muhaymin Chowdhury, and Aqeel Muthaliff won third place for their Capstone poster, "An Attachable Camera for Bedside Assessment of Commonly Placed Gastrointestinal Medical Devices." Laura Reus, who works in the Jay lab on campus, won first place for her poster on the

"Anti-Inflammatory Efficacy of Probiotic Bacterial Extracellular Vesicles." Congratulations! We look forward to the next Mid-Atlantic Research Day hosted at UMD and the research presented by more UMD and JHU students.

Acknowledgments: we greatly appreciate the assistance of the BMES-UMD Executive Board members that reviewed and provided some of the information in this article.

Sources:

1. "BMES's 13th Annual Mid-Atlantic Research Day Conference." Fischell Department of Bioengineering, <https://bioe.umd.edu/event/18382/bmess-13th-annual-mid-atlantic-research-day-conference>. Accessed 30 July 2023.

A Sneak Peek into the Senior Design Capstone

Author: Matthew Ensign



Besides ENES100, the Capstone courses are the only required bioengineering courses where teams of students design products by applying the skills and experience they acquired in lectures. To some students, the Capstone is one of the most meaningful experiences in their undergraduate career – a sentiment shared by Dr. Jenna Mueller, an Assistant Professor of Bioengineering and the instructor for BIOE486. Despite being faculty, she says that she still “remember[s] and value[s]” her “senior design experience” because of the unique opportunity to “interact with providers and end users throughout the design process”. Now that students from the new Biocomputational Engineering program at Shady Grove are participating in the Capstone, even more students will participate in the competition in the coming years.

The goal of the Capstone program is to give students opportunities to “engage in discussion on current issues in bioengineering such as ethics, clinical trials, regulatory processes, venture capitalism, business principles, and entrepreneurship”¹ and to show students how they can develop and commercialize medical technologies. Because of Mrs. Susan Fischell, the creator and sponsor of the Capstone Design Awards, and her gracious donations, the Capstone teams can win monetary prizes and present their work to the public. Some of the student teams may even see their prototypes become actual products through the efforts of the Robert E. Fischell Institute for Biomedical Devices.

Designing and prototyping a product with a small team in a little over one semester seems daunting, but the Capstone courses and faculty provide the resources to make this possible. In BIOE485, students learn the principles of “engineering design, design approaches, economics of design, ethics in engineering, and patent regulations”² and complete design proposals under the mentorship of their advisors. A significant portion of this course is dedicated to completing milestones required for this report and planning for the production process of the selected device.

In BIOE486, students apply what they learned in their prior coursework to “fabricate their proposed design under BIOE485, test the design, write the report and present it to their fellow seniors and board of faculty mentors”². In the lecture portion, Dr. Mueller guides the Capstone students through the Stanford Design



A member of the 2023 Second Place Capstone team showcasing their use of the HoloLens 2

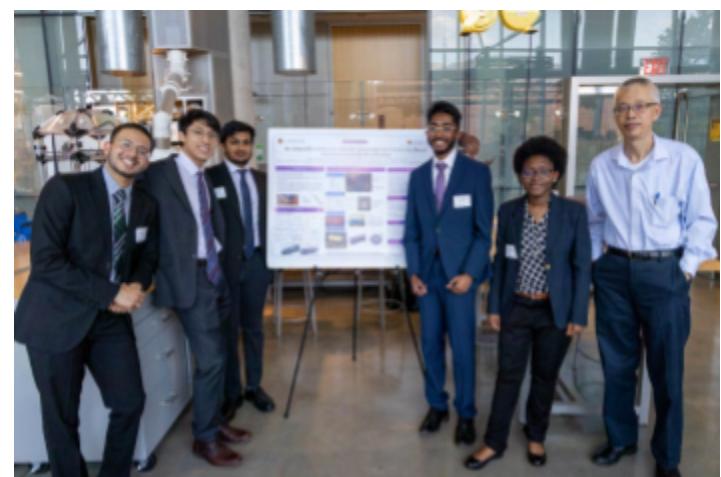
School’s biodesign process and encourages them to apply this knowledge to the independent lab time. Throughout the course, teams complete assignments, presentations, and check-ins to ensure they are on track. The breakout sessions in February and April are particularly helpful as Bioengineering and Clinical faculty use this time to provide feedback to every team. Dr. Mueller asks teams to prepare a model or data to support their design and prototype for the first breakout, and by the second breakout session, teams should have a report of their design progress and plans for completing their project before Capstone Day.

On competition day, the student teams gather in the Leidos Innovation Lab and pitch their designs to judges from the BIOE Advisory Board, the Children’s National Health Center, the FDA, the Fischell Institute for Biomedical Devices, investigators from the UMD School of Medicine, faculty, mentors, and other students that attend the poster sessions. Teams can win first, second, or third place, the MPower award, the Student’s Choice award, the Advisory Board Award for Translational Design, and the Best Poster award.

According to Dr. Mueller, the panel of judges must consider the following criteria: the teams’ capacity to design, prototype, test, and implement their solution to a public health problem, ability to communicate their problem statement and its potential impact, and their understanding of the ethical implications surrounding



The 2023 First Place team with their winning poster



Members of the 2023 Third Place team with their poster

their solution. To score the 24 teams, each judge meets a subset of the teams. Dr. Margaret Prendergast, a member of the BIOE Advisory Board, remembers how she and the other judges were split into groups of two and met with her assigned teams for 5-10 minutes. During that time, she and the other judges listened to an overview of the teams' projects and their answers to a series of questions. After scoring, team metrics were averaged, and the top teams were selected for the finals. The selected teams then presented their projects to a larger crowd and the judges voted again—in the case of the student's choice award, the teams' peers in attendance voted on the best team.

Both Dr. Mueller and Dr. Prendergast believe that the value of the Capstone program cannot be understated; in academia, industry, and elsewhere, bioengineering students will likely work in teams on various projects and must consider business, ethical, or human-design principles. Through the Capstone, seniors have many opportunities to meet with faculty and practice these principles as innovators developing novel technologies that tackle significant issues. We hope that future Capstone teams have meaningful experiences through the program and we look forward to what the 2024 Capstone Competition has to offer.

Acknowledgments: I would like to thank the following people for helping with this piece—

- Dr. Jenna Mueller for providing information about BIOE486 and competition judging.
- Dr. Margaret Prendergast for sharing her perspective on the value of the competition and providing information about judging.
- Abby Shantzis for connecting us with people that helped plan and execute the Capstone courses and competition.
- Ellen McDaniel from BIOE Communications for providing all of the photos in this article.

Sources:

1. Fischell Department of Bioengineering. (2023). *Senior Design Capstone Competition*.
<https://bioe.umd.edu/capstone>
2. University of Maryland. (2023). *BIOE – Bioengineering*. 2023-2024 Undergraduate Catalog.
<https://academiccatalog.umd.edu/undergraduate/approved-courses/bioe/>

Class of 2023 Q&A:

Conducted by: Duy Le

Ella Evensen

Fast Facts

Name: Ella Evensen

Pronouns: She/her

PI/Lab: Worked with Dr. Mohamad Al-Sheikhly for Gemstone, Radiation Facility (Amber Johnson and Dr. Luke Guild)

What are you currently doing?

Ella is currently working in the Food Quality Lab at the U.S. Department of Agriculture as a research intern with Dr. Sunny Luo. She is working on multiple projects, including examining microbial growth on green vegetables and investigating plant root growth in a hydrogel substrate in order to simulate growth in zero-gravity.



What was your most memorable experience during undergrad? What was the most important experience?

Ella's most memorable experience was Capstone Day because it was amazing to see the culmination of everyone's efforts over the last year on display. Her own project, which involved programming a robotic arm, was on a topic that was outside of her wheelhouse. Despite this, she enjoyed working on the project and was proud to present it to the judges and the rest of the Capstone students. As for her most important experience, Ella said that she found her work in Gemstone to be most beneficial to helping her figure out what she wanted to do after undergraduate school. The 4-year long research program taught her how to plan and design a research question, introduced her to working in a lab on campus, and showed her what works and what does not work in research.

Are you involved with any labs on campus? If so, which ones?

Ella worked in Dr. Al-Sheikhly's lab in the Material Science and Engineering department for her Gemstone project. This project looked at improving the current technology behind polyvinylpyrrolidone (PVP) based hydrogels for treating glioblastoma multiforme. Ella also worked in the Radiation Facilities on campus with Amber Johnson and Dr. Luke Guild. There, Ella started out working with electronics and soldering capacitors to printed circuit boards (PCBs) but eventually found herself building a neutron detection robot.

Though her work at the Radiation Facilities did not align with her other research interests, Ella is still grateful as the experience helped allow her to say “yes” to more opportunities.

If you could go back and meet yourself during your first year, what would you tell yourself?

“I would tell myself to not stack so many classes.” Ella mentioned how it can quickly become overwhelming to take so many classes on top of trying to adjust to college during the first 2 years. Also, she would caution herself that not everything in the real world is about classes. Instead, she recommends looking for other opportunities such as working in a lab, finding an internship, or joining an on-campus organization as these things will help you develop skills that are more useful in the real world.

Kaitlyn Moore

Fast Facts

Name: Kaitlyn Moore

Pronouns: She/her

PI: Dr. Katharina Maisel

Favorite classes: Immunoengineering (BIOE489G), Synthetic Biology (BIOE461), Therapeutic Development and Delivery (BIOE462)



What are you currently doing?

Currently, Kaitlyn is working in Dr. Maisel's immunoengineering and lymphatics lab on campus. Additionally, she is tutoring with the Academic Achievement Programs (AAP) at UMD where she is teaching a class of HIST201, Interpreting American History: From 1865 to the Present.

What do you hope to do in the near future?

Kaitlyn will be attending UMD and pursuing her Ph.D. in bioengineering this Fall. She chose not to be directly matched with any professors and instead, she will be doing rotations in which she spends time in different PI's labs to determine which is the best fit for her. Currently, Kaitlyn plans on pursuing her interests in immunoengineering and drug delivery research.

Are there any aspects of undergrad that helped prepare you for what you are currently doing or hope to do?

The one thing that helped Kaitlyn the most was making connections everywhere she went. From working as an undergraduate teaching fellow, Kaitlyn met Dr. Ed Eisenstein who helped her discover her love for teaching. Additionally, by talking to her advisor, Dr. Maisel, Kaitlyn joined the Maisel lab because she discovered that the lab matched her own research interests. Dr. Maisel also helped Kaitlyn navigate her way through the graduate school application process and offered her invaluable advice. Lastly, being involved in

student organizations such as BMES and AEMB helped Kaitlyn connect with her peers and find like-minded students. The friends she made in BMES and AEMB ended up being the same friends she would form study groups with and were the ones who helped encourage each other throughout college.

If you could go back and meet yourself during your first year, what would you tell yourself?

"I would tell myself to just put myself out there." Getting involved, finding out what her interests are and finding friends both inside and outside of the major are what Kaitlyn enjoyed the most about college. By joining a lab and being active in clubs, she discovered both what she enjoyed doing and what she did not enjoy doing. As Kaitlyn said, "you should just enjoy college."

Mitsuo Kumagai

Fast Facts

Name: Mitsuo Kumagai

Pronouns: He/him

PI: Dr. Xiaoming He

Favorite class: Biology for Engineers Laboratory (BIOE121)

What are you currently doing?

Currently, Mitsuo is spending his summer working in the Army Research Lab (ARL). He is continuing his work from the previous summer where he worked with *E. coli* to examine its capabilities in synthetic biology for the degradation of plastics. Because of the nature of his work, Mitsuo could not offer too many details except that although it is not within his particular field of interest, he still finds the work to be interesting and valuable to him as a researcher in practicing his wet lab skills.



What do you hope to do in the near future?

Mitsuo will be pursuing a Ph.D. in bioengineering here at UMD and he has directly matched with Dr. He, a professor in the Bioengineering department. After graduate school, Mitsuo hopes to go into governmental research as he discovered his interest in governmental work through working at ARL. While at ARL, Mitsuo learned about the SMART fellowship offered by the Department of Defense (DoD), which provides up to 5 years of tuition in exchange for working for the DoD for the same number of years. Mitsuo plans on applying for the SMART fellowship during graduate school and using that to jumpstart his career in governmental research.

How did you decide on what you wanted to do?

Initially, Mitsuo was interested in stem cells and that was "what got [him] into bioengineering." Because of this interest, Mitsuo decided to join Dr. He's lab in his fourth year at UMD where he worked with cancer stem cells and the encapsulation of induced pluripotent stem cells (iPSCs). He learned to transform these cells from a 2D structure into a 3D structure which allowed him to do things such as grow his own cardiac organoid from cells. In addition to working in the He lab, Mitsuo took the biomaterials course taught by Dr. He, BIOE453, which further solidified his interest in biomaterials. These two experiences combined led to Mitsuo's realization that research was what he wanted to pursue.

If you could go back and meet yourself during your first year, what would you tell yourself?

Looking back, Mitsuo would tell himself and all underclassmen to not stress too much and to try and enjoy college. Although college is much harder than high school, it works out in the end and you should just try and take it all in. Also, Mitsuo would recommend those who are interested to join a lab because he believes it is the best and fastest way to learn anything within a particular field. "Being able to work side-by-side with a professional in the field allows you to pick up on things that took them years to figure out. It was how I learned most of what I know now."

Conducted by: Anika Dasgupta

Anjali Gajendiran

Fast Facts

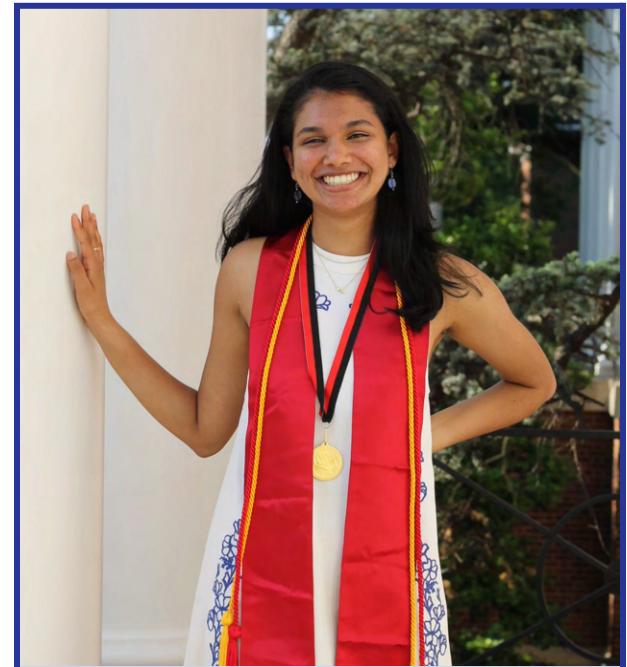
Name: Anjali Gajendiran

Pronouns: She/her

Track: Biotechnology and Therapeutics (BiTE)

PI: Participated in iGEM as a part of Dr. Edward Eisenstein's lab at UMD

Favorite classes: Synthetic Biology (BIOE461) and Quantitative Biotechnology (BIOE489D)



Tell me about yourself:

Anjali graduated from the University of Maryland, College Park in 2023 with a double degree in Bioengineering and German Studies. On campus, she was a part of the iGEM team and TA'd for Biology for Engineers (BIOE120) and Thermodynamics (BIOE232). She also participated in the Research, Instruction, and Service in Engineering (RISE) Leadership Academy. Through iGEM and her classes, Anjali developed a love for Synthetic Biology. In fall of this year, Anjali will pursue her Ph.D. in bioengineering with a focus on synthetic biology at Boston University. In her free time, Anjali enjoys reading sci-fi books, bullet journaling, and spending time with her friends.

What are some of the research projects have you participated in?

Anjali was heavily involved with the iGEM team at UMD. Their 2021 project, *Phosphoreuse*, aimed to uptake, store, and eventually hydrolyse phosphorus chains. The Chesapeake Bay is subjected to harmful algal blooms which are caused by excess nutrients, one of which is Phosphate. The team wanted to build genetic constructs in *E. coli* which would be encapsulated in a sol-gel bead and trap excess phosphorus. The trapped phosphorus could then be recycled, as phosphorus is a nonrenewable resource that needs to be mined. Through iGEM, Anjali gained a deep understanding of the research process - the project was student developed and student led so she was able to gain experience in the aspects of conceptualization, funding, coordinating, and presenting. Anjali's interest in Synthetic Biology was further solidified through her research at the Army Research Lab, where she encoded enzymes in algae to increase photosynthetic output.

What aspects of your undergraduate experience best prepared you for the present?

Research was the biggest preparation for graduate school. Anjali received a well rounded experience, not only learning lab skills but also about project design and funding. TA-ing was also a good experience because Anjali discovered that she liked teaching, which is important for a Ph.D.!

Muhaymin Chowdhury

Fast Facts

Name: Muhaymin Chowdhury

Pronouns: He/him

PI: Dr. Sarah Glancy (Public Health) in freshman year, Dr. Tao Lowe (BIOE) in junior year

Favorite classes: Therapeutic Development and Delivery (BIOE462)

Tell me about yourself:

Muhaymin graduated from the University of Maryland, College Park in 2023. Finding what he wanted to pursue wasn't a linear path! He started out as a pre-med in public health but switched to engineering. He now says that he appreciates that he can tackle real-life problems better with an engineering mindset. He explored the field of drug delivery in junior year but after a year and a half in the Lowe Lab, he realized that though drug delivery was really interesting, it wasn't for him. Muhaymin found his passion in the medical devices field through his BIOE Senior Capstone project. He plans to pursue his Ph.D. in Bioengineering with a focus on medical devices at the University of Maryland, College Park. In his free time, he likes reading, writing, cooking, working out, playing video games, and playing soccer with his brother.



What aspects of your undergraduate experience best prepared you for your present?

Junior year was a big year for Muhaymin - he was able to take interesting BIOE upper-level electives for the first time, which allowed him to really explore the technical aspects of the BIOE field. He was able to connect the things he learned in class to what's happening in the field. Muhaymin found his calling through the BIOE

senior capstone program, in which he and his group designed a low-cost endoscope from scratch with no prior experience. The process and the progress that the group made really inspired him, and he hopes to explore more of the medical devices field in the future. In addition to Capstone, Muhaymin was a TA for biomaterials, bioimaging, and biofluids.

What are you hoping to do in the future?

Muhaymin would like to one day be a professor who conducts research in the field of biomedical devices. He's interested in devices because he doesn't usually see much research on devices in academia - it's a very industry-centered field. He'd like the freedom to explore devices in research without being bound by the demands of the market. Additionally, device development research accelerates much faster in devices than in traditional wet-lab work. Muhaymin would like to combine his interest in devices with his love of teaching - he's loved teaching throughout his life and wants to make a positive impact on his students, just as his professors have impacted him.

What advice do you have for current students?

"The thing that holds most people back from competing in college is that they're afraid to reach out. You should reach out! Everyone is there to help you, so reach out! Email everyone, talk to all the people you interact with, ask people about everything, connect with people on LinkedIn, be proactive, and talk to everyone and you will be super successful." He also said to remember that you have options - you don't need to take the first opportunity you get. "Keep an open mind and look at the situation from above before you make any commitments," he said. Email some people, see what you get back, and weigh your options.

What would you tell yourself if you could go back to freshman year?

Anjali says that her first two years were very study-focused. She says that if she could go back, she would "go chill", "go hang out with friends", and "take time to be happy." We agree!

Sriya Pothapragada

Fast Facts

Name: Sriya Pothapragada

Pronouns: She/her

Track: Pre-med

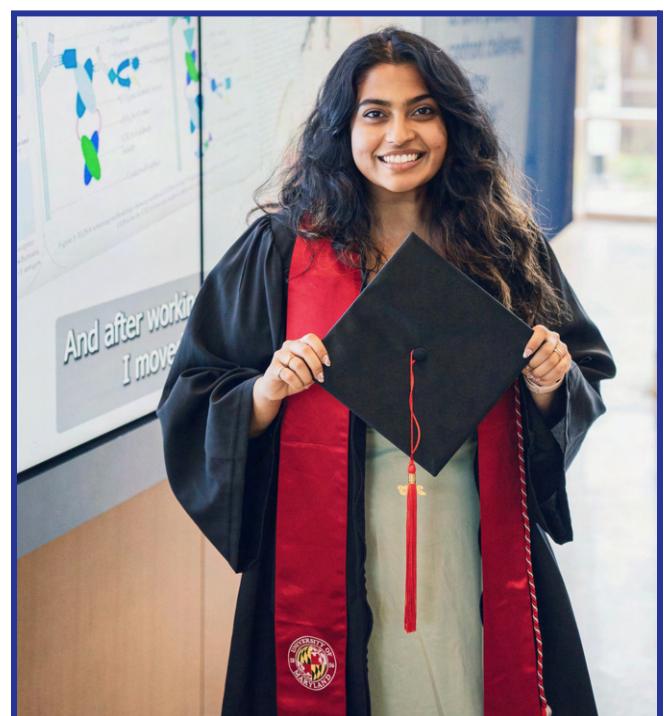
PI: Worked with Dr. Jeffery Klauda from ChemE.

BIOE co-advisor was Dr. Silvina Matysiak.

Favorite class: Biofluids (BIOE331)

Tell me about yourself:

Sriya studied bioengineering at the University of Maryland, College Park from 2018 to 2023. She started on the premed track in case she wanted to be a doctor eventually, but her interests pivoted several times. One of



her mentors in undergrad was an astrochemist who specialized in studying the radioactivity of organic mineral interactions on Mars. This sparked her interest in astrobiology. In the fall of this year, Sriya will pursue her Ph.D. in genetics with a research focus on evolutionary genetics at Clemson University in South Carolina. In her free time, Sriya is a huge foodie, enjoys photography, and is planning to get a certification in skydiving.

What are some of the research projects have you participated in?

Sriya interned with the Applied Physics Laboratory at Johns Hopkins University for two years and focused on optimization and applied AI. In high school, she researched mobile health and created an app for heart attack patients. Her undergraduate research with Dr. Jeffery Klauda was on macromolecular biophysics, studying molecule interactions on a macromolecular level. As a part of the project, she ran integrated simulations using UMD's high-performance computing clusters.

Did you always know what you wanted to do?

Nope. Sriya started out as a pre-med but switched interests to therapeutics in her sophomore year, medical devices in her junior year, and settled on evolutionary genetics in an astrobiology context in her senior year.

What aspects of your undergraduate experience best prepared you for the present?

Sriya cites the BIOE Honors program as a significant factor in her deciding to do a Ph.D. She appreciates the thesis-based nature, independence, and opportunity to see if she could commit to a research project. It gave her a sense of belonging in academia.

If you could go back to yourself in freshman year, what would you tell yourself?

“Don’t be a pre-med! Only do it if you know for sure that it’s what you *want to do*.” Sriya says that if you choose the pre-med path “just because”, you might miss out on taking classes that could be more interesting to you.

Undergraduate Research Highlights

Authors: The Catalyst Board

As we are an undergraduate research journal, we are excited to share research from students within the Bioengineering department and other students that focus on biomedical research. We hope to receive many more submissions for future editions so we can celebrate the accomplishments of UMD students.

Sarah Firdaus

Major: Bioengineering

Year: Class of 2025

Laboratory Affiliation: 3i Diagnostics

Faculty Mentor: Dr. Rajesh Krishnamurthy

Abstract: Effective treatment of bacterial bloodstream infections requires knowledge of the infection-causing pathogen. Current methods take two to seven days to yield results, primarily because there is no effective way to separate, purify, and concentrate bacteria from blood or positive blood cultures (PBC). Every hour of delay in appropriate treatment increases morbidity and mortality, extends hospital stays, and raises treatment costs. 3i Diagnostics' technology purifies bacteria from blood and PBC in minutes by selectively lysing blood cells but not bacteria. I investigated the recovery of bacteria from PBC through a model system to understand if the bacteria interact with the cartridge, the nature of this interaction, and the impact of bacteria concentration.

Takeaways: Through this research experience, I've gained an appreciation for the significance of paying attention to intricate details. Research doesn't always yield straightforward answers; rather, it's about delving into the complexities of the subject at hand, where the fundamentals play a crucial role. The 3i Diagnostics lab has shown me the value of challenging outcomes and consistently asking "why." The technology developed by 3i Diagnostics holds the potential to save lives and help low-income communities. As I move forward, I aim to continue my research journey, using my knowledge to engage in work that helps those in need.

Link:  [sarahfirdausresearchposter - Sarah Firdaus.pdf](#)

Sophia Fanzini

Major: Chemistry

Year: Class of 2025

Laboratory Affiliation: Chen Lab at Rutgers University

Faculty Mentor: Dr. Suzie Chen

Abstract: The growth of metastatic melanoma, a highly aggressive skin cancer, is correlated with the abnormal, ectopic expression of GRM1, a normal neuronal receptor not normally expressed in melanocytes. L1, a cell adhesion molecule, was found to upregulate its expression in tumor cells and potentially generate an invasive phenotype through its motility. This study determines if two L1 antagonists, 2-hydroxy-5-fluoropyrimidine (2H5F) and anagrelide, may affect cell viability and/or cell migration. We assessed the protein levels of L1 in vivo and in vitro. The in vitro Mass 3 Clone 1 cell line and the in vivo isolated Mass 3 Clone 1 2H5F-resistant cell line were tested using MTT cell viability/cell proliferation assays. The assay spanned 96 hours and consisted of treatments of growth media containing vehicle (DMSO) and 100uM of anagrelide and 2H5F. We also tested both cell lines for cell motility using scratch assays and measured the changes in distances of the space made when we scratched the surface of the culture plates. These plates contained different concentrations of anagrelide and 2H5F at 1uM, 10uM, or 100uM. Protein expression was verified with the same sets of cells in the scratch assays. Cell proliferation appeared to be unaffected by the two L1 antagonists, whereas cell motility appeared to be reduced in the presence of either inhibitor. Western immunoblots demonstrated the presence of L1 for each sample. Future directions for L1 studies include additional examination in in vivo settings.

Takeaways: This summer, I was able to take part in a ten-week research program at Rutgers University where I focused on metastatic melanoma in vivo and in vitro. Aspiring to pursue a career in pharmaceutical R&D, I regularly searched for opportunities that involved research projects and learning laboratory techniques. Members of the Chen lab have taught me how to take care of cells, how to run different assays and western blots, and have helped me interpret my data. I am forever thankful for this experience, and I will continue to immerse myself in studies that can expand my scientific knowledge.

Link:  [36x48_Horizontal_Templatev12.pdf](#)

Zuzanna Mamczarz

Major: Cell Biology and Molecular Genetics

Year: Class of 2024

Laboratory Affiliation: Fischell Department of Bioengineering

Faculty Mentor: Dr. Steven Jay

Abstract: Bacterial Extracellular Vesicles (BEVs) have recently emerged as a potential new class of therapeutics for a variety of inflammatory diseases involving host-microbiome communication, such as inflammatory bowel disease (IBD) or neurologic diseases. BEVs are a promising therapeutic for these diseases due to their nature as cell-secreted nanovesicles that efficiently deliver protein and RNA cargo to human cells. While BEVs from numerous probiotic bacteria species have been tested individually, it remains unclear if BEVs from particular species hold superior therapeutic potential. Probiotic BEVs generally derive therapeutic efficacy via anti-inflammatory mechanisms, particularly in innate immune cells, such as macrophages. Therefore, our aim was to screen BEVs from various probiotic bacteria to identify which had the strongest anti-inflammatory effects in macrophages including human dTHP1, mouse RAW264.7, as well as brain macrophages (microglia).

Takeaways: I wanted to gain exposure to bioengineering research, and I knew I was interested in therapeutics. The research I am involved in looks at the therapeutic effects of probiotic BEVs and understanding any potential anti-inflammatory mechanism the BEVs may have, which can be applied therapeutically in a wide variety of diseases, including neurodegenerative diseases. This research is really interesting as not only might it be relevant clinically, it also surrounds me everyday outside the lab. The probiotic BEVs I study are found in a lot of foods like yogurts, kefirs, and kombucha, so it's cool to be actively studying the effects of something I am exposed to daily. My undergraduate research has allowed me to understand research to a greater extent than I could with only textbooks and I really appreciate the experience.

Link:  [ZM_undergrad poster \(1\) - Zuzanna Mamczarz.pdf](#)

Updates from the BIOE Diversity, Equity, and Inclusion (DEI) Committee

Authors: Dr. Alisa Clyne, Matthew Ensign

The Fischell Department of Bioengineering created an Associate Chair for DEI and a DEI Committee in July 2020 shortly after the murder of George Floyd. Currently, the Associate Chair is Dr. Alisa Clyne, who works with faculty, staff, and students that share the same vision: the department will be a bioengineering community in which every student, staff member, faculty member, and alum feels welcome and has the resources they need to succeed.

To realize this vision, the DEI committee has the following mission: to support the department in creating a diverse community that welcomes everyone and promotes equity within and beyond the community. More specifically, the committee aims to provide the community with learning opportunities centered around DEI, empower the community to change educational and engineering practices that negatively impact underrepresented groups, remove barriers that prevent members of the community from reaching their potential, and inspire the community to positively impact justice and equity.

Though the BIOE DEI committee has only existed for three years, they have created many initiatives that support their mission and enhance departmental culture. In this article, Dr. Clyne and the members of The Catalyst Executive Board would like to highlight a few initiatives that the committee has developed in the past two years.

FALL 2022: TEXTBOOK LIBRARY

In Fall 2022, the committee created a textbook library located in the BIOE Advising Office in 3102 AJC. The committee recognizes that textbooks can be prohibitively expensive and hopes that this library can reduce the impact of this barrier to the learning of BIOE students. Students may borrow commonly used core BIOE textbooks from the bookshelf located in 3102 AJC for as long as they need them and can donate their textbooks once they no longer need them. By donating books instead of selling them, students can enhance the learning of other students who may otherwise be unable to acquire a textbook.

FALL 2022: INCLUSIVE MENTORING PROGRAM

The goal of the program is to teach faculty and graduate students the best practices for inclusive mentoring. All people should feel welcome in our classes and labs and this program helps bioengineering educators ensure that students feel included. Dr. Belinda Huang started the training by leading several workshops. Faculty and staff were also trained as facilitators for the “Entering Mentoring” program, which was created by the Center for the Improvement of Mentoring Experiences in Research at UW Madison. As of 2023, graduate students and post-doctoral fellows are being trained through this curriculum.

FALL 2021: UNDERGRADUATE RESEARCH PROGRAM

This initiative provides funds for 3-5 students to do research in BIOE laboratories. The committee wants every student interested in research to have opportunities, though some students face financial constraints that prevent them from beginning unpaid research internships/programs. Drs Maisel, Clyne, and Stroka were recently awarded a grant from the NIH that will support additional undergraduate research. Applications for these programs are available over the summer, so keep an eye out for them in Summer 2024. Any questions may be sent to aclyne@umd.edu.

Students may also direct any questions or comments to the entire committee, who has posted the following message: "The BIOE DEI committee is always open to your feedback. If you have additional books you would like to see in the library, or ideas for DEI training and activities, let us know through the DEI committee feedback form (<https://bioe.umd.edu/about/DEI/contact-us>).” The Catalyst Board also echoes this statement as the committee cannot know every issue that students in the department face and do not know how well their initiatives are working without student feedback. The committee values the voices of every student and would appreciate any input. Students may also contact the Director of Operations, Matthew Ensign, and the Director of Human Resources, Anika Dasgupta, who will continue to work with the DEI committee for future editions of this journal.

2022-2023 BIOE DEI COMMITTEE MEMBERS



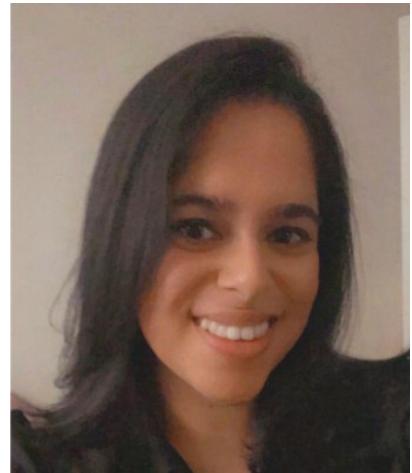
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Ambi Narula
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Dr. Brian Blair
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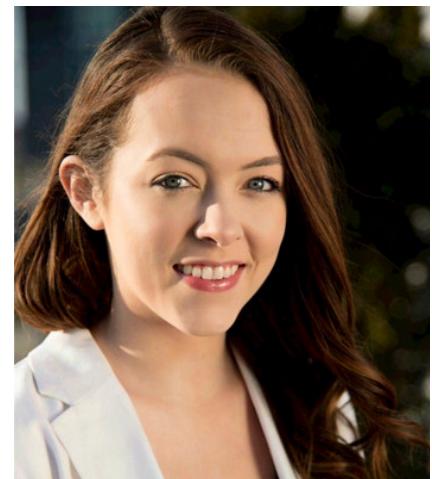
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Assistant Professor



Shannon McLoughlin
Biomedical Engineering Ph.D. Candidate

Acknowledgements: We greatly appreciate the assistance of Dr. Alisa Clyne, who provided the updates for this piece and reviewed the DEI section of this edition.

Diversity in the Department and Undergraduate Admissions

Authors: Matthew Ensign, Anika Dasgupta

Diversity, equity, and inclusion. These are terms that are familiar to almost every student, faculty, and staff member. Students at UMD frequently see comments and statements from university administrators that acknowledge and celebrate the apparent diversity on campus. On June 23, President Pines sent an email that highlighted the “50th anniversary of the passage of Title IX of the Education Amendments”, essentially stating that the university will continue to ensure that students are not denied admission due to their gender or sexual identity. This commitment is supported by the TerrapinSTRONG program in the Clark School, but do admissions statistics for the BIOE department, engineering college, and the university also demonstrate this commitment?

EXAMINING ADMISSIONS

According to reports.umd.edu, the proportion of Asian students in the university overall has increased from 16% in Fall 2016 to 22.3% in Fall 2022, but the proportions of Native American/Alaskan Native, Native Hawaiian/Other Pacific Islander, Hispanic/Latino, and Black students at UMD have remained stagnant at 0.1%, 0.1%, 10.3%, and 12.6%, respectively, over the last decade. The proportion of male and female-identifying students is at an even split: 50.8% and 49.2%.¹ Notably, the site makes no mention of gender identities beyond the binary male and female. In order to further recognize and represent gender diversity, UMD may also consider publishing data that represents individuals who are not cisgender.

If a student filters by the Fischell Department of Bioengineering, they'll notice that the above proportions are different; there have been no Native American/Alaskan Native BIOE undergraduates in the past 5 years and the proportions of Hispanic/Latino and Black students are at a mere 6% and 8.4%, respectively. The proportion of Asian undergraduates, however, is higher than the university average at 33.1%. Interestingly, the proportion of female-identifying students is 56.4%, which is dramatically higher than the proportion of female students in the School of Engineering overall (27.1%). Though the BIOE department appears to have more gender diversity than the Clark School and the overall university, its ethnic diversity presents a stark contrast to the demographic of Prince George's (PG) County, where 59.8% of people are Black or African American.²

IMPACT OF CURRENT EVENTS

Methods of improving campus diversity should always be considered because of a simple fact: increasing diversity dramatically increases happiness and productivity. These improvements are especially important now due to Supreme Court cases SFFA v. Harvard and SFFA v. UNC, which ruled that university admissions offices can no longer use affirmative action. Affirmative action is traditionally defined as a set of policies used to address historical discrimination against underrepresented groups by providing educational opportunities and pushing for greater diversity.³ Removing it will impact admissions policies that consider race, but how do these rulings affect holistic admissions? Holistic admissions policies like those employed by UMD consider many factors that contribute to a student's core identity. The process considers 24 factors in all (such as academic merit, achievements, and potential in the context of the challenges and opportunities that the student

chooses to share). These review criteria are meant to increase diversity within the incoming class.⁴ Therefore, while grades are important, the university also considers gender, extenuating circumstances, and socioeconomic backgrounds to recognize that not all students have had the same opportunities.

The new rulings mean that universities are no longer allowed to consider race, though there are other factors that they may consider to strengthen diversity on campus. In an email sent on June 29 2023 to all students, President Pines said that UMD will “remain a national leader by encouraging and supporting students of all backgrounds as they apply, enroll and graduate from the University of Maryland.” So, while the Supreme Court’s ruling rolls back decades of precedents that counter discrimination, UMD should be able to uphold DEI ideals by considering every aspect of a student’s application – as they have done for years.

Though the Supreme Court decision may not directly hurt campus diversity, the BIOE department must consider ways to increase the number of students from underrepresented groups in its student body. There are several ways that the department can approach the issue. One way to improve ethnic diversity is through active outreach to high schools within the community through demos, classes, or panels hosted by BIOE admin and students. These would serve to inspire students to pursue bioengineering and direct them to resources that may further nurture their interests.

SUPPORTING THE COMMUNITY

Nevertheless, this does not address the root of the problem, which is an issue that the department simply cannot handle alone. About half of the students in PG County are economically disadvantaged, and only 29% and 8% of high schoolers are proficient in reading and math⁵, respectively, which correlates with the county’s college readiness score of 15.2 out of 100 (determined based on the percentage of 12th graders that tested and passed AP and IB exams).⁶ The educational data make sense as the stress associated with financial instability impairs learning and potentially limits the number and variety of academic and professional activities with which students engage. It’s important to note, however, that the college readiness metric is elitist; it ignores the fact that some schools don’t have the resources, adequate numbers of students, or skilled teachers to support these advanced classes. College readiness cannot simply be calculated based on completion of AP or IB exams – other activities such as working and providing for a family indicate a student’s independence and self-assuredness.

In the meantime, there are certainly more ways of supporting students in the community. One method is partnering with local high schools to provide funding for school supplies and materials that facilitate students’ learning outside the classroom, such as test prep books or laptops. The county’s educational board may need to be involved depending on the scale of this initiative, but with some prioritization of the educational budget, it could be a possibility. The department could also partner with these high schools by facilitating a mentoring program that matches UMD BIOE students with groups of interested high school students to advise them on the college application process, exploring their interests within the field, and more. Other options, like research fellowships and paid internships, more directly benefit a high school student’s career in academia or industry. For example, if the DEI committee receives more funding/backing, they could expand their current undergraduate research fellowship to high school students interested in biomedical research. Additionally, the department could partner with local biotech companies to create paid internship opportunities that strongly

consider high school students with demonstrated financial need. Both programs incentivize students to pursue opportunities that greatly benefit their college applications and careers. Walking out of an internship or fellowship with laboratory and interpersonal skills is invaluable.

Most importantly, the department must actively advertise and promote all of these initiatives to these communities - knowing about opportunities is instrumental in being able to take advantage of them. The efforts of the BIOE department have already been so fruitful in many aspects, but there's always room for improvement. Though the effects of these initiatives would not be immediate, quick and decisive action will be a catalyst in the growth of a more diverse campus community.

Acknowledgements: we appreciate the support and feedback that Dr. Alisa Clyne provided during the development of this piece.

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<https://www.usnews.com/education/best-high-schools/maryland/districts>.

DEI in Research and Education

Authors: Matthew Ensign, Anika Dasgupta

The following links have been curated for students and faculty interested in learning more about DEI. We have separated them into a few categories and added short descriptions so that our readers are better able to select the papers and resources that interest them.

Challenges to Implementing Initiatives

El-Deiry, W. S., & Giaccone, G. (2021). Challenges in Diversity, Equity, and Inclusion in Research and Clinical Oncology. *Frontiers in Oncology*, 11. <https://doi.org/10.3389/fonc.2021.642112>

This paper details the challenges in making research in the field of clinical oncology more inclusive and representative of our diverse population as well as the disparities in cancer care based on socioeconomic status. We like this article because it comprehensively details the direct correlation of socioeconomic status to the quality of patient care and stresses the importance of including underrepresented minorities in clinical trials. It acknowledges the lack of trust in the medical system due to historical victimization of these populations and stresses the importance of active outreach to help bridge the gap in equitable healthcare.

Boulware, L.E., Corbie, G., Aguilar-Gaxiola, S., Wilkins, C.H., Ruiz, R., Vitale, A., & Egede, L.E. (2022). Combating Structural Inequities – Diversity, Equity, and Inclusion in Clinical and Translational Research. *The New England Journal of Medicine*, 386, 201-203. <https://www.urmc.rochester.edu/MediaLibraries/URMCMedia/mbi/documents/NEJMp2112233.pdf>

This article highlights the underrepresentation of minorities across the wide spectrum of roles in the research process, from the participants involved in clinical trials to the faculty who propose and support research projects. It stresses that for us to have improvements in equitable healthcare, we need to consider it in every facet of the research process. We liked this article because it extensively highlights areas in which academia and research organizations have failed to implement DEI and directly connects them to relevant consequences that the general public can recognize. Not only does this point out the areas for improvement, but also it provides specific solutions to resolve these issues.

Passmore, S.R., Kisicki, A., Gilmore-Bykovskyi, A., Green-Harris, G., & Edwards, D.F. (2022). "There's not much we can do..." researcher-level barriers to the inclusion of underrepresented participants in translational research. *Journal of Clinical and Translational Science*, 6(1), 1-9. <https://pubmed.ncbi.nlm.nih.gov/35154814/>

Lack of representation of minorities in clinical trials leads to healthcare that may not suit everyone's needs and creates distance between these underrepresented communities and the scientific explorations that may potentially benefit them. However, a common barrier in pushing for diversity in clinical trials is that there's "not much we can do". This study uses various methods to examine and address these barriers to diversity in clinical trials. We like this study because as biomedical engineers, we're involved in translational research that's much closer to clinical implementation and which will serve a diverse population. The paper does a great job of bringing up specific examples of what we can do to make clinical trials more inclusive. It's especially important for researchers who design clinical trials to keep in mind that they are the ones who bear the responsibility of ensuring that they're accessible to the minorities that they will serve.

Leibnitz, G.M., Gillian-Daniel, D.L., Greenler, R., Campbell-Montalvo, R., Metcalf, H., Segarra, V.A., Peters, J.W., Patton, S., Lucy-Putwen, A., & Sims, E.L. (2021). The Inclusive Professional Framework for Societies: Changing Mental Models to Promote Diverse, Equitable, and Inclusive STEM Systems Change. *Frontiers in Sociology*, 6.
<https://www.frontiersin.org/articles/10.3389/fsoc.2021.784399/full>.

This article describes how STEM professional societies are the perfect medium through which DEI can be established and reinforced, but work must be done to shift mindsets of DEI within STEM to make progress. We like this article because it delves into the mental patterns that perpetuate the "exclusionary norms and values" that still plague science today. In particular, a mindset that is still in circulation is that STEM is an "apolitical, value-free, empirical meritocracy" while the truth is that it's anything but. Woven tightly in the very foundation of STEM are the subjective factors that make us a society.

Gonzales, L.D., Hall, K., Benton, A., Kanhai, D., & Núñez, A. (2021). Comfort over Change: a Case Study of Diversity and Inclusivity Efforts in U.S. Higher Education. *Innovative Higher Education*, 46, 445-460. <https://link.springer.com/article/10.1007/s10755-020-09541-7>.

This case study featured a meeting in which stakeholders in STEM were invited to a meeting to engage in conversations on how to make STEM more diverse and inclusive. While diversity refers to the presence of different groups of people, inclusive practices ensure that these different groups each get a voice. We like this study because it highlights many of the issues that we too have seen in DEI discussions. The most active participants in these discussions are the underrepresented minorities which they concern, while overrepresented populations were more hesitant to participate, contribute, define, and discuss. This needs to change for DEI initiatives to be realized - the onus cannot always be on marginalized groups to fight for inclusion.

Challenges Faced by Underrepresented Groups

Walsh, B.A., Woodliff, T.A., Lucero, J., Harvey, S., Burnham, M.H., Bowser, T.L., Aguirre, M., & Zeh, D.W. Historically Underrepresented Graduate Students' Experiences During the COVID-19 Pandemic. *Family Relations*, 70(4), 955-972.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8444674/>

This study aimed to understand the experiences of graduate students from underrepresented groups in STEM during the pandemic and inspires interventions for these students and their families. The lack of support systems was one of the most significant contributors as underrepresented students faced difficulties with accessing resources, adjusting to family life, and amplified financial issues. We like this study because the authors use their results to suggest initiatives such as informing families about graduate school so they are better able to provide support. They also included multiple focus groups (doctoral students, master's students, faculty, and administrators) to conduct a robust thematic analysis.

National Center for Sciences and Engineering Statistics. (2021). Women, Minorities, and Persons with Disabilities in Science and Engineering : 2021. <https://ncses.nsf.gov/pubs/nsf21321/report>

This report on “women, minorities, and persons with disabilities” illustrates the participation of these groups in STEM, and though the authors did not intend to take a stance or offer recommendations, the findings support the value of DEI. We like this report because it includes robust statistics on awarded degrees, minority enrollment, and salaries that are eye-opening.

Cech, E.A., & Pham, M.V. (2017). Queer in STEM Organizations: Workplace Disadvantages for LGBT Employees in STEM Related Federal Agencies. *Social Sciences*, 6(1).
<https://www.mdpi.com/2076-0760/6/1/12>

The authors’ findings show that LGBTQ+ individuals in STEM face significant workplace inequalities across age and supervisory statuses. Though federal employers have more expansive non-discrimination policies that formally protect LGBTQ+ scientists, these individuals still deal with disadvantages in inclusion and informal discriminatory policies involving health benefits. We like this study because the authors systematically examined 30,000 workers across six federal agencies to compare the experiences of LGBT and non-LGBT colleagues.

Russo, E.R., Ott, D.L., & Moeller, M. (2023, June 13). Helping Neurodivergent Employees Succeed. Tribune Content Agency.
<https://tribunecontentagency.com/article/helping-neurodivergent-employees-succeed-2/>

Neurodivergent individuals are often excluded or discounted by employers due to prevailing ideas of what it means to be “neurotypical”. There is significant neurodiversity that is overlooked by many DEI programs, which is a shame as these people face workplace discrimination simply because their brains are not “normal” – a damaging idea that overlooks the strengths and contributions of neurodivergent workers. We like this article because it breaks down challenges faced by workers with autism, dyslexia, and Tourette’s that neurotypical people would not think of, such as sensory overstimulation from fluorescent lighting, and recommends recruitment and maintenance strategies that corporations can employ to increase their neurodiversity.

Canady, J. (2022). DEI without Equity: Lab Coat Culture and Persistent Racism in Bioengineering Laboratories (Publication No. 2820) [Master of Arts thesis, Washington University in St. Louis]. Open Scholarship Institutional Repository.

This Master's thesis highlights how biomedical products are created in such a way that produces racial disparities as labs rarely consider how their research reflects biases and racist ideas. As the author says, racial processes greatly contribute to product outcomes. We like this paper because the author invested a lot of time into interviewing bioengineers and investigating labs to capture how labs simultaneously advance and challenge systemic racism. We hope that their work encourages activism within academia to ensure that certain demographics are not left out of the research pipeline.

Promoting DEI in Biomedical Science

Chesler, N.C. (2019). A How-To Guide for Promoting Diversity and Inclusion in Biomedical Engineering. *Annals of Biomedical Engineering*, 47(5), 1167-1170.
<https://link.springer.com/article/10.1007/s10439-019-02223-2>.

This paper argues that if we prioritize inclusivity by understanding our privilege and accepting complexity and diversity, then we will see significant advancements in the field of biomedical engineering from future generations of researchers that bring diverse experiences. In the same way that corporations become more productive after upholding DEI ideals, labs will produce more output from people that enjoy being there. We like this article because it breaks down all the author's recommendations into sections and provides examples of meaningful actions that biomedical engineers can take to work toward diversity and inclusion.

Lanier, O.L., Green, M.D., Babrabino, G.A., & Cosgriff-Hernandez, E. (2022). Ten simple rules in biomedical engineering to improve healthcare equity. *PLoS Computational Biology*, 18(10).
<https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1010525>

As the title suggests, this paper provides ten rules to improve healthcare equity, and these rules fall under three categories: employing community-based design, diversifying biomedical research, and prioritizing underresearched areas. We like this article because the authors provide their rationale for the value of the three categories and they provide historical inequities and issues that could have been addressed by adhering to their rules.

Santiago, P.N., Konopasky, A.W., & Railey, K.N. (2021). Words as Windows: Using Language to Move Toward an Inclusive Environment. *Journal of Graduate Medical Education*, 13(6), 871-872.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8672823/>

The authors of this paper argue that language drives culture as it can include or exclude certain identities in our institutional environments. To create a more diverse climate, we must carefully consider the impacts and implications of the words we use. We like this source because it breaks down what is known about the influence of language in the workplace and provides short-term and long-term action items that anyone can consider before they converse with different people.

Marshall, A.G., Vue, Z., Palavicino-Maggio, C.B., Neikirk, K., Beasley, H.K., Garza-Lopez, E., Murray, S.A., Martinez, D., Crabtree, A., Conley, Z.C., Vang, L., Davis, J.S., Powell-Roach, K.L.,

Campbell, S., Brady, L.J., Dal, A.B., Shao, B., Alexander, S., Vang, N., Vue, N., Vue, M., Shuler, H.D., Spencer, E.C., Morton, D.J., & Hinton, Jr., A. (2022). The role of mentoring in promoting diversity equity and inclusion in STEM Education and Research. *Pathogens and Disease*, 80(1), 1-7. <https://academic.oup.com/femspd/article/80/1/ftac019/6609773>

The authors of this paper analyzed feedback from a recent mentoring workshop and found that students interested in attending graduate school were satisfied with what they learned despite having low expectations for the workshop. Advocating for active, respectful, and successful mentoring is essential for the success of students and the output of their labs, so knowing that workshops like these work is extremely valuable. We liked this article because it meticulously described the methods they employed when running the workshop and qualitatively measured student outcomes to show statistically significant improvements in the value of the workshop before and after it happened.

Leibnitz, G.M., Peters, J.W., Campbell-Montalvo, R., Metcalf, H., Lucy Putwen, A., Gillian-Daniel, D., Sims, E.L., & Segarra, V.A. (2022). Refining a DEI Assessment Tool for Use in Optimizing Professional STEM Societies for Gender Equity. *Frontiers in Sociology*, 7. <https://www.frontiersin.org/articles/10.3389/fsoc.2022.755372/full>

Historic disciplinary cultures in STEM that cater to the majority (white, male, heterosexual, able-bodied) must be reformed to maximize talent within STEM and include people from diverse backgrounds. Resources like the Equity Environmental Scanning Tool can be adapted to foster new DEI efforts and advance inclusive reform, which is what the authors of this paper have done. We like this paper because it comprehensively reviews the tool the authors adapted and provides their rationale for changing certain elements of the tool that could be improved, such as structural elements that could allow the tool to be used as a discussion tool.

More Resources

<https://bioe.umd.edu/about/DEI/resources>

This link provides a list of resources for UMD students to educate themselves on DEI, learn about various support systems on campus, and get more involved with DEI in the department. Resources are grouped under the following categories: BIOE students, faculty and staff, the STEM community, the Clark School, and the entire campus.

<https://www.fda.gov/consumers/minority-health-and-health-equity/minority-health-and-health-equity-resources>

This link provides many “easy-to-use and culturally-appropriate” guides on minority health and disparities. There are many brochures and fact sheets on topics such as Alzheimer’s, COVID, and diabetes, some of which have been translated into multiple languages.

<https://hr.mit.edu/diversity-equity-inclusion/resources>

This link provides resources posted by the MIT Human Resources department, including affirmative action data, tips for creating inclusive workplaces, and more.

<https://www.aota.org/practice/practice-essentials/dei/diversity-equity--inclusion-toolkit-resource-library>

The American Occupational Therapy Association provides guides on addressing racial stigma and discrimination, self-assessments that reveal a user's biases, equity resources, and more.

<https://www.nonprofitlearninglab.org/dei>

The Nonprofit Learning Lab provides a multitude of anti-racism and equity resources through this link. These curated websites and readings educate the reader on recognizing privilege, AAPI hate, DEI philanthropy, LGBTQ+ issues, and more.

<https://library.georgetown.edu/dei>

This link provides readings on microaggressions, bystander intervention, inclusivity, implicit bias, disability justice, and more, which were curated by the Georgetown University Library.

Faculty Q&A

Conducted by: Anika Dasgupta

Dr. Sara Molinari

Tell me about yourself:

Dr. Molinari was born and raised in Italy. She enrolled in her local university, majoring in pharmaceutical biotechnology. She went to Milan for her masters degree in Bioinformatics, as a masters is required before entering the Ph.D. in Italy. She completed her Ph.D. at Rice University in Synthetic Biology, and continued on at Rice for her postdoctoral degree. After completing her post-doc, she was recruited to the University of Maryland last year. She is teaching a new class this semester on Engineered Living Materials (BIOE689B), which she plans to offer to undergraduates in Fall 2024. In her free time, Dr. Molinari enjoys hiking, traveling, and reading.



What inspired you to pursue science?

When she was thirteen years old, she read a book about Italian nobel prize winner Rita Levi-Montalcini and decided to be a scientist. She was particularly inspired because Dr. Levi-Montalcini was a jewish woman during times of political unrest. Law prevented her from being a part of scientific society because of her identity, but that didn't stop her. She hid in a bedroom and she did research with chicken embryos. Dr. Molinari read this and was fascinated and inspired. Science could be such a driving force - Dr. Levi-Montalcini had risked her life to pursue science and didn't give up, despite the challenges.

How did you find this path?

Dr. Molinari's grandparents were farmers and her parents didn't have a college degree, so the route to professorship "wasn't a straight line". After her undergrad, the "set path" would have been to join a pharmaceutical company, but that prospect didn't thrill her. She wanted to pursue her studies further, so she went to Milan to do her masters in Bioinformatics. Though it was interesting and enjoyable, she missed bench science. A colleague from her masters program introduced her to synthetic biology, but there were only three labs in Europe. She contacted all of the professors, but the two that responded said that they weren't taking Ph.D. students. A friend of hers in the US said that there were universities there that offered a synthetic biology program, so she applied to Rice because it was very well known in the field of synthetic biology. She was soon invited to interview and did well, so she took the position! Everything since is history.

When did you join the BIOE department at UMD? What drew you towards Maryland?

Dr. Molinari is one of our two newest faculty members! She joined earlier this year and moved in in August. She likes the geographical location and the big-school feel of UMD, and her decision to join was reaffirmed by her new colleagues. She believes that she can thrive and collaborate well here, with the fantastic facilities and lab space. It's a great place to start a lab!

How has your experience been as a new faculty member?

At the time of this interview, it had been three weeks since Dr. Molinari moved in! It had definitely been more work than she expected, but it's been fun. She currently has two students and enjoys the mentorship process - there aren't many opportunities in which one can relate with students, but research is one of them.

Where did you graduate from and with what degree? What was your dissertation on?

Dr. Molinari did her Ph.D. at Rice University in synthetic biology. Specifically, she did research on engineering living materials. Engineered living materials have properties of living and artificial material - they can respond to stimuli to adjust their own properties. A good analogy is a house with a wall that can self-repair. Dr. Molinari started with engineering bacteria; they're a good organism because they are quite resilient and resistant to many things. One of the things that makes living tissue so cool is that the cells differentiate and the differentiated cells have different functions. Dr. Molinari wanted to bring that differentiation to bacteria, and she did so by engineering asymmetrical cell division in bacteria.

What is your field of interest? What made you interested in this field initially?

While she was at Rice, Dr. Molinari was a part of a synthetic biology project funded by the Defense Advanced Research Projects Agency (DARPA). She enjoyed the DARPA program immensely. DARPA had started Engineered Living Materials, and it was a wonderful opportunity to be working among the pioneers of the field. It was fascinating and inspiring to see the projects that her peers were working on, and she learned a lot about the challenges that required more exploration. Engineered Living Materials is a very rapidly developing field, and Dr. Molinari is excited to pursue it further.

Do you teach any classes, if so, which ones?

Dr. Molinari will teach the engineered living materials class every fall. The class will have a foundation of synthetic biology (though BIOE461 will not be a prerequisite). There will be a brief review of the necessary synthetic biology principles in the first few classes, and then cellular engineering will be covered. The course will cover important literature to understand the field and will discuss the challenges to address and the developments that can be made.

What is one thing you are most proud to have achieved?

Dr. Molinari is very proud that she didn't let her background define her future. She was the first in her family to go to college. Her family didn't expect her to become a scientist or an academic; though they were supportive, she had to navigate her own life. She didn't know which universities to aim for or what opportunities were there to take advantage of, but she's proud to be here today, having conquered those challenges.

What is one thing that you are most excited to see in your field?

Dr. Molinari wants to see engineered living materials moving from proof of concept into actual commercialized applications.

Dr. Gregg Duncan

Tell me about yourself:

Dr. Duncan was born and raised in the St. Petersburg/Tampa Bay area of Florida. He majored in Chemical Engineering at Florida State University, before going on to complete his doctorate in Chemical Engineering at Johns Hopkins University. He continued his training at the Johns Hopkins University School of Medicine at the Center for Nanomedicine for his postdoctoral studies. After completing his post-doc, he was recruited to the University of Maryland. He alternates teaching Biofluids (BIOE331) and Pulmonary Engineering (BIOE489K), and was recently promoted to associate professor. Dr. Duncan enjoys spending time with his family in his free time, taking care of his children and “keeping them entertained”.



What did you do your research on before coming here?

Chemical engineering and biomedical engineering have a considerable overlap - Dr. Duncan did his thesis on how nanomaterials interact with cells from a chemical engineer’s viewpoint. He would quantify these interactions with microscopy to see how cells unbind and bind to these nanomaterials. The ultimate goal was to determine how drug delivery systems work.

What is your field of interest? What made you interested in this field initially?

Dr. Duncan felt like what he was doing “gave him a fundamental basis to do applied research in the drug delivery areas.” His interest grew further as a postdoctoral fellow when he worked at a Medical school and interfaced with clinicians. It was there that he developed an interest in the biology and physiology of respiratory diseases and drug delivery for respiratory diseases. Why do people respond to medications differently? What causes medications that were previously effective to stop working? What are the cellular mechanisms behind the obstruction of the lungs? Learning about lung conditions revealed that there’s a lot left to learn. There are plenty of gaps in knowledge, and Dr. Duncan’s interested in working on projects to understand exactly where respiratory problems come from tracing the mechanisms of variability in these conditions. The primary disease models that the Duncan Lab uses are cystic fibrosis, asthma, and other conditions and infections.

Have you always wanted to be in academia?

Dr. Duncan “thought he was going to go for a career in the pharmaceutical industry with an interest in research and development but not from the academic perspective”, but his conversations with his Ph.D. advisor gradually changed his mind from industry to academia. In industry, though he could pick projects related to his specific interest, he would ultimately have to meet the demands of the company. Academia, on the other hand, allows a mixture of basic research and applied research, with more flexibility on the types of projects he could pursue.

When did you join the BIOE department at UMD? What drew you towards Maryland?

Dr. Duncan joined the BIOE department in fall of 2017. He was particularly drawn by the excellent facilities - they had just been built and they were top notch. In retrospect, he says that it’s hard to imagine not having access to everything his lab has access to now. As this was his first professorial position, he was “definitely nervous”, but “took comfort in knowing that the department chair [had] a plan about mentorship and supporting new faculty”, and at the time the “younger faculty made it clear that it was a good place for someone to start their career.” He did his graduate school and post-doctorate work in Maryland, so he had been familiar with the general area for almost a decade and it was an overall good match.

What is one thing you are most proud to have achieved?

The biggest milestone was when the lab published their first article in 2019. It felt like it took a lot more effort than it should have, getting the lab to the point that it could contribute to the literature on the subject.

What is one thing that you hope to achieve during your career?

Dr. Duncan isn't particularly interested in starting a company or anything, and tries not to "be too prescriptive" about the future. He's happy doing research that he thinks is important "for a more complete understanding of the field". If he's contributed to the field, then it's "mission accomplished."

What is one thing you hope to see happen in your field?

One of the major challenges is that a lot of what we know about respiratory diseases is based on imperfect animal models; there's a lack of in vitro human models that are complex enough to follow the whole disease process. Animal cells work differently - for example, if the genetic defects that code for cystic fibrosis are induced in a mouse, the mouse would have no disease and no issues. In humans, this would be a major issue. For now, a combination of in-vivo and in-vitro work addresses this issue, but better models using human cells would be a goal.

Tell me more about the classes you teach

Dr. Duncan teaches Biofluids and Pulmonary Engineering. He previously taught an elective on biopolymers. He helps out with graduate training on responsible conduct and teaches a class on ethical issues in bioengineering research. Teaching gives him an opportunity to think differently about some of the work doing in his lab - he finds it pretty helpful. He's been able to integrate concepts that he'd long forgotten about relating to fluid mechanics his lab analyzes the experiments they're conducting. Additionally, he's improved as a communicator.

What do you enjoy most about the BIOE department?

The students are personable and easy to work with, which is a nice part of working here. The culture of respect in the department and the university are very nice as well. There are a lot of collaborators on campus, including a lot of faculty within and outside of BIOE. The Clark School has a lot of support to do educational research.

What advice would you give to our readers?

Dr. Duncan feels like the students in the department are "way more informed than he was." He didn't know that he wanted to be a faculty member when he was an undergrad, and he thinks that there's value in getting to know the faculty. Students most often get to know faculty through class or through capstone, but students don't often have in-depth discussions with them about other things. Faculty members have a lot of experience, and chatting with them may lend a lot of insight into a field of interest or a life in academia.

Conducted by: Emre Derin

Dr. Xiaoming (Shawn) He

Departmental Affiliations

Professor of Bioengineering
Fischell Department of Bioengineering
Maryland Robotics Center
Brain and Behavior Institute
Robert E. Fischell Institute for Biomedical Devices



Introducing our Faculty Advisor

Dr. He is a professor of Bioengineering at the University of Maryland, College Park in the Fischell Department of Bioengineering. Educationally, he earned his Ph.D. from the University of Minnesota-Twin Cities and completed his post-doctoral training at the Harvard Medical School and the Massachusetts General Hospital.

What is your field of interest? What got you interested in this field initially?

“I am interested in developing multiscale biomaterials/medical devices to engineer medicine including living stem and immune cells. The reason is that work in this field can utilize my extensive training in engineering for improving the safety and efficacy of medicine.”

How do you balance your academic & research responsibilities?

“Interest drives me to work hard for both. I enjoy incorporating the cutting-edge research from my lab and others into my classes and seeing young researchers mature both professionally and personally.”

What do you enjoy the most about your research? What are your goals for research?

“The potential of clinical translation to reduce morbidity and mortality of patients” excites him the most. His research goals are to “discover and translate into the clinic and market.”

Do you have any advice for students interested in research?

Follow your interest; comprehend (understand and infer); think critically and out of the box; learn from failure; be dedicated, communicative, responsive, grateful, humble, and willing to learn from all people around you all the time; and leave nothing half-done.

Any other insights you'd like to share with our Catalyst readers?

When you work, work hard; when you play, play hard.; then you can both play and work well.

Faculty Research Highlights

Authors: Emre Derin, Sarah Han

Though we are an undergraduate research journal, we are also excited to celebrate the contributions of BIOE faculty members. We have curated a list of publications from each faculty member that have been published in 2023.

Dr. Helim Aranda-Espinoza

Micromechanical characterizations and viscoelastic modeling reveal elastic and viscoelastic heterogeneities in ovarian tissue and the significant viscoelastic contribution to the apparent elastic modulus determined by AFM indentation

Hyperglycemic Conditions Enhance the Mechanosensitivity of Proinflammatory RAW264.7 Macrophages

A Case for Material Stiffness as a Design Parameter in Encapsulated Islet Transplantation

Dr. William Bentley

Spectroelectrochemical testing of a proposed mechanism for a redox-based therapeutic intervention: Ascorbate treatment of severe paraquat poisoning

Redox-Enabled Bio-Electronics for Information Acquisition and Transmission

Electro-Biofabrication. Coupling Electrochemical and Biomolecular Methods to Create Functional Bio-Based Hydrogels

Cell-Like Capsules with “Smart” Compartments

Electrochemical classification and quantification of biologics using cyclic voltammetry and machine learning

Electrogenetic signaling and information propagation for controlling microbial consortia via programmed lysis

System for produciton of high yield of recombinant proteins

Highly stable, antiviral, antibacterial cotton textiles via molecular engineering

Spectroelectrochemical network measurements for redox bioelectronics

Quorum Sensing from Two Engineers' Perspectives

High performance anion exchange chromatography purification of probiotic bacterial extracellular vesicles enhances purity and anti-inflammatory efficacy

Chapter 4: Electrofabrication to Create Structured Hydrogels

Dr. Alisa Clyne

Angiotensin II Increases Oxidative Stress and Inflammation in Female, But Not Male, Endothelial Cells

Fast-Training Deep Learning Algorithm for Multiplex Quantification of Mammalian Bioproduction Metabolites via Contactless Short-Wave Infrared Hyperspectral Sensing

Interpreting metabolic complexity via isotope-assisted metabolic flux analysis

Dr. Gregg Duncan

Inhaled drug delivery for the targeted treatment of asthma

Hydrogels for Mucosal Drug Delivery

pH-Responsive Mucus-Penetrating Nanoparticles for Enhanced Cellular Internalization by Local Administration in Vaginal Tissue

Synthetic mucus biomaterials for antimicrobial peptide delivery

Biomaterials for intranasal and inhaled vaccine delivery

Engineering in vitro models of cystic fibrosis lung disease using neutrophil extracellular trap inspired biomaterials

Dr. John Fisher

4D Bioprinting via Molecular Network Contraction for Membranous Tissue Fabrication

Acellular bioactive scaffold device and methods of fabrication and treatment relating thereto

Fabrication Strategies for Engineered Thin Membranous Tissues

Mesenchymal Stem Cell Culture within Perfusion Bioreactors Incorporating 3D-Printed Scaffolds Enables Improved Extracellular Vesicle Yield with Preserved Bioactivity

Hyperglycemic Conditions Enhance the Mechanosensitivity of Proinflammatory RAW264.7 Macrophages

A Case for Material Stiffness as a Design Parameter in Encapsulated Islet Transplantation

Dr. Xiaoming (Shawn) He

Micromechanical characterizations and viscoelastic modeling reveal elastic and viscoelastic heterogeneities in ovarian tissue and the significant viscoelastic contribution to the apparent elastic modulus determined by AFM indentation

System, device, and method for single-cell encapsulation and culture

Trehalose delivered by cold-responsive nanoparticles improves tolerance of cumulus-oocyte complexes to microwave drying

Culture and differentiation of pluripotent stem cells

In-situ cryo-immune engineering of tumor microenvironment with cold-responsive nanotechnology for cancer immunotherapy

Chapter 10: Technologies for Oocyte Cryopreservation

Dr. Huang Chiao Huang

Transient fluid flow improves photoimmunoconjugate delivery and photoimmunotherapy efficacy

Dr. Steven Jay

Impact of storage conditions and duration on function of native and cargo-loaded mesenchymal stromal cell extracellular vesicles

Assessment of anti-inflammatory bioactivity of extracellular vesicles is susceptible to error via media component contamination

Induced Pluripotent Stem Cell-Derived Extracellular Vesicles Promote Wound Repair in a Diabetic Mouse Model via an Anti-Inflammatory Immunomodulatory Mechanism

Mesenchymal Stem Cell Culture within Perfusion Bioreactors Incorporating 3D-Printed Scaffolds Enables Improved Extracellular Vesicle Yield with Preserved Bioactivity

High performance anion exchange chromatography purification of probiotic bacterial extracellular vesicles enhances purity and anti-inflammatory efficacy

Differentiation state and culture conditions impact neural stem/progenitor cell-derived extracellular vesicle bioactivity

Dr. Christopher Jewell

Safety and clinical activity of autologous RNA chimeric antigen receptor T-cell therapy in myasthenia gravis (MG-001): a prospective, multicentre, open-label, non-randomised phase 1b/2a study

PD-L1 couples with LT β R signaling to accelerate tumor growth and metastasis

Harnessing Biomaterials to Study and Direct Antigen-Specific Immunotherapy

Transforming bioengineering with unbiased teams and tools

Delivery Route Considerations for Designing Antigen-Specific Biomaterial Strategies to Combat Autoimmunity

Biomaterial Strategies for Selective Immune Tolerance: Advances and Gaps

Engineering the lymph node environment promotes antigen-specific efficacy in type 1 diabetes and islet transplantation

Enhancing the functionality of self-assembled immune signals using chemical crosslinks

Dissecting regulatory T cell expansion using polymer microparticles presenting defined ratios of self-antigen and regulatory cues

Tuning innate immune function using microneedles containing multiple classes of toll-like receptor agonists

Tissue-Targeted Drug Delivery Strategies to Promote Antigen-Specific Immune Tolerance

Self-Assembly of Immune Signals to Program Innate Immunity through Rational Adjuvant Design

Dr. Catherine Kuo

Methods for improving mechanical properties of a tissue or for regenerating an injured or diseased tissue

Histological and immunohistochemical guide to tendon tissue

Establishing in vivo and ex vivo chick embryo models to investigate fetal tendon healing

Dr. Katharina Maisel

Mechanisms of Nanoparticle Transport across Intestinal Tissue: An Oral Delivery Perspective

In Vitro Models of Blood and Lymphatic Vessels—Connecting Tissues and Immunity

Hypotonic microbicidal formulations and methods of use

Nanotechnologies for Physiology-Informed Drug Delivery to the Lymphatic System

Hypotonic hydrogel formulations for enhanced transport of active agents at mucosal surfaces

Biomaterials for intranasal and inhaled vaccine delivery

Mechanical Dissociation of Tissues for Single Cell Analysis Using a Simple Motorized Device

Para-and transcellular transport kinetics of nanoparticles across lymphatic endothelial cells

Inhaled CpG increases survival and synergizes with checkpoint inhibition in lymphangioleiomyomatosis

Dr. Silvina Matysiak

Decoupling epistasis mechanisms in biomacromolecules

Emergence of allostery through reorganization of protein residue network architecture

Understanding BirA allostery from a network perspective using MD simulations

Effect of amyloid-beta aggregation and absorption on lipid demixing in mixed anionic/zwitterionic bilayers

Role of N17's hydrophobic face in membrane curvature sensing and polyQ aggregation

Discovery and characterization of a functional scFv for CCR2 inhibition via an extracellular loop

Protein folds vs. protein folding: Differing questions, different challenges

Folding and modulation of the helical conformation of Glycophorin A by point mutations

[Mechanistic insights into the inhibition of amyloid- \$\beta\$ aggregation by chitosan](#)

Dr. Jenna Mueller

[KeyLoop retractor for global gasless laparoscopy: evaluation of safety and feasibility in a porcine model](#)

[Crucial Business Model Elements for Medical Device Startup Companies in Emerging Markets](#)

Dr. Giuliano Scarcelli

[Motion-Tracking Brillouin Microscopy Evaluation of Normal, Keratoconic, and Post-Laser Vision Correction Corneas](#)

[Rapid biomechanical imaging at low irradiation level via dual line-scanning Brillouin microscopy](#)

[The Most Cited Articles and Authors in Refractive Surgery](#)

[Full-field optical spectroscopy at a high spectral resolution using atomic vapors](#)

[Time-lapse mechanical imaging of neural tube closure in live embryo using Brillouin microscopy](#)

Dr. Kimberly Stroka

[The multifaceted role of aquaporins in physiological cell migration](#)

[Matrix stiffness regulates the tight junction phenotypes and local barrier properties in tricellular regions in an iPSC-derived BBB model](#)

[Aquaporin-mediated dysregulation of cell migration in disease states](#)

[Abstract B010: The effects of tumor cell-secreted factors on endothelial cell junction phenotype](#)

Dr. Ian White

[Sample-to-answer diagnostic system for the detection of circulating histones in whole blood](#)

Dr. Yang Tao

[SYSTEMS AND METHODS FOR MACHINE VISION ROBOTIC PROCESSING](#)

[Fast-Training Deep Learning Algorithm for Multiplex Quantification of Mammalian](#)

[Bioproduction Metabolites via Contactless Short-Wave Infrared Hyperspectral Sensing](#)

[Visualization of erythrocyte stasis in the living human eye in health and disease](#)

[Systems and methods for ph sensing in fluids](#)

[Systems and methods for compound concentration sensing in fluids](#)

Dr. Bardia Yousefi

[Optimal thermomic biomarkers for early diagnosis of breast cancer](#)

Dr. Li-Qun Zhang

[MCP extensors respond faster than flexors in individuals with severe-to-moderate stroke-caused impairment: Evidence of uncoupled neural pathways](#)

[The directionality of interjoint neural coupling in the impaired arm post stroke](#)

[Effect of robot-aided hand rehabilitation on motor recovery post stroke](#)

[Characterization of the influence of the dominant tract on hand closing post stroke based on the Fugl-Meyer score](#)

[Robotic Ankle Training Improves Sensorimotor Functions in Children with Cerebral Palsy—A Pilot Study](#)

[Open reduction internal fixation of rib fractures: a biomechanical comparison between the RibLoc U Plus®system and anterior plate in rib implants](#)

[Effect of Multicomponent Home-Based Training on Gait and Muscle Strength in Older Adults After Hip Fracture Surgery: A Single Site Randomized Trial](#)

Closing Notes

Authors: The Catalyst Executive Board

Hi everyone!

Thank you for reading our Executive Board's inaugural edition of The Catalyst! We hope that you learned something new and saw an article that you enjoyed. Our team of eight writers, designers, and editors could not have finished this Summer 2023 edition without the students, faculty members, and advisors that reviewed or provided information for our content: Dr. Alisa Clyne, Dr. Xiaoming (Shawn) He, Dr. Jenna Mueller, Dr. Margaret Prendergast, Ellen McDaniel, Abby Shantzis, and the 2023-2024 BMES Executive Board (Kaylin Baumiller and Mya Hamstra in particular). We are so grateful to them for helping us make this possible.

We are proud of what we have accomplished in just 3 months with a small team, and we have all learned a lot from this experience. So, we want to take some time to reflect on the past summer and make this edition a little more personal with a message from each member of our Executive Board:

Anika: "It's been a wonderful experience bringing back The Catalyst! In the process of crafting some of these pieces, I've had the opportunity to connect students, alumni, and faculty of the BIOE department in ways that I wouldn't normally. I've immensely enjoyed hearing about their lives, talking about their research, and asking for their advice. I'm so grateful for their time and insight! I'd like to thank my fellow board members for their support and teamwork - I've enjoyed the late-night calls and work sessions that we needed to make this edition possible. Looking back, I wouldn't have imagined that we would have a sizable edition ready to release, but the more we learned about the department, the more there was to share! We hope you enjoy our new version of The Catalyst, and stay tuned for many more editions to come!"

Duy: "5 months ago, Emre asked me over dinner whether I had heard about the BIOE department's student journal, the Catalyst. It was during that dinner that we discovered how the journal had been out of commission for some time and we pondered the idea of how great a journal would be to highlight our amazing department. 5 months later and I still cannot believe that we are publishing our first edition! It has been an eventful 5 months with highs and lows but I am impressed by what we have been able to accomplish and I hope to continue our incredible work. I hope you, the reader, enjoyed reading this as much as I enjoyed working on it and be sure to be on the lookout for our next edition!"

Emre: "Looking back, reviving The Catalyst was quite the task. I am pleasantly surprised and inspired by what we have accomplished in such a short time frame. What began as a simple idea has accumulated into a journal presenting its first edition as a result of sincere dedication and effort. I couldn't be more thankful and appreciative for the wonderful team that helped me turn this hypothetical idea into a piece that we all can take inspiration from."

Matthew: "As one of the first three Board members of The Catalyst, I did not know how this organization would look and never thought that I would be finishing an issue at this moment. Though it was a lot of work and I had no idea what I was doing in the early stages, I am so happy to share this edition with

everyone in the BIOE department. I hope that many more students will join our team and the organization will persist for years to come!"

Sarah: "I am so happy that I'm part of this wonderful team and this summer issue. I'm also so proud of this team for starting from the very base and building our own content. There were so many things that needed to be discussed and figured out to put out this issue, and we hope we were able to deliver research to you well from our unique undergraduate perspective. I cannot wait to deliver our next issue, and make sure to follow our Instagram for the breakdown of the summer issue and more updates!"

If you are interested in joining our team, let us know by sending catalyst.umd@gmail.com a copy of your resume, a personal statement, and other materials required for the positions in which you are interested. We would love to build our student body with more writers, interviewers, graphic designers, and website developers to make future editions of this journal even better! Be on the lookout for more information about us during the first few weeks of the Fall 2023 semester, where we will work with the department to periodically send out information about interest meetings, signing up for a listserv, and more.

Additionally, please reach out to us if you would like to provide your research, time for an interview, or ideas for future articles in our DEI and student sections! As an undergraduate research journal committed to inclusivity, we want to highlight undergraduate researchers and potential improvements that BIOE administrators might make to improve the culture of our department. Students interested in submitting their research can use the Google Form linked below.

We are also happy to review any feedback you have, and we encourage you to respond to the Google Form linked below if you would like to tell us anything at all. Your voice improves the quality of this journal. The next QR code is linked to another Google Form that allows you to offer suggestions to the BIOE DEI committee, including changes you want to see and ideas for events. While the committee has its own feedback form, you may use ours as well.

Thank you again for reading and engaging with our content! We hope to see many of our readers on campus very soon.

Best,

The Catalyst Executive Board

Links:

Undergraduate Research Submissions: <https://forms.gle/LgKwSRN94TYXp9Mu5>

Feedback Form for Future Editions: <https://forms.gle/MKm4F2n8Wh6yiftx6>

Feedback Form for DEI Committee: <https://forms.gle/rWGUotePYYPxoqyw6>