

# DESIGN DAY 2024

MAY 1, 2024



JOHNS HOPKINS

WHITING SCHOOL  
of ENGINEERING

# WELCOME

**TO ALL THE PARENTS, ALUMNI, STUDENTS, FACULTY, AND GUESTS** who are joining us today, welcome to Design Day 2024—the Whiting School of Engineering’s annual showcase of our students’ energy, creativity, and innovation. Design Day gives undergraduate and graduate students from all ten of the Whiting School’s departments the opportunity to display how they put theoretical knowledge into practice, devising systems, processes, components, and products that solve important and pressing problems in the real world.

We are excited to offer a showcase of poster displays with most of our departments in one room. I know you will enjoy browsing and learning about the innovative solutions to the real-world problems they address. Examples of our students’ achievements this year include: a tool to help support breastfeeding parents; real-time tracking for an infant’s heartbeat and breathing to prevent SIDS and Shaken Baby Syndrome; using shellfish to help clean effluent from wastewater treatment plants in the City of Baltimore; a low-cost autonomous maritime loitering platform; an oyster bed restoration device for the Chesapeake Bay; and many more.

We are also thrilled to welcome Dean Kamen as our Blumenthal Lecturer and Design Day Keynote. Dean’s accolades and inventions—along with his tireless work motivating young people to understand, use, and enjoy technology—will certainly inspire future generations of transformative engineers to create a better future.

Design Day is an exciting landmark on our students’ journeys from studying engineering in the classroom and laboratory to becoming practicing engineers heading out to make a lasting and positive impact on our world. I know you will join me in celebrating their outstanding work and accomplishments.

I hope you enjoy the day!

Ed Schlesinger  
Benjamin T. Rome Dean  
Whiting School of Engineering



**MORE INFORMATION ABOUT  
DESIGN DAY CAN BE FOUND HERE.**

# BLUMENTHAL LECTURER AND KEYNOTE SPEAKER

## DEAN KAMEN—FOUNDER AND PRESIDENT, DEKA R&D AND FIRST®

Dean Kamen is an inventor, an entrepreneur, and a tireless advocate for science and technology. His roles as inventor and advocate are intertwined—his own passion for technology and its practical uses has driven his personal determination to spread the word about technology’s virtues and by so doing to change the culture of the United States.

Kamen is the founder and president of DEKA Research & Development Corporation. Examples of technologies developed by DEKA include the HomeChoice™ portable dialysis machine, the iBOT™ Mobility System, the Segway™ Human Transporter, a DARPA-funded robotic arm, a new and improved Stirling engine, and the Slingshot water purifier.

In addition to DEKA, one of Kamen’s proudest accomplishments is founding FIRST® (For Inspiration and Recognition of Science and Technology), an organization dedicated to motivating the next generation to understand, use, and enjoy science and technology. Founded in 1989, this year FIRST® will serve more than 3,200,000 young people, ages 4 to 18, in more than 100 countries around the globe. Last year, high-school-aged participants were eligible to apply for more than \$80 million in scholarships from over 200 leading colleges, universities, and corporations.

Kamen has received many awards for his efforts. Notably, he was awarded the National Medal of Technology in 2000. Presented by President Clinton, this award was in recognition for inventions that have advanced medical care worldwide, and for innovative and imaginative leadership in awakening America to the excitement of science and technology. Kamen was elected a member of the National Academy of Engineering in 1997. He was awarded the Lemelson-MIT Prize in 2002, and was inducted into the National Inventors Hall of Fame in May 2005. He is a Fellow of the American Institute for Medical and Biological Engineering, as well as many other national and international engineering organizations.

## ABOUT THE BLUMENTHAL LECTURE AND AWARD FOR CONTRIBUTIONS TO MANAGEMENT IN TECHNOLOGY

*Established by Sydney C. Blumenthal '37 and his wife, Mitzi Blumenthal, the annual Blumenthal Lecture highlights distinguished leaders whose careers have demonstrated an exceptional bridging of business with technology, capped by managerial accomplishment. The purpose of this award is to enrich the educational environment at Johns Hopkins by providing students with opportunities to hear how fields such as business management, entrepreneurship, law, and ethics interface with engineering and technology. For the first time in this award's illustrious history, the Blumenthal Lecture will take place during the 2024 Johns Hopkins Engineering Design Day.*



# SCHEDULE OF EVENTS

## TUESDAY, APRIL 30

TIME	LOCATION	EVENT
9 a.m. to 12:10 p.m.	Hodson 210 and 213	Mechanical Engineering presentations
12:10 to 1:10 p.m.	Hodson second-floor lobby	Mechanical Engineering lunch
1:10 to 3:10 p.m.	Hodson 210 and 213	Mechanical Engineering presentations
3:10 to 3:45 p.m.	Hodson second-floor lobby	Mechanical Engineering judging, awards, closing remarks, and reception

## WEDNESDAY, MAY 1

### MORNING SESSIONS

TIME	LOCATION	EVENT
8:30 to 11:30 a.m.	Hodson 311, 313, 315, and 316	Center for Leadership Education presentations
8:30 to 11:30 a.m.	Goldfarb Gym	Biomedical Engineering presentations
8:30 to 11:30 a.m.	Multipurpose Room B	Electrical and Computer Engineering presentations
9 to 11:30 a.m.	Hodson 210	Materials Science and Engineering presentations
9 to 11:30 a.m.	Multipurpose Room A	Chemical and Biomolecular Engineering presentations
9 to 11:30 a.m.	Hackerman B-17	Civil and Systems Engineering presentations and Blue Hat and Awards Ceremonies
10:30 to 11:30 a.m.	Hodson 213	Environmental Health and Engineering presentations

## BLUMENTHAL LECTURE AND DESIGN DAY KEYNOTE

TIME	LOCATION	EVENT
11:45 a.m. to 12:45 p.m.	Goldfarb Gym	Blumenthal Lecture and Design Day Keynote <b>Dean Kamen</b> , Founder and President, DEKA R&D and <i>FIRST</i> ® <b>T.E. Schlesinger</b> , Benjamin T. Rome Dean, G. W. C. Whiting School of Engineering  Presentation of the Blumenthal Lecture Award

## LUNCH

TIME	LOCATION	EVENT
12:45 to 2 p.m.	Goldfarb Gym	Lunch

## POSTER SESSION

TIME	LOCATION	EVENT
2 to 4 p.m.	Bob Scott Gym	Main poster sessions and demonstrations presented by: Applied Mathematics and Statistics, Biomedical Engineering, Center for Leadership Education, Chemical and Biomolecular Engineering, Civil and Systems Engineering, Computer Science, Electrical and Computer Engineering, Materials Science and Engineering, Mechanical Engineering, and WSE student groups and organizations

## CLOSING REMARKS AND AWARDS CEREMONY

TIME	LOCATION	EVENT
4 to 4:30 p.m.	Bob Scott Gym	Closing Remarks and Awards Ceremony Presentation of the Tau Beta Pi Appreciation Awards Presentation of the Whiting School of Engineering Dean's Design Awards Presentation of the Cross-disciplinary People's Choice Awards



**VOTE HERE FOR CROSS-DISCIPLINARY  
PEOPLE'S CHOICE AWARDS!**

# DESIGN DAY BY DEPARTMENT

## APPLIED MATHEMATICS AND STATISTICS

**2 to 4 p.m.:** main poster session and demonstrations (*Bob Scott Gym*)

## BIOMEDICAL ENGINEERING

**8:30 to 9 a.m.:** breakfast and registration (*Goldfarb Gym*)

**9 to 11:30 a.m.:** presentations (*Goldfarb Gym*)

**2 to 4 p.m.:** main poster session and demonstrations (*Bob Scott Gym*)

## CENTER FOR LEADERSHIP EDUCATION

**8:30 to 11:30 a.m.:** presentations (*Hodson 311, 313, 315, and 316*)

**2 to 4 p.m.:** main poster session and demonstrations (*Bob Scott Gym*)

## CHEMICAL AND BIOMOLECULAR ENGINEERING

**9 to 11:30 a.m.:** presentations (*Multipurpose Room A*)

**2 to 4 p.m.:** main poster session and demonstrations (*Bob Scott Gym*)

## CIVIL AND SYSTEMS ENGINEERING

**9 to 10:30 a.m.:** presentations (*Hackerman B-17*)

**10:30 to 11:30 a.m.:** Blue Hat and Awards Ceremonies (*Hackerman B-17*)

**2 to 4 p.m.:** main poster session and demonstrations (*Bob Scott Gym*)

## COMPUTER SCIENCE

**2 to 4 p.m.:** main poster session and demonstrations (*Bob Scott Gym*)

## ELECTRICAL AND COMPUTER ENGINEERING

**8:30 to 11:30 a.m.:** presentations (*Multipurpose Room B*)

**2 to 4 p.m.:** main poster session and demonstrations (*Bob Scott Gym*)

## ENVIRONMENTAL HEALTH AND ENGINEERING

**10:30 to 11:30 a.m.:** presentations (*Hodson 213*)

## MATERIALS SCIENCE AND ENGINEERING

**9 to 11:30 a.m.:** presentations (*Hodson 210*)

**2 to 4 p.m.:** main poster session and demonstrations (*Bob Scott Gym*)

## MECHANICAL ENGINEERING

### TUESDAY, APRIL 30

**9 a.m. to 12:10 p.m.:** presentations (*Hodson 210 and 213*)

**12:10 to 1:10 p.m.:** poster session (*Hodson second-floor lobby*)

**1:10 to 3:10 p.m.:** presentations (*Hodson 210 and 213*)

**3:10 to 3:45 p.m.:** judging, awards, remarks, and reception (*Hodson second-floor lobby*)

### WEDNESDAY, MAY 1

**2 to 4 p.m.:** main poster session and demonstrations (*Bob Scott Gym*)

## BLUMENTHAL LECTURE AND DESIGN DAY KEYNOTE

11:45 a.m. to 12:45 p.m.: Goldfarb Gym

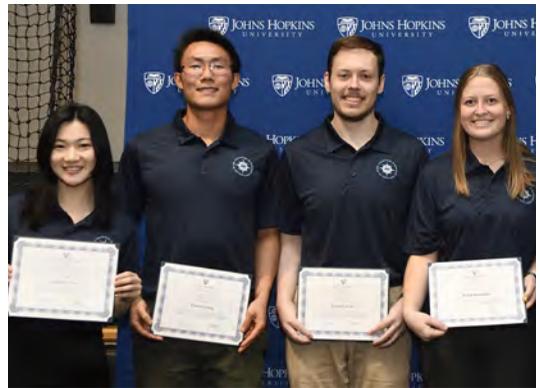
## LUNCH

12:45 to 2 p.m.: Goldfarb Gym

## CLOSING REMARKS AND AWARDS CEREMONY

4 to 4:30 p.m.: Bob Scott Gym

## 2023 WINNERS OF THE DEAN'S DESIGN AND PEOPLE'S CHOICE AWARDS



VOTE HERE FOR  
CROSS-DISCIPLINARY  
PEOPLE'S CHOICE AWARDS!



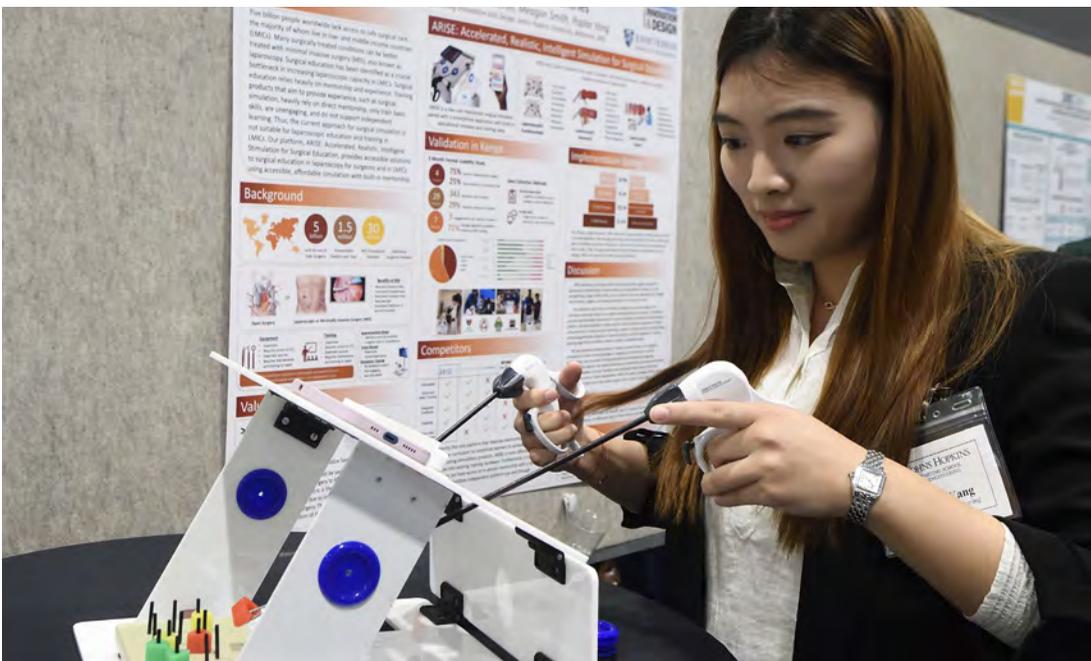
**The Department of Applied Mathematics and Statistics** is a center for the study and development of mathematical disciplines, especially oriented to helping solve modern society's most complex challenges. Applied mathematics and statistics play pivotal roles in burgeoning domains such as computational medicine/biology, natural language processing, sustainable energy, optimization, risk management, health care, and artificial intelligence. In today's era dominated by data, applied mathematics is indispensable for unraveling complex questions and devising solutions across diverse sectors including business, health, finance, government, and national security. This year, an undergraduate team conducted groundbreaking research on particulate matter (PM) pollution levels in commercial kitchens, aiming to protect kitchen workers' health. Their study utilized a PurpleAir sensor to monitor PM concentration in the air inside the Homewood Café Kitchen for 10 days, revealing significant exposure. They found that N95 and surgical masks were far more effective than cloth masks in reducing workers' exposure to particulate matter. This emphasized the urgent need to address health risks in commercial kitchens and calls for continued efforts to safeguard worker well-being.

# BIOMEDICAL ENGINEERING



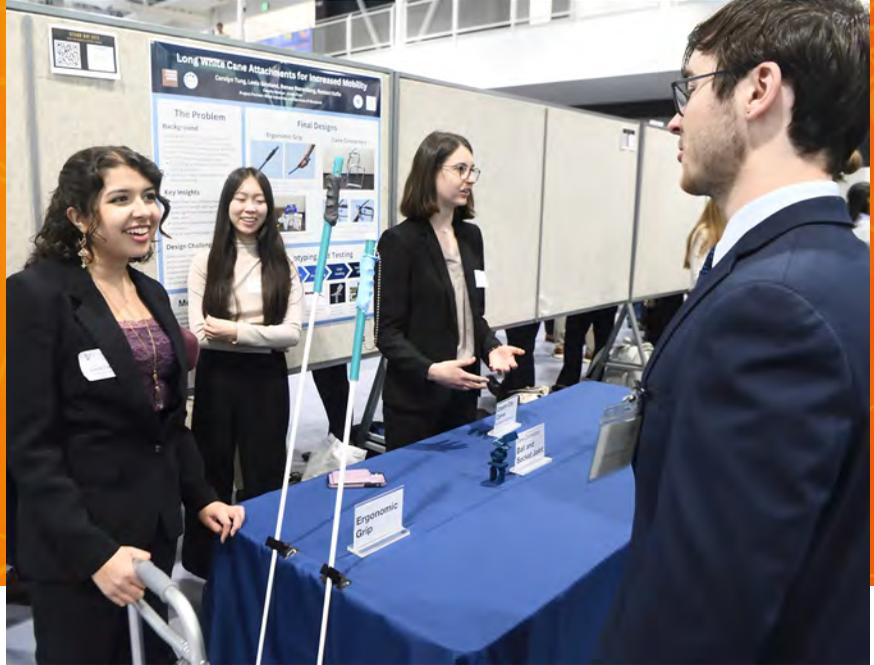
## The Department of Biomedical Engineering

has set the standard in biomedical design since introducing its landmark undergraduate Design Team program 25 years ago. With the addition of its renowned master's design program more than 10 years ago, offered through the department's Center for Bioengineering Innovation and Design, biomedical engineering students of all levels are engineering the future of medicine by developing new health care technologies. This year, students are designing methods to monitor Parkinson's disease symptoms, building tools to provide breast-feeding support, improving adoption of over-the-counter hearing aids, developing machine learning models to predict adverse post-surgery outcomes, making physician-patient communication more accessible, and more.

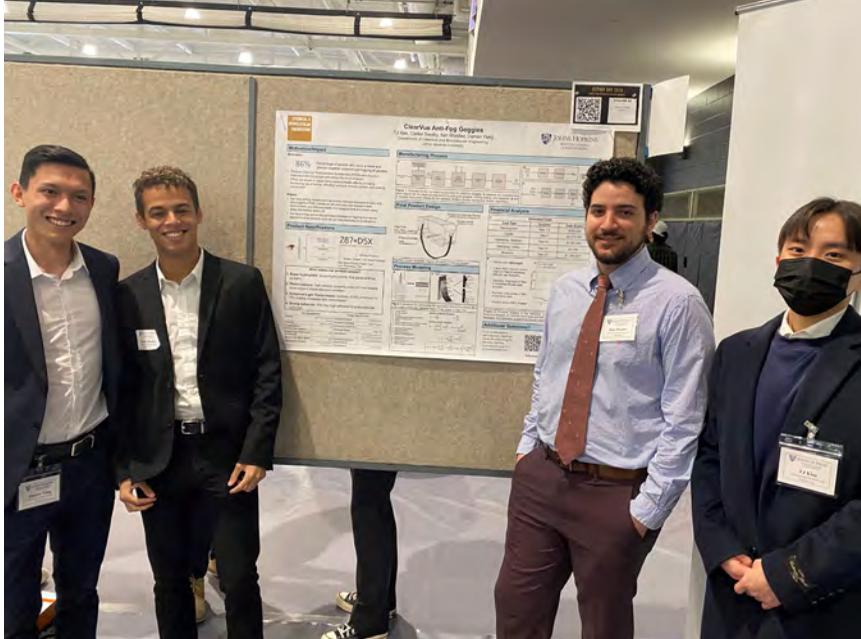




## CENTER FOR LEADERSHIP EDUCATION



**The Center for Leadership Education** offers coursework, minors, graduate programs, internships, competitions, hands-on learning experiences, and networking opportunities to prepare students for leadership in the professional world. More than 1,850 undergraduate and 225 graduate students each semester from the schools of Engineering and Arts and Sciences take courses through the CLE in accounting and finance, entrepreneurship and management, leadership, communication, and marketing. The center also offers a host of experiential activities, including HopStart: Hopkins New Venture Challenge and study-abroad programs in Denmark, Portugal, England, and Spain. Center alumni can be found in leadership roles in organizations around the globe. This year's projects include methods for encouraging natural hunting behaviors in bobcats at the Maryland Zoo; technology that provides autonomy in the shower for quadruple amputees; an employment and career hub for refugees; indoor gardens to enhance classroom learning in Baltimore public schools; and more.

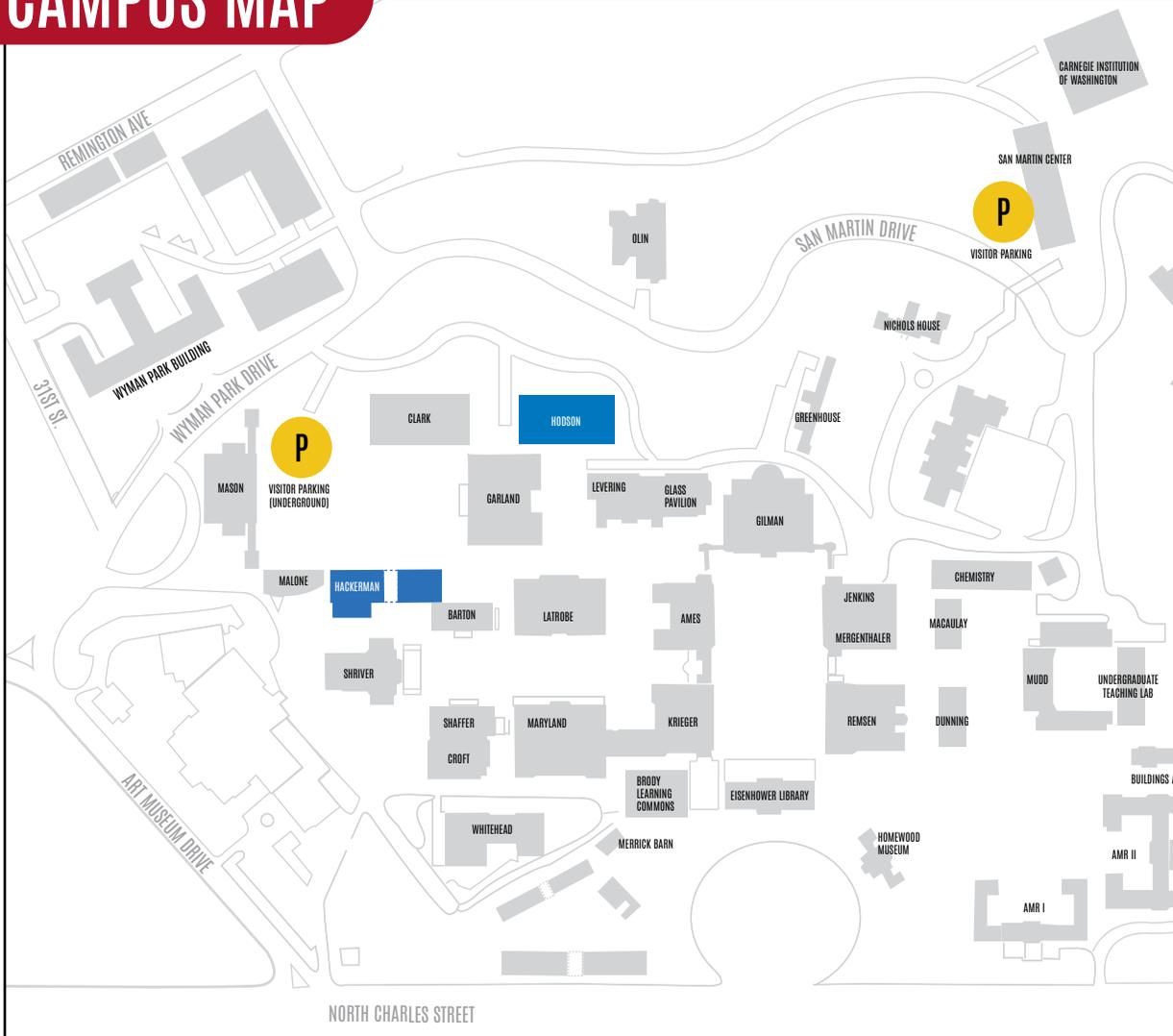


**The Department of Chemical and Biomolecular Engineering** prioritizes interdisciplinary research and teaching endeavors that target the world's most challenging problems. These include innovative therapies to combat cancer, the development of Earth-friendly biofuels and alternative energy sources, the design of molecular electronics, and more impactful initiatives. The department hallmarks are the Product and Process Design classes which challenge students to apply skills from earlier classes to real-world problems in industry. Projects this year include the Process Design course's blue hydrogen production and post-combustion carbon capture and the Product Design courses' innovative group projects such as compostable condiment packets, a biodegradable incontinence pad, new designs on personal medical devices, and industrial products designed to reduce methane emissions and degrade microplastics.

**CHEMICAL AND BIOMOLECULAR  
ENGINEERING**



# CAMPUS MAP



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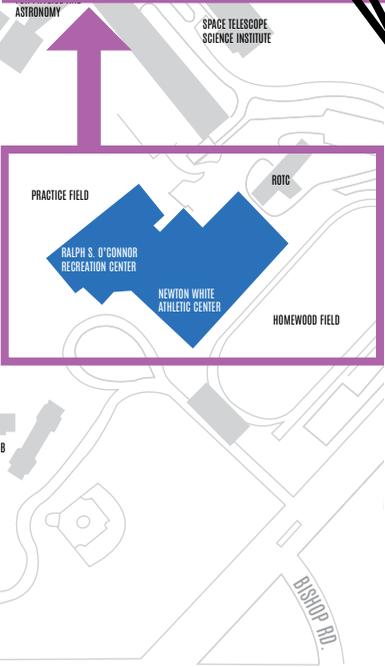
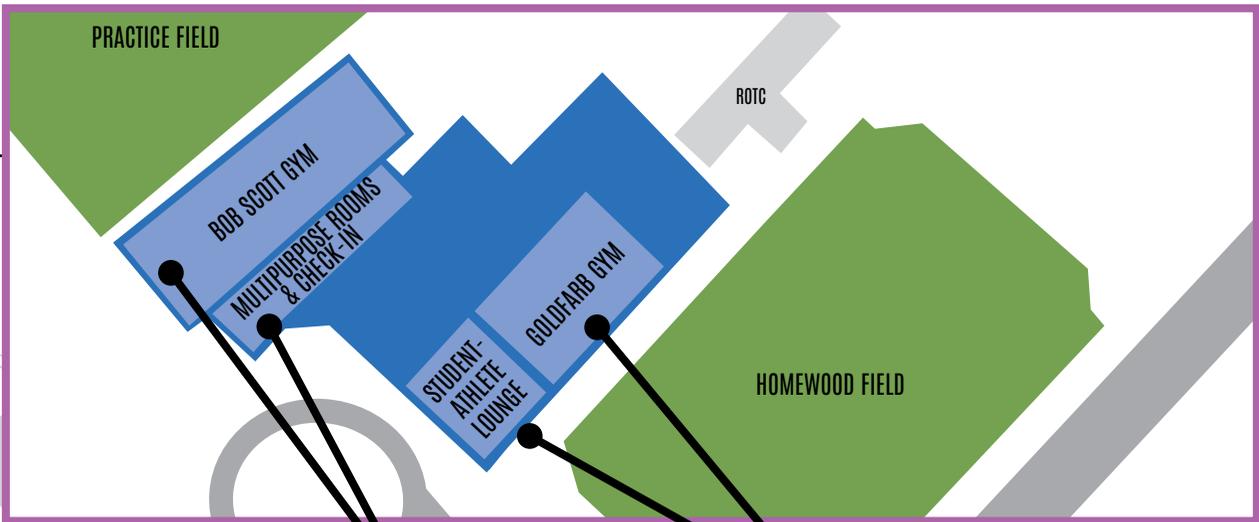
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**RALPH S. O'CONNOR RECREATION CENTER**

- MAIN LEVEL**  
Check-in
- MULTIPURPOSE ROOMS A & B (UPPER LEVEL)**  
Presentations
- BOB SCOTT GYM (LOWER LEVEL)**  
Poster Session and Awards

**NEWTON WHITE ATHLETIC CENTER**

- GOLDFARB GYM**  
Blumenthal Lecture and  
Design Day Keynote  
Presentations  
Lunch
- STUDENT-ATHLETE LOUNGE**  
Alumni Suite

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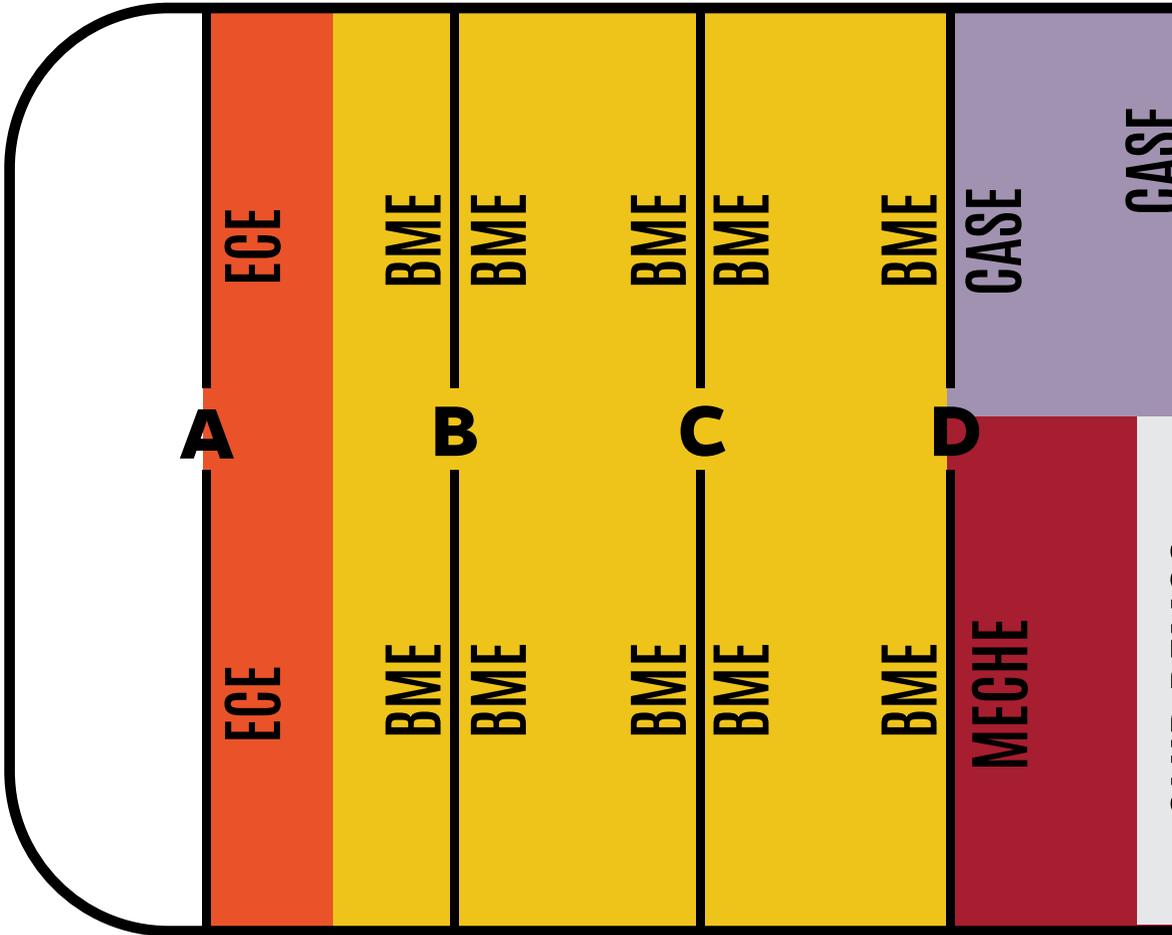
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# POSTER DIRECTORY



Applied Mathematics and Statistics (AMS)



Chemical and Biomolecular Engineering (CHEMBE)



Biomedical Engineering (BME)



Civil and Systems Engineering (CASE)



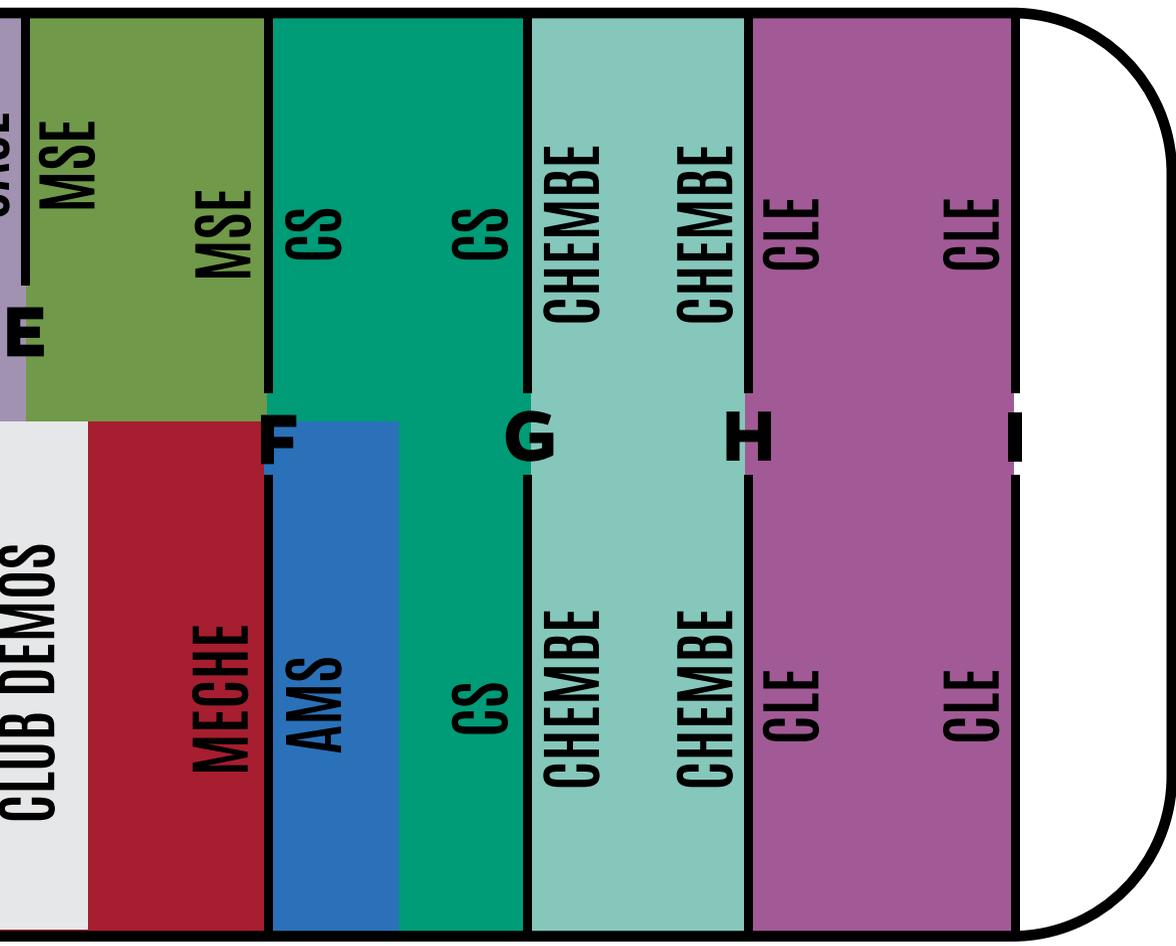
Center for Leadership Education (CLE)



Computer Science (CS)



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Electrical and Computer Engineering (ECE)

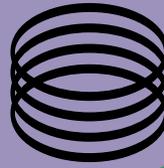
Materials Science and Engineering (MSE)

Mechanical Engineering (MECHE)

**PARTICIPATING DESIGN CLUBS**

- AstroJays Rocketry
- Blue Jay Racing (Baja SAE)
- Design, Build, Fly
- Hopkins iGEM (Internationally Genetically Engineered Machine)
- Hopkins Mars Rover Team
- Hopkins Student Wind Energy Team
- Johns Hopkins Undergraduate Brain Computer Interface Society
- Sardella Engineering Design Center Student Advisory Board
- Themed Entertainment Association
- Volunteers for Medical Engineering
- Women of Mechanical Engineering Network (WoMEen)

## CIVIL AND SYSTEMS ENGINEERING



**The Department of Civil and Systems Engineering** prepares students to tackle the major complex challenges that society will face in the coming decades. As seniors, students are challenged to devise innovative and sustainable solutions to a variety of problems in the built environment. The objective of this year's student project is to propose options for expanding the use of the Baltimore Museum of Art's historic Antioch Court through the addition of a new glass roof and raised floor. The project will integrate the structural and geotechnical engineering design with a systems engineering design that will consider access to and integration of the expanded space for both museum visitors and the broader urban community.



## COMPUTER SCIENCE



**The Department of Computer Science** is diverse, collaborative, and intensely research focused. Its research program couples core areas with novel interdisciplinary, application-oriented subjects, bringing together colleagues from the schools of Engineering, Medicine, Arts and Sciences, and Public Health in particular. The department draws upon the university's strengths in areas including robotics and computer vision, natural language processing, information security, machine learning and artificial intelligence, theory and programming languages, computational biology, human-computer interaction, and computer-assisted medicine. Undergraduate and graduate students are immersed in interdisciplinary research that stresses fundamental problem solving. Projects this year include Delineo, a simulator for showing the spread of infectious respiratory diseases in specific communities, and MindMatch, a mobile application for revolutionizing mental health support for high school and college students.



## ELECTRICAL AND COMPUTER ENGINEERING



Research in **the Department of Electrical and Computer Engineering** is far-reaching and diverse, spanning areas from medicine and defense to environmental protection. The department provides a rigorous educational experience that prepares students for further study and to practice engineering professionally and ethically in a competitive global environment. Its world-renowned faculty members are pioneers in areas including medical imaging, speech and language processing, control and networking systems, intelligence systems, brain-like computing and artificial intelligence, bio-inspired robotics and neuroprosthetics, biophotonics, ultrafast photonics and communication systems, and renewable energy devices, among others. This year, student engineers designed a device that stops headaches without medicine, a wearable infant heart and lung monitor offering real-time tracking of infants' heartbeats and breathing to prevent shaken baby syndrome and SIDS, and a solar-powered device to help the Chesapeake Bay Foundation restore oyster reefs for a healthier ecosystem.



**The Department of Environmental Health and Engineering**, affiliated with the Whiting School of Engineering and the Bloomberg School of Public Health, is uniquely positioned to conduct cutting-edge research and to prepare young scholars who can solve critical issues at the nexus of public health and engineering. Each year, clients challenge teams of students to solve real-world problems ranging from nutrient control in wastewater discharges and storm water management to upgrading public drinking water systems. This year, teams are working with outside sponsors to advance conceptual designs using nature-based solutions to create climate resilience and improve our environment. These include coastal and green infrastructure designs for underserved communities exposed to sea level rise and other climate-change-related impacts along Bear Creek and Turner Station in Baltimore County. In addition, team members are working with the City of Baltimore to engineer the use of shellfish to help clean effluent from wastewater treatment plants.



**ENVIRONMENTAL HEALTH AND ENGINEERING**



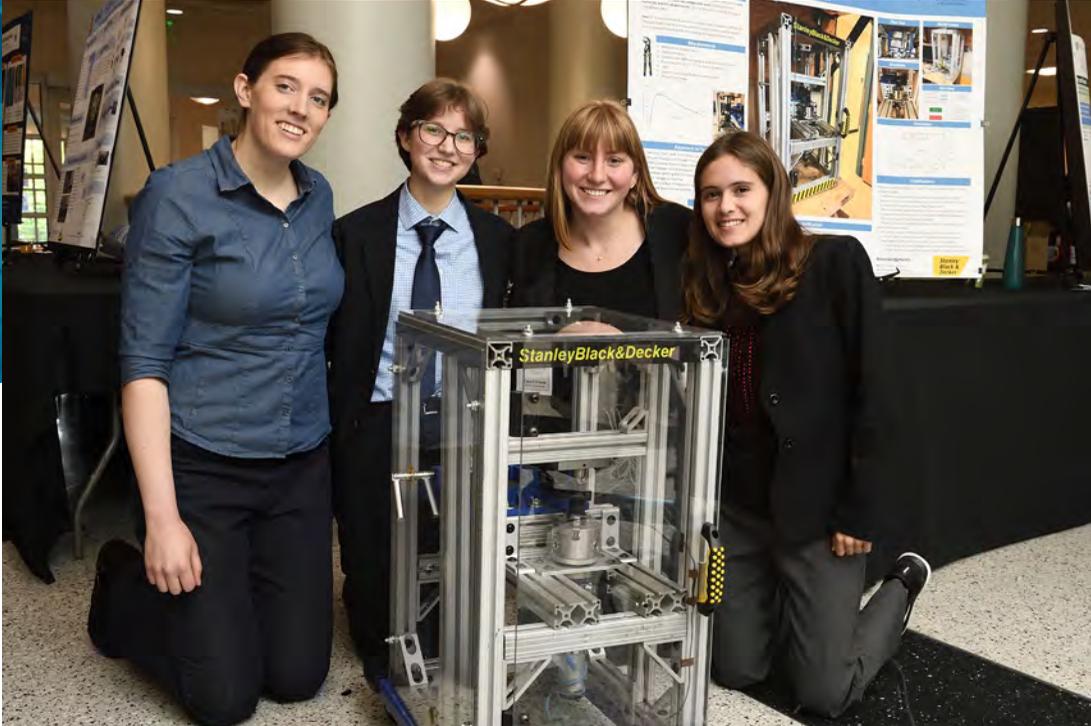


## MATERIALS SCIENCE AND ENGINEERING



In **the Department of Materials Science and Engineering**, undergraduate and graduate students are pushing boundaries to solve real-world problems. This year, we offer 10 projects completed by both teams and individual students. Presented in both poster and oral presentation forms, the projects span a broad range of topics, from designing a microfluidic system for the early detection of Alzheimer's disease to bioengineering a device promoting soft tissue restoration for patients with Crohn's disease. Through these projects, our faculty encourage students to apply the knowledge they have learned in the classroom to create materials that will improve society.

## MECHANICAL ENGINEERING



**The Department of Mechanical Engineering** sits at the intersection of science and engineering, preparing students for careers applying skills and knowledge to applications ranging from robotics and human-machine interactions to aerospace and machine systems to micro- and nanoscale engineered devices to biology and medicine. Mechanical Engineering pioneered the capstone experience on the Homewood campus in 1984, and more than 1,260 students have gone through the program. In Senior Design, students apply their understanding of engineering principles to real-world projects presented by industry, nonprofit, and government sponsors and emerge with tested and working prototypes. This year's projects range from a noise-reduced leaf blower to an automated pollen detection device.

# 2024 JOHNS HOPKINS ENGINEERING DESIGN PARTNERS

ABELL FOUNDATION

AMERICAN CANCER SOCIETY

AMERICAN SOCIETY OF NAVAL ENGINEERS

ARTIS VENTURES

BALTIMORE CITY PUBLIC SCHOOLS: FARM TO CLASSROOM

BILL & MELINDA GATES FOUNDATION

BLIND INDUSTRIES AND SERVICES OF MARYLAND

CARGO AND SPECIAL OPERATIONS LABORATORY AT NAVAL AIR STATION (NAS)

CITY OF BALTIMORE DEPARTMENT OF PUBLIC WORKS

COAPTECH, LLC

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INTELEHEALTH

IQT LABS

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JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY

JOHNS HOPKINS UNIVERSITY SCHOOL OF MEDICINE

JOHNSON & JOHNSON MEDTECH

MENDAERA

THE NATIONAL AQUARIUM

NAVAL AIR STATION PATUXENT RIVER

NIHON KOHDEN

ORTHOPEDIATRICS

PHILIPS ORAL HEALTHCARE RESEARCH AND DESIGN TEAM

ROARK DENTAL GROUP

RTI INTERNATIONAL

SHORELINE HEALTH

STANLEY BLACK & DECKER

STARX TECHNOLOGY

THE MARYLAND ZOO



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