

Create a Better Future

# DESIGN DAY 2023

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MAY 2, 2023



JOHNS HOPKINS

WHITING SCHOOL  
*of* ENGINEERING

Dear parents, alumni, students, faculty, and invited guests,

Welcome to Design Day 2023—the Whiting School of Engineering’s annual showcase of our students’ energy, creativity, and innovation. Design Day gives undergraduate and graduate students from all nine of the Whiting School’s academic departments, as well as the Center for Leadership Education, the hands-on opportunity to put theoretical knowledge into practice, devising systems, processes, components, and products that solve important and pressing problems in the real world—ones that haven’t yet been solved by today’s engineers.

This year, we are pleased and excited to offer a concentrated poster display with almost all of our departments in one room. I know you will enjoy browsing and learning about all of their innovative solutions. Examples of our students’ achievements this year include: a portable traumatic brain injury assessment tool; autonomous shuttles to connect students to volunteer and other Baltimore City activities; an augmented reality platform that allows students to learn lab skills and techniques; layout for a wind farm in the Gulf of Mexico; a strong-but-light floor panel for next-generation military helicopters; bioprinting scaffolds for modeling cervical softening in pregnancy; and more.

Design Day is an exciting landmark in 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.

Sincerely,

Ed Schlesinger

Benjamin T. Rome Dean

Whiting School of Engineering

## MY JOURNEY TO DEMOCRATIZING HEALTHCARE

### Vasiliki (Vicky) Demas



Before joining identifeye HEALTH (formerly Tesseract) as CEO, Demas led the development of new products at the cancer screening company GRAIL, where she also managed the scientific and technology portfolio and led a cross-functional competitive intelligence program. She supported the development of the core platform technology which formed the basis of the company’s first multicancer early detection test (Galleri),

and she led GRAIL’s post-diagnostic efforts. Prior to joining GRAIL, she was a founding member of the Google Life Sciences (GLS) team within Google [x], which was later spun out to form Verily. At Verily, she led several teams and projects, including in diagnostics, medical devices, and translational laboratory science, and helped build its multidisciplinary science and engineering programs. Before Verily, she held multiple positions of responsibility at T2 Biosystems where she worked in engineering consulting and, prior to that, led a three-phase, NASA-sponsored project. She holds several patents and has authored and co-authored numerous publications across multiple disciplines.

Vicky received her BS in chemical engineering from the University of Illinois Urbana-Champaign and her PhD from the University of California, Berkeley. During her doctoral studies and subsequent postdoctoral fellowship at Lawrence Berkeley and Livermore National Labs, she developed portable magnetic resonance spectroscopy and imaging systems, set up international collaborations, and supported efforts to commercialize magnetic resonance in ambulatory settings.

More information about Design Day projects can be found here.



# SCHEDULE OF EVENTS Note: This schedule is subject to change.

## Morning Sessions

Time	Location	Event
9 to 11 a.m.	Hodson 311	Materials Science and Engineering presentations
9 to 11:30 a.m.	Hodson 210 and 213	Mechanical Engineering presentations
9 to 11:30 a.m.	Goldfarb Gym	Biomedical Engineering presentations
9 a.m. to noon	Multipurpose Room A	Chemical and Biomolecular Engineering presentations
9 a.m. to noon	Hackerman B-17	Civil and Systems Engineering breakfast, presentations, and Blue Hat and Awards Ceremonies
10:30 to 11:30 a.m.	Multipurpose Room B	Environmental Health and Engineering presentations
10:30 to 11:30 a.m.	Meeting Room A	Multidisciplinary Design, Center for Leadership Education presentations

## Lunch

Time	Location	Event
11:30 a.m. to 1 p.m.	Bob Scott Gym	Applied Mathematics and Statistics, Civil and Systems Engineering, Computer Science, Electrical and Computer Engineering, and Materials Science and Engineering
11:30 a.m. to 1 p.m.	Auxiliary Gym	Biomedical Engineering, Center for Leadership Education, Chemical and Biomolecular Engineering, and Environmental Health and Engineering
Noon to 1 p.m.	Hodson first-floor lobby	Mechanical Engineering

## Plenary Session

Time	Location	Event
1 to 2 p.m.	Goldfarb Gym	Plenary session

## Afternoon Sessions

Time	Location	Event
Noon to 1 p.m.	Hodson second-floor lobby	Mechanical Engineering poster session
1 to 5 p.m.	Hodson 210 and 213	Mechanical Engineering presentations
2 to 4 p.m.	Multipurpose Rooms A and B	Center for Leadership Education presentations
2 to 4 p.m.	Bob Scott Gym	Main poster session and demonstrations including: Applied Mathematics and Statistics, Biomedical Engineering, Center for Leadership Education, Chemical and Biomolecular Engineering, Civil and Systems Engineering, Computer Science, Electrical and Computer Engineering, and Materials Science and Engineering

## Awards Presentation

Time	Location	Event
4 to 4:30 p.m.	Bob Scott Gym	Awards presentation

# DESIGN DAY BY DEPARTMENT

## Applied Mathematics and Statistics

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

## Biomedical Engineering

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- 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

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- 10:30 to 11:30 a.m.: Multidisciplinary Design presentations (Meeting Room A)
- 2 to 4 p.m.: Center for Leadership Education presentations (Multipurpose Rooms A and B)
- 2 to 4 p.m.: main poster session and demonstrations (Bob Scott Gym)

## Chemical and Biomolecular Engineering

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- 9 a.m. to noon: presentations (Multipurpose Room A)
- 2 to 4 p.m.: main poster session and demonstrations (Bob Scott Gym)

## Civil and Systems Engineering

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- 9 to 9:30 a.m.: breakfast (Hackerman B-17)
- 9:30 to 10:30 a.m.: presentations (Hackerman B-17)
- 10:30 a.m. to noon: Blue Hat and Awards Ceremonies (Hackerman B-17)
- 2 to 4 p.m.: main poster session and demonstrations (Bob Scott Gym)

## Computer Science

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

## Electrical and Computer Engineering

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

## Environmental Health and Engineering

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- 10:30 to 11:30 a.m.: presentations (Multipurpose Room B)

## Materials Science and Engineering

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- 9 to 11 a.m.: presentations (Hodson 311)
- 2 to 4 p.m.: main poster session and demonstrations (Bob Scott Gym)

## Mechanical Engineering

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- 9 to 11:30 a.m.: presentations (Hodson 210 and 213)
- Noon to 1 p.m.: poster session (Hodson second-floor lobby)
- 1 to 5 p.m.: presentations (Hodson 210 and 213)

## Plenary Session

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1 to 2 p.m.: Goldfarb Gym

## Lunches

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### 11:30 a.m. to 1 p.m.: Bob Scott Gym

Applied Mathematics and Statistics, Civil and Systems Engineering, Computer Science, Electrical and Computer Engineering, and Materials Science and Engineering

### 11:30 a.m. to 1 p.m.: Auxiliary Gym

Biomedical Engineering, Center for Leadership Education, Chemical and Biomolecular Engineering, and Environmental Health and Engineering

### Noon to 1 p.m.: Hodson first-floor lobby

Mechanical Engineering

**VOTE!** Attending the main poster and demonstration session? Use this QR code to vote for your favorite project. Winners will be announced during the Awards presentation.



## 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 are integral to emerging fields, such as computational medicine/biology, language processing, information security, and artificial intelligence. In today's data-intensive world, applied mathematics is used to answer questions and solve problems in areas as diverse as engineering, finance, government, law, and national defense. This year, for instance, the Hopkins Baseball Research Scheduling Team has been optimizing schedules for various professional baseball leagues, and more recently submitted a final schedule for members of the Frontier League. Analyzing the advantages and cost of changing requirements has been a challenge for the team, but by using MATLAB to enter variations of mathematical expressions, they were able to create the most effective schedule for the league.



## THE DEPARTMENT OF BIOMEDICAL ENGINEERING

has set the standard in biomedical design since introducing its landmark undergraduate Design Team program more than two decades ago. With the addition of its renowned master's design program, more than 10 years ago, offered through the department's Center for Bio-engineering Innovation and Design, biomedical engineering students of all levels are engineering the future of medicine by developing new technologies to diagnose and treat disease. This year, students are improving training for robotic surgery, overcoming sleep apnea during sedation, designing a portable traumatic brain injury assessment tool, developing ways to monitor early signs of heart failure in pediatric patients, and more.



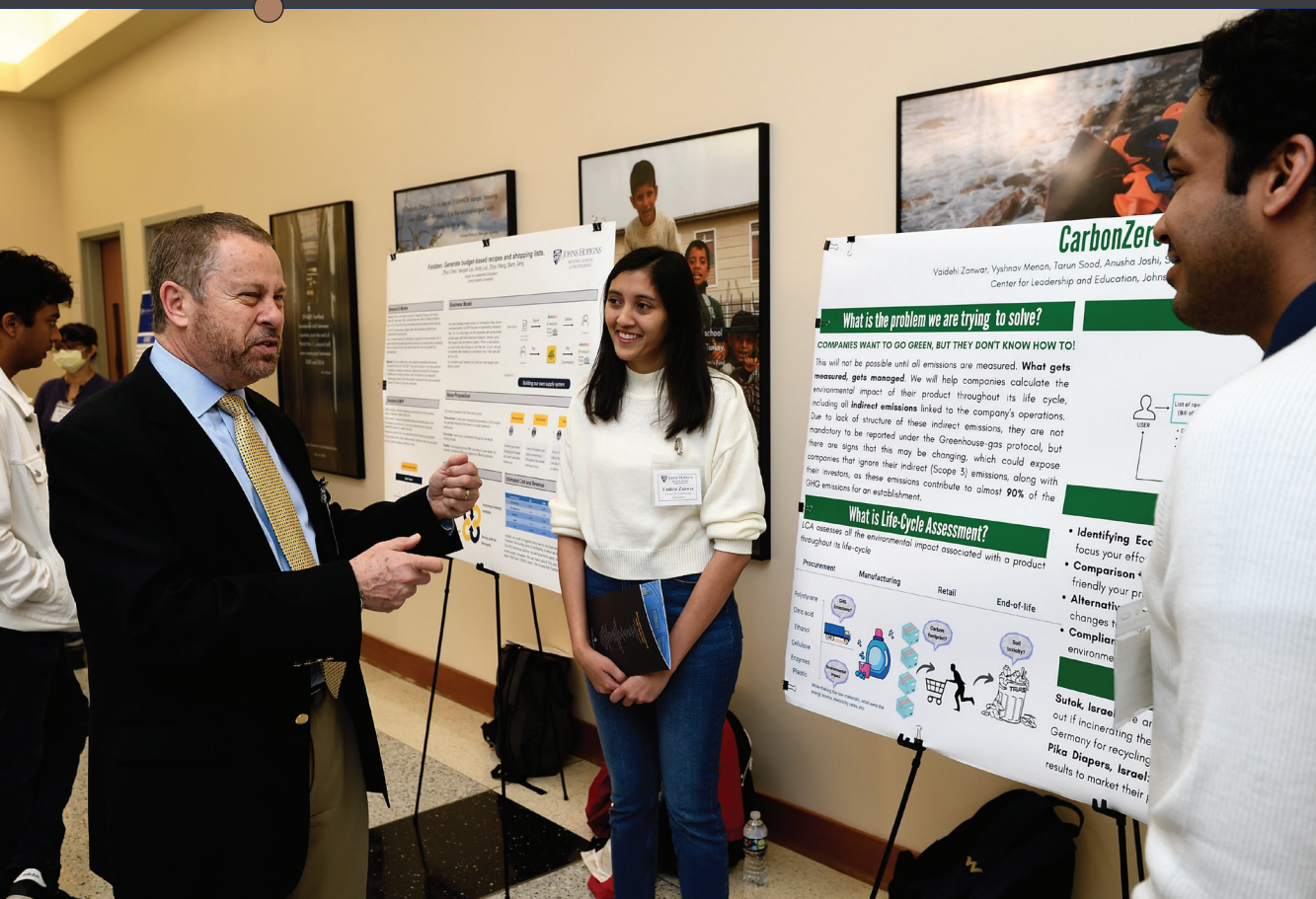
## THE CENTER FOR LEADERSHIP EDUCATION

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, Israel, and Spain. Center alumni can be found in leadership roles in organizations around the globe. This year's projects include a storage solution that more effectively separates berries to increase longevity and reduce food waste; an automated breakfast-cooking machine; a platform that connects people who have extra storage space with people who need storage space; and more.

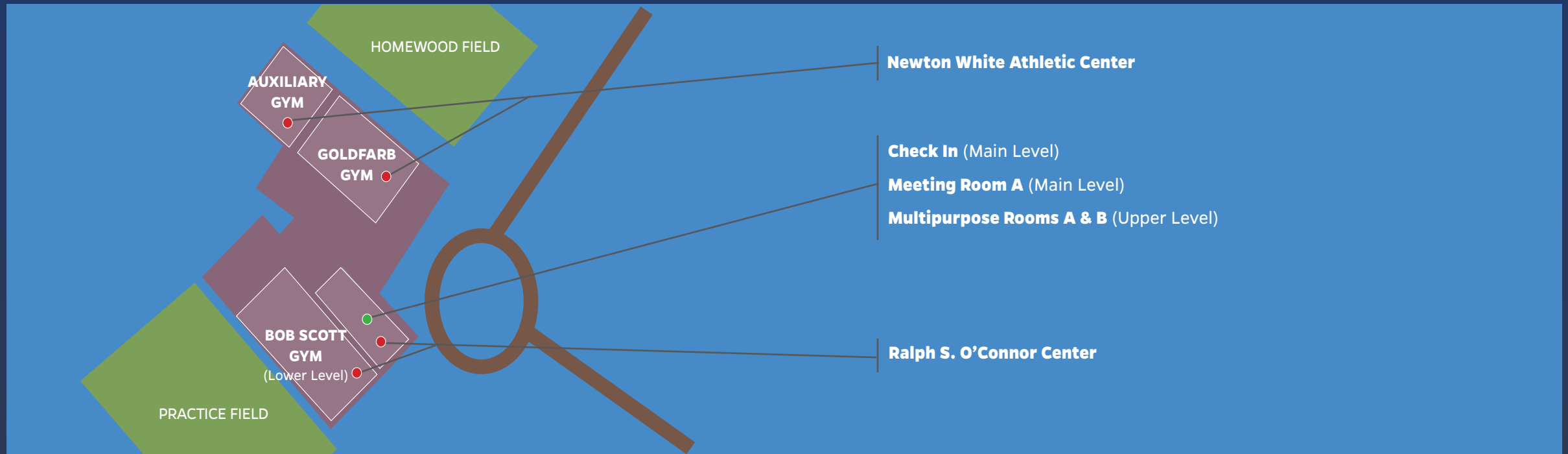


## THE DEPARTMENT OF CHEMICAL AND BIOMOLECULAR ENGINEERING'S

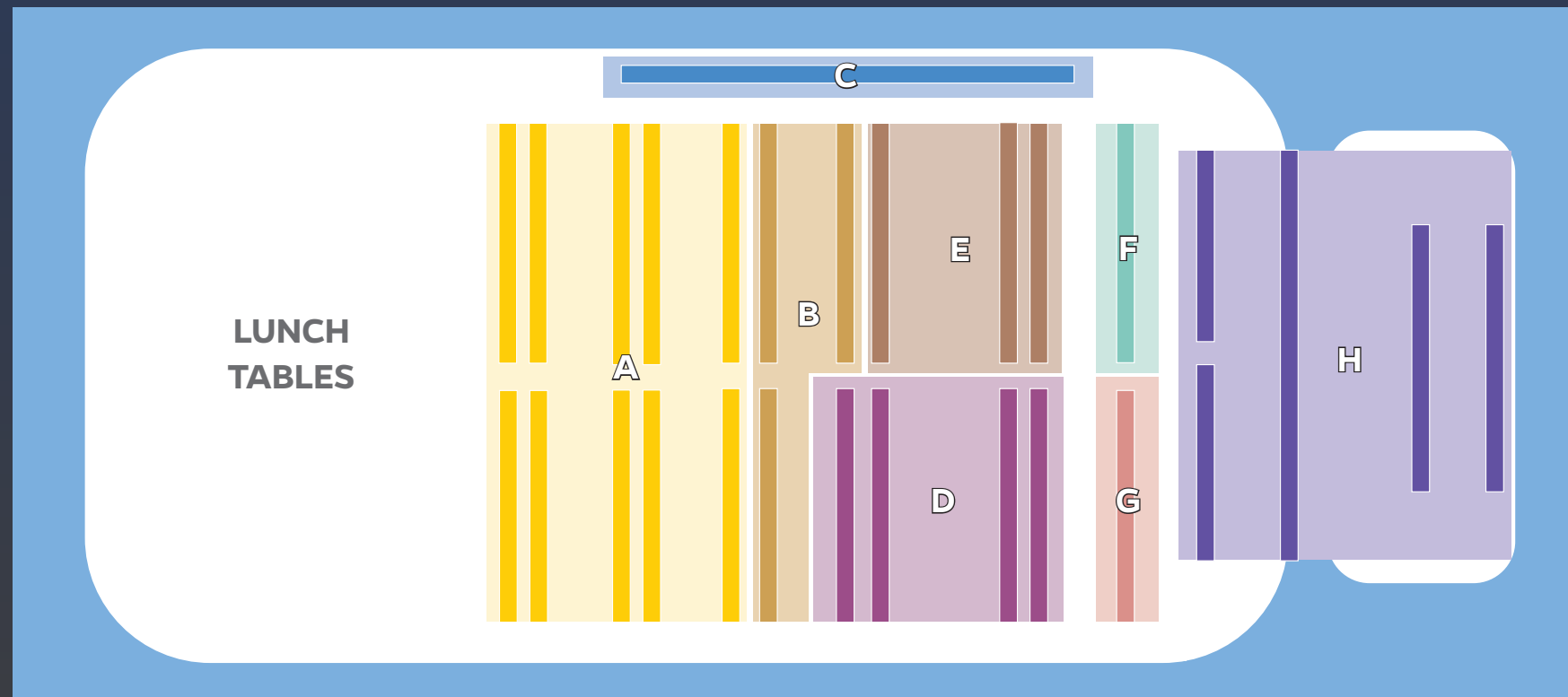
research and teaching are deeply interdisciplinary and targeted at solving some of the world's most challenging problems, ranging from the development of new therapies to conquer cancer, to the creation of Earth-friendly biofuels and other sources of energy, to the design of molecular electronics, and more. 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 will include the Process Design course's acrolein production process and the Product Design courses' innovative group projects such as sustainable nanotech, biomarker detection kits, and new types of antibacterial consumer goods.



**Athletic Center overview**



**Bob Scott Gym—Poster Session directory (subject to change)**



**Poster displays by department starting from lunch tables**

- A** Biomedical Engineering
- B** Chemical and Biomolecular Engineering
- C** Civil and Systems Engineering
- D** Computer Science
- E** Center for Leadership Education
- F** Applied Mathematics and Statistics
- G** Materials Science and Engineering
- H** Electrical and Computer Engineering

## THE DEPARTMENT OF CIVIL AND SYSTEMS ENGINEERING

prepares students to tackle the major complex challenges that will face society in the coming decades. As seniors, students are challenged to devise innovative and sustainable solutions to a variety of problems in the built environment. This year, our senior design teams focused on the redesign of the Glass Pavilion and portions of Levering Hall, integrating both structural and geotechnical engineering design involving the building's structure, with systems engineering design to improve transportation to/from the building and fresh food access for the Levering Kitchens via a green roof and connections to local urban farms. A route for an autonomous shuttle is included in the design to allow students to connect to volunteer and other activities in the surrounding Baltimore City urban environment. Student groups will present their designs to an audience and participate in the schoolwide poster session.



## 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 and Medicine. It draws upon the university's strengths in areas including robotics, speech and language processing, information security, machine learning, theory and programming languages, and computational health and medicine. Undergraduate and graduate students are immersed in interdisciplinary research that stresses fundamental problem solving. Projects this year include Quest2Learn, an augmented reality (AR) platform that allows students to learn lab skills and techniques in a safe, interactive, and affordable way, with highly realistic 3D models of lab equipment.





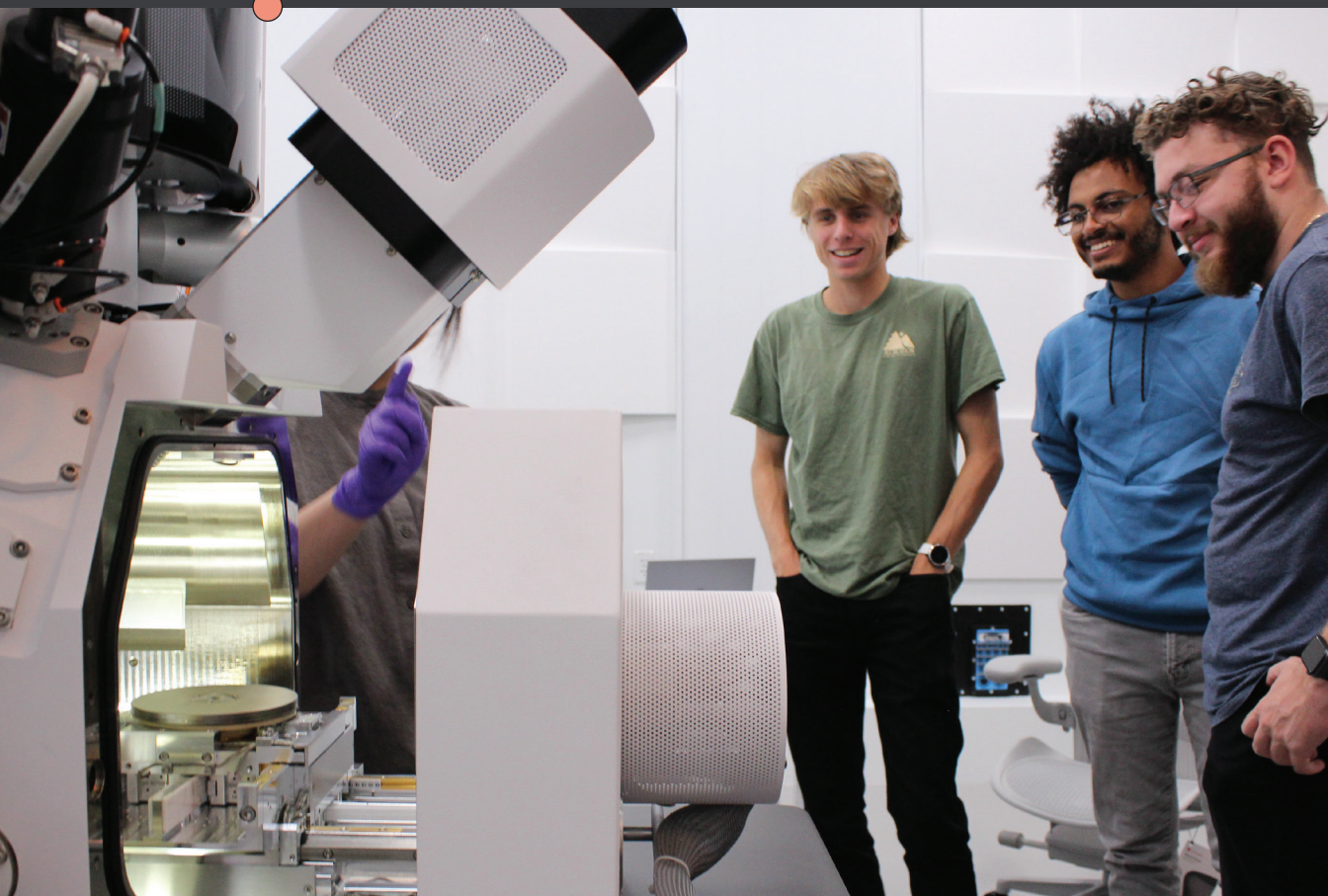
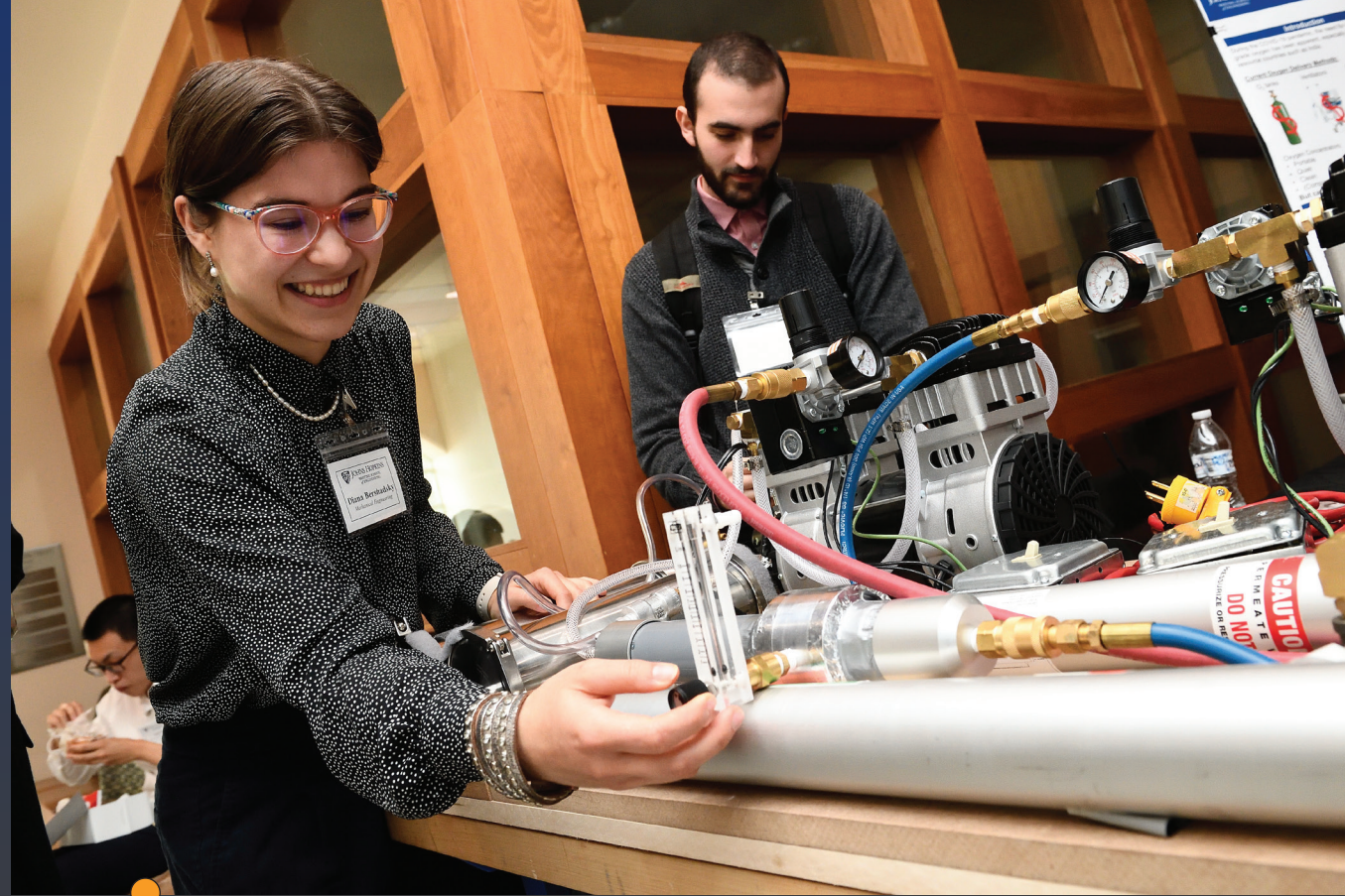
Research in **THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING** is widespread, spanning areas from medicine and defense to environmental protection. The department's world-renowned faculty members are pioneers in areas including medical imaging, speech and language processing, control and networking 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 wide range of projects, including a JHU BirdTracker, PulsApe EKG reading for chimpanzees, a robotic horse-shoe bat, and several projects involving solar cells and quantum dots.



## 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 design the layout for a wind farm in the Gulf of Mexico, including an ecological impact assessment, and design upgrades to road water crossings at Aberdeen Proving Grounds to improve resilience to climate change and sea level rise.

In **THE DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING**, undergraduate and graduate students are pushing boundaries to solve real-world problems. This year, we offer nine 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 bioprinting scaffolds for modeling cervical softening in pregnancy to microplastics and fabrics sourced from recycled materials. Through these projects, our faculty encourage students to apply the knowledge they have learned in the classroom to create materials that will improve society.



**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 an electric-powered boat to a strong-but-light floor panel for next-generation military helicopters.

# 2023 Johns Hopkins Engineering Design Partners

Adventist HealthCare  
American Society of Naval Engineers  
Aravind Eye Hospital  
Bill & Melinda Gates Foundation  
Blind Industries and Services of Maryland  
Collegiate Wind Competition  
C.R. Dyer '84 Summer Design Award  
Hogan Lovells  
Johns Hopkins Applied Physics Laboratory  
MedStar Union Memorial Hospital  
Nihon Kohden  
Office of the Undersecretary of Defense  
OrthoPediatrics  
Sandia National Laboratories  
Space Telescope Science Institute  
Stanley Black & Decker  
University of Maryland Medical Center  
VentureWell



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