

Mechanical Engineering Master's Program Info Session

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Director of Master's Studies

Mike Bernard

Academic Program Manager



MSE Degree Requirements

Section A - 8 advisor-approved courses

- 2 must be applied math, numerical analysis, or computational
- 4 (all-course) or 3 (essay) must be 530.xxx or 535.xxx Mechanical Engineering
- No more than 2 from Engineering for Professionals
- No more than 4 from upper-undergrad level (xxx.4xx only)
- No independent research, graduate research, or special studies.

Section B – choose one

- 2 more courses (530.823 MSE Graduate Research can be one)
- Certain Center for Leadership Education courses can count.
- Master's Essay – Research or Co-Op

See Section 3.2 of the Master's Advising Manual

Master's Essay (Thesis) – Research

Conduct original research with world-renowned professors!

- 1. Complete 8-10 courses – 1st-4th semesters**
- 2. Identify a research advisor – 1st-2nd semester**
- 3. Conduct research – 2nd-4th semesters**
 - 6 total credits of 530.823 (equivalent of 2 courses);
 - Prepare and submit a master's essay that summarizes your research (approved by advisor + one other faculty “reader”)
 - There is no essay defense

Advantages of MSE Research Essay

- Become part of a research team and learn from a topic-area expert.
- Conduct research that might lead to papers and/or conference presentations.
- Improve your writing/presentation skills.
- Impress potential employers with your expertise.
- Improve chances of entering a PhD program (JHU or others).

Master's Essay (Thesis) – Co-Op

Immerse yourself in a co-operative work experience!

- 1. Complete 8-10 courses – 1st-2nd-3rd semesters**
- 2. Meet with the Industry Co-Op Program – 2nd-3rd semester**
- 3. Work – Last semester**

Advantages of MSE Co-Op Essay

- Get work experience
- Increase potential for continued employment
- Impress potential employers with your expertise.

Avery Barth will provide details today.

Frequently Asked Questions about MSE Essay

- **How do I find an advisor?**
 - Contact professors in your area of interest and inquire about master's research opportunities.
 - Contact the Director of Graduate Studies or the Academic Program Manager to inquire about potential advisors.
- **What kinds of research projects do Master's students do?**
 - There is significant flexibility on what constitutes a master's essay project, which is decided with your advisor.
 - For example, master's research may be a fundamental scientific investigation involving theory, experiments, computational modeling, or it may involve experimental design and/or testing of a device.
- **How long is the Master's Essay?**
 - There is no recommended length. The essay is a summary of your project and is approved by your advisor and one other reader. Your advisor will usually guide you in the writing of your essay.
- **Research can sometimes be open-ended. What if I cannot achieve my research objectives even after 6 credits of research? Will that delay my graduation?**
 - No! The MS essay is written, submitted and approved at the end of 6 credits of MSE research. As long as your advisor is satisfied that your research effort was appropriate and you prepare an approved essay, you are done.
- **I am thinking of joining the 5th-Year Master's program. Can I do an essay and finish in one year?**
 - Yes! Talk to potential advisors early in your Junior and Senior years so that you can start planning your essay right away.
- **Is there funding available for Master's students who conduct research?**
 - Most MS research is unfunded, but some advisors might have funding available.



**Best of luck
to you this year!**



Questions?



Industry Co-Op Program For Master Of Science In Engineering Students

Luke Thorstenson, Senior Director Strategic Initiatives

Avery Barth, Program Manager

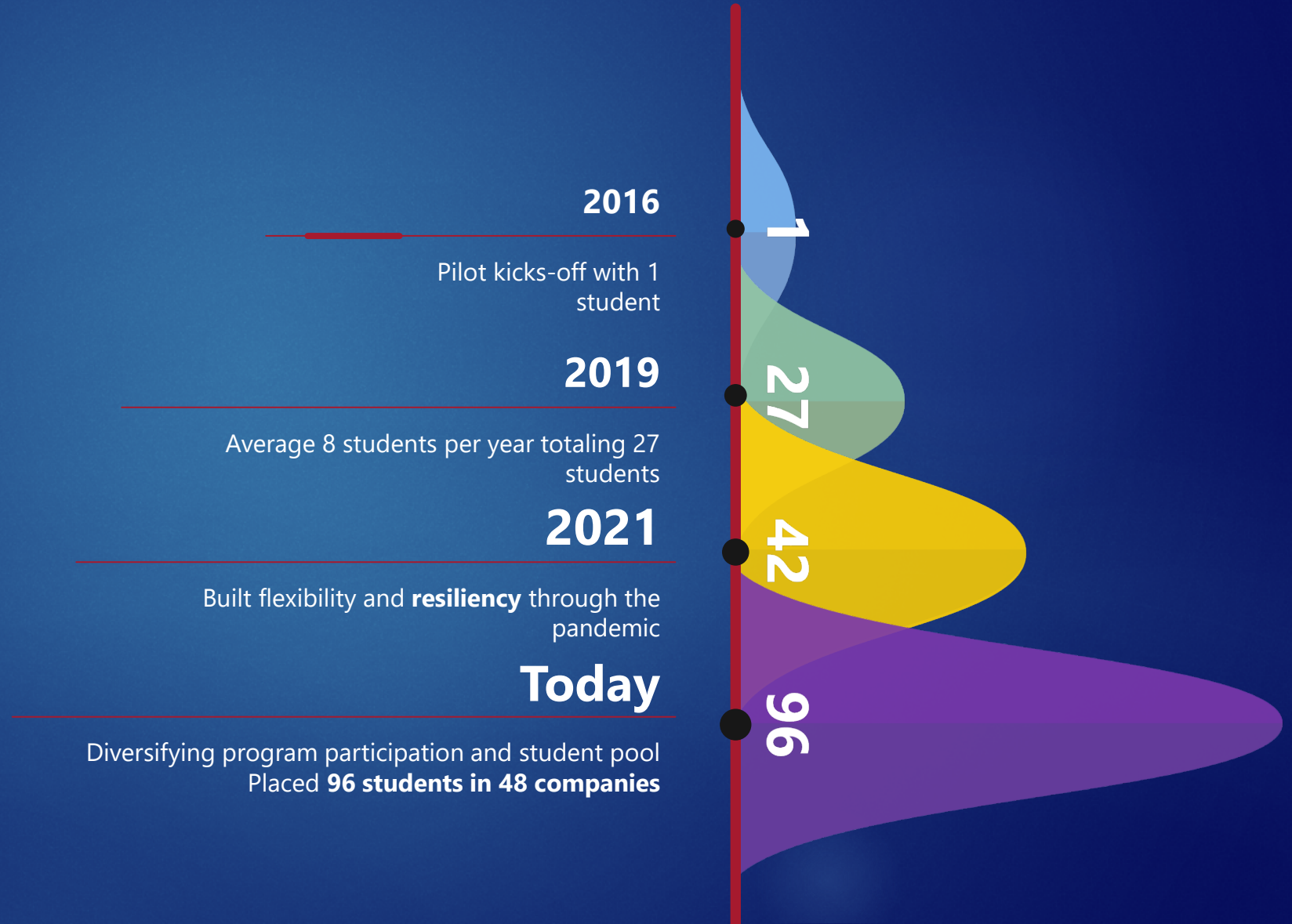
Our History

In Total

96
Students



48
Corporate
Partners



What to Expect

The prime objective of the Co-Op program is to broaden the experiential and integrative learning for Master of Science and Engineering (MSE) students and provide them with industrial exposure and experience.

The Co-Op assignment will take the place of the research requirement as defined by the academic departments.

The Co-Op is currently only offered to Materials Science & Engineering, Chemical & Biomolecular Engineering and Mechanical Engineering programs.

The Co-Op assignment is six months, either January-June or July-December.

Longer assignments and extensions can be discussed on a case-by-case basis.

The company will provide a project proposal and expected deliverables for the student's tenure.

The assignment will be technical in nature and relevant to the student's area of study.

The company will retain any IP rights resulting from the student's work and appropriate CDA/NDA will be in place.

The company will have the opportunity to remove proprietary information from the final essay.

The student will work full-time and be paid a competitive salary.

Applying to the Co-Op Program

The application package will include a **cover letter, resume, and two professional recommendations.**

- BS-MSE students can participate the first semester after BS graduations.
- Incoming MSE students need to have at least one semester residency prior to Co-Op assignment.
- International students need to have 1 full year of JHU residency before the Co-Op.

Candidates will be interviewed by INBT staff.

If necessary, INBT staff will help students apply to and interview for co-op positions.

Once they secure a position, Co-Op students will identify a corporate mentor and faculty advisor and sign an agreement to the terms of their co-op.

Summer-Fall 2025 Timeline



Mentoring



The student will find a JHU faculty advisor, within their home department, that has experience with the company's research area.

Students will also have a corporate mentor at the sponsoring company.

The student's industry research mentor and faculty advisor will jointly evaluate the student's performance.

The student will be expected to:

- Submit progress reports in a review meeting (or call/zoom/skype) every 6 weeks.
- Submit a final essay subject to agreement between Hopkins and the company.

The essay will be evaluated and approved by their faculty advisor and one other person, typically another faculty member from the student's home department.

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FORWARD ROBOTICS

REGENERON

Biogen

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BAC

Annapolis
Micro Systems

HARTING

lumafield

c.care

Homewood Policies

International students must apply for Curricular Practical Training (CPT) to do the Co-Op.

- Students must complete at least one academic year (Fall & Spring) before they are eligible for CPT.
- The application for CPT should be submitted at least **two weeks** before the desired employment start date. Authorization will not be granted for training that has started before approval.

All students must apply for Non-resident (NR) status before starting the Co-Op.

- Students cannot be registered in classes while in Non-resident status.
- In this status, the student is responsible for the NR tuition (10% of standard tuition) and health insurance costs.
- Students should apply for NR status at least **two weeks** before the start of the semester in which they will do the CO-OP.
- Students need to submit the Non-resident application to the academic contact in their department.

Frequently Asked Questions

When are applications due?

October 1, 2025 for the January-June 2026 cohort. However, some companies have different application deadlines for their co-op programs, so it's a good idea to start looking into and applying to co-op positions as soon as you know when and where you want to co-op.

Can I take classes during the Co-Op?

No. Students participating in the Co-Op must apply for non-resident status through their department and pay 10% of standard tuition for the spring or fall semester while they work.

What if I'm not a U.S. citizen, will companies hire me?

Yes. At least half of the students who have completed the program have been international students. International students must apply for CPT (Curricular Practical Training).

How will I know this program is comparable to a traditional research master's?

Your faculty advisor will meet with you and your corporate mentor regularly to ensure that you are on the right track for master's level research. The faculty advisor is responsible for signing off on your final essay.

How does the program fit into the course schedule for master's degrees?

This depends on which MSE program you belong to and how you structure your courseload. Talk to your advisor about how you want to fulfill your degree requirements.

What if the company I want to co-op for is worried about the confidentiality of their research?

Many INBT Master's Co-Op alumni have completed their essay requirements despite their research being proprietary and/or confidential. There are many tools that can protect proprietary information in student essays, including obscuring details, requiring faculty assessors to sign an NDA, and placing the essay on a publication embargo.

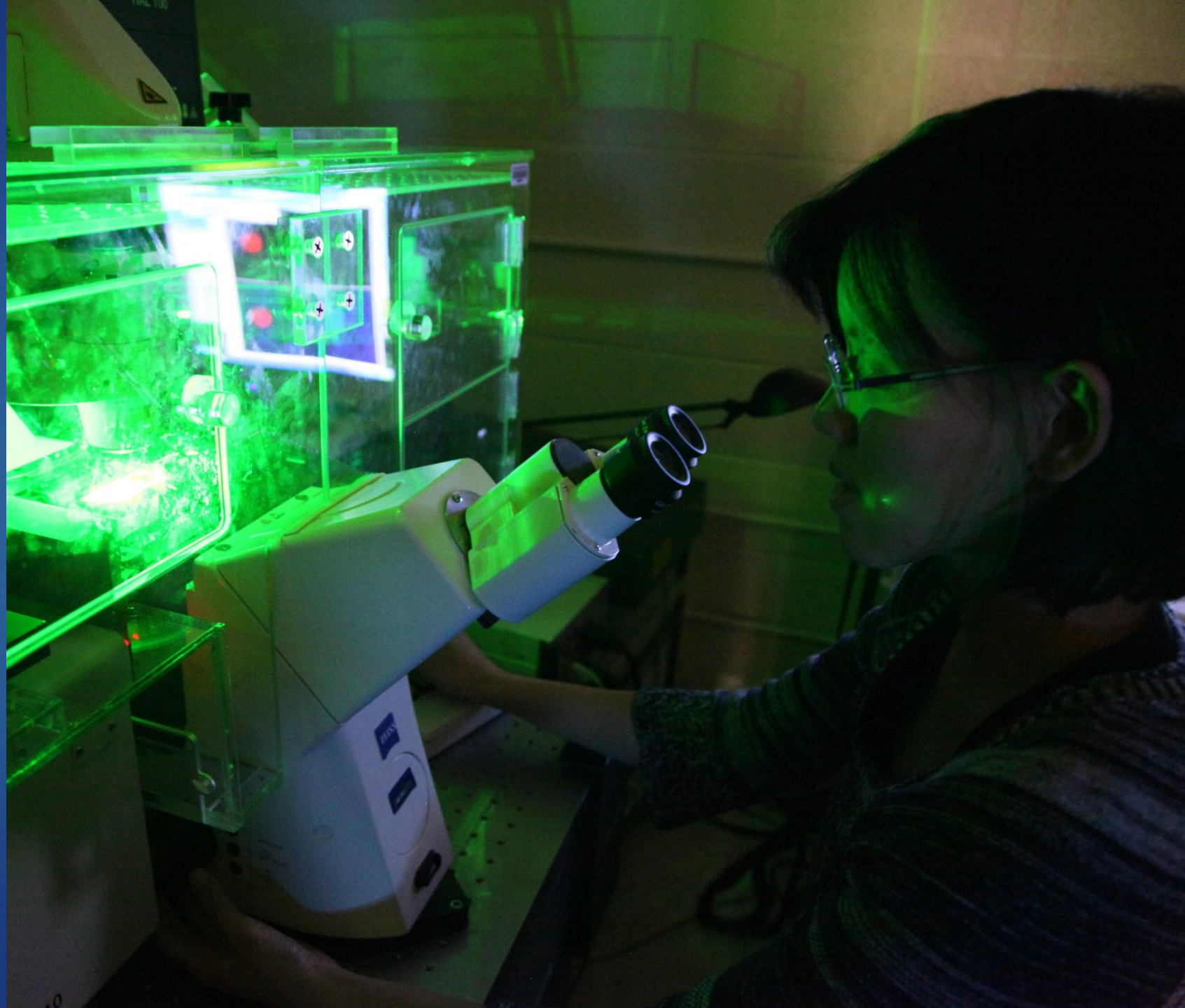
For More Information

Visit our website:

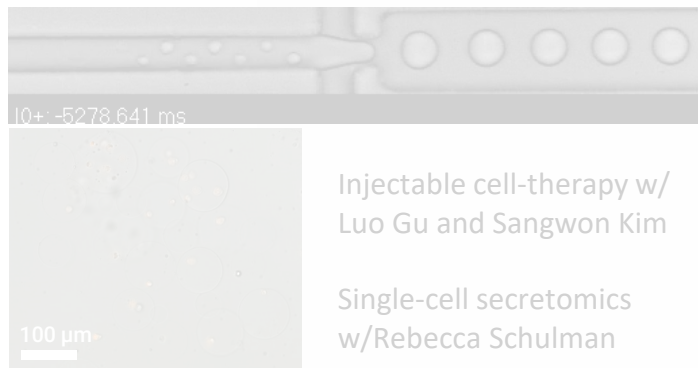
inbt.jhu.edu/masters/

Email us at:

inbtco-op@jh.edu



Cell encapsulation in functional gel



Injectable cell-therapy w/
Luo Gu and Sangwon Kim

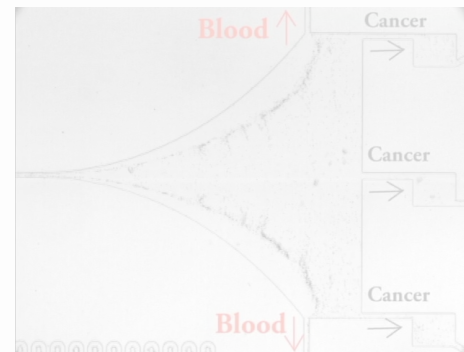
Single-cell secretomics
w/Rebecca Schulman

Pumpless flow control



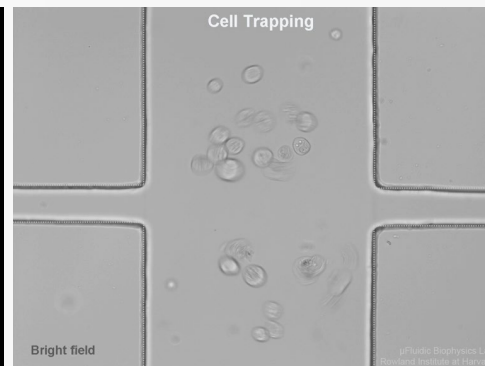
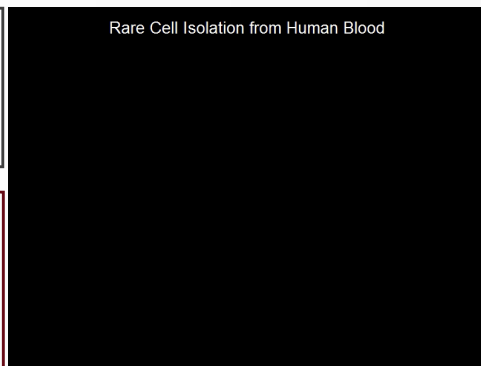
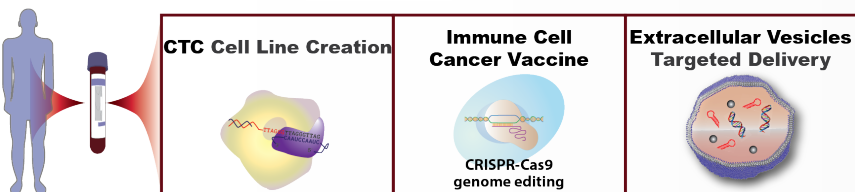
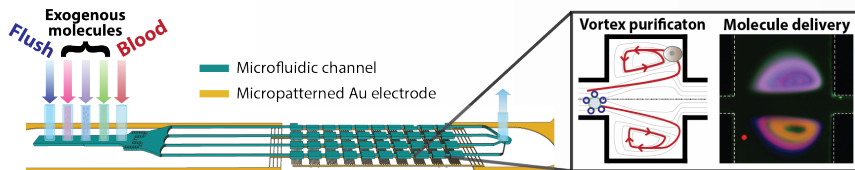
POC diagnostics
w/ Jamie Spangler and Netz Arroyo

Label-free cell sorting



Retina transplantation w/ Don Zack

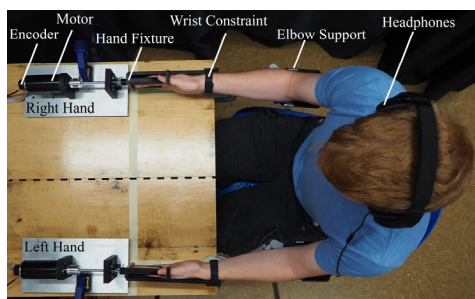
Vortex-mediated multi-molecular delivery



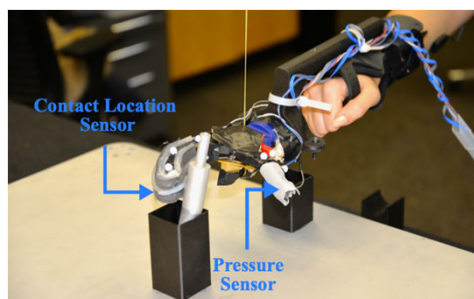
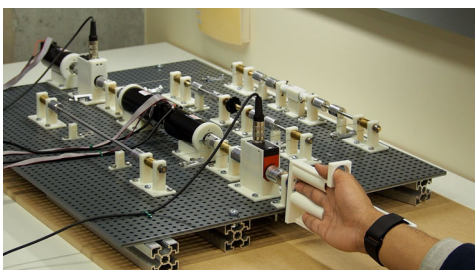


Haptic and Medical Robotics (HAMR) Lab

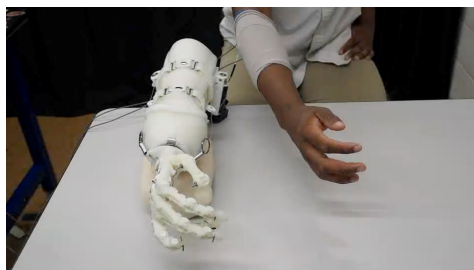
Extending the current knowledge surrounding the human perception of touch, especially as it relates to applications of human/robot interaction and collaboration



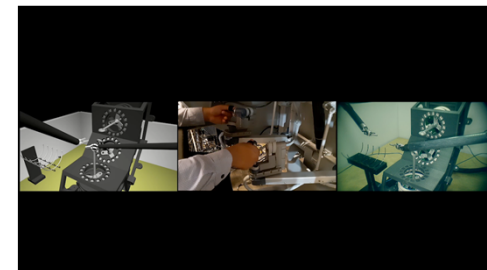
Fundamental Haptic Perception in Haptic and Telerobotic Devices

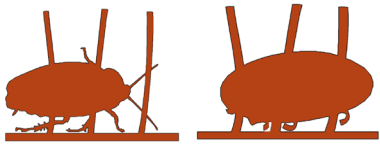


Haptic Shared Control for Upper-Extremity Prostheses



Haptic Feedback and Skill Assessment for Robotic Surgery





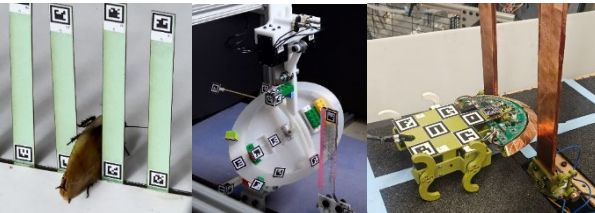
Terradynamics Lab

Movement Science at the Interface of Biology, Robotics, & Physics

<https://li.me.jhu.edu>, chen.li@jhu.edu

We study how the mechanics and dynamics of interaction with complex terrain shape animals' movement, morphology, sensing, control, planning, and predator-prey interaction strategies, and how to use principled understanding of this "terraddynamics" to improve the performance and functions of bio-inspired robots in the complex, 3-D, real world.

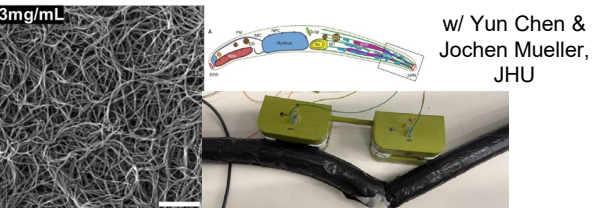
Insects and legged robot sensing force to traverse cluttered terrain



Fishes and fish robot crawling on mud



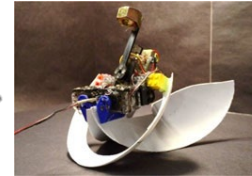
Cell robot going through model tissue to understand how to treat disease



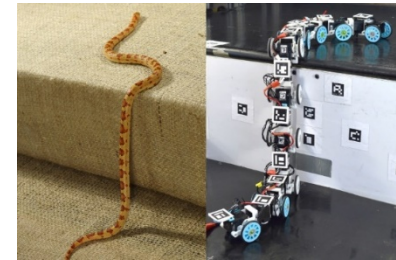
Vine robot growing into packed rubble



Animal and robot self-righting after flipping over



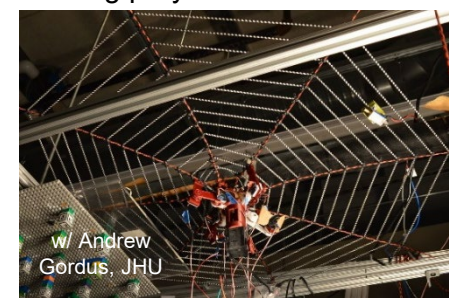
Snake and snake robot traversing uneven terrain



Animals and robots climbing on steep terrain

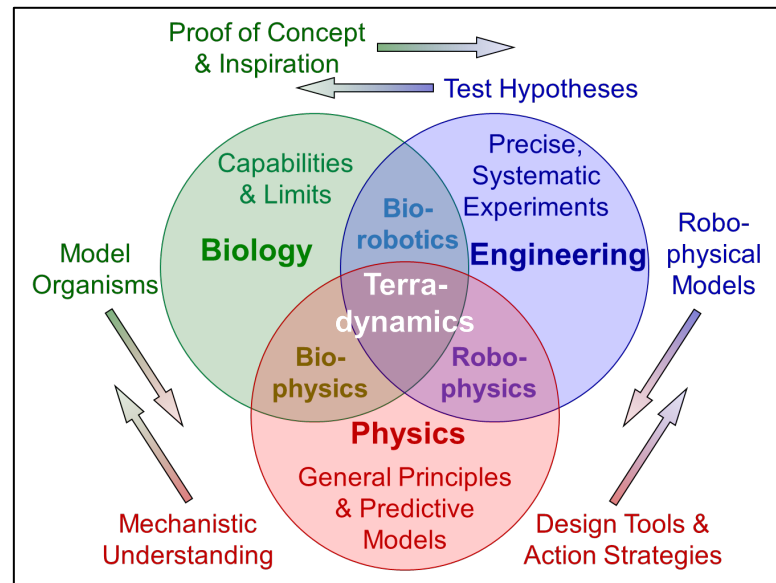
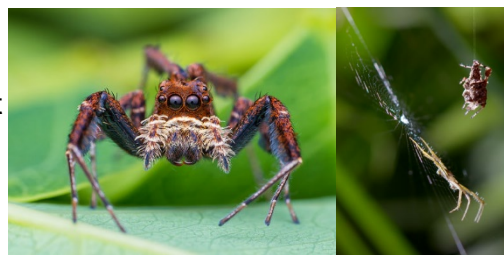


Robotic modeling of web spider sensing prey via web vibrations



Jumping spider stalking web spider in forest environment

w/ Malcolm MacIver at Northwestern, Ximena Nelson at Canterbury, Daiqin Li at Hubei

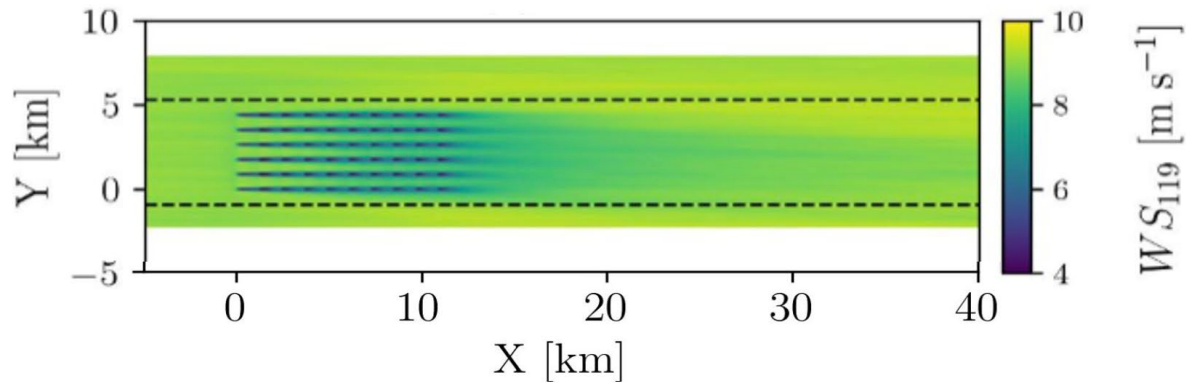


Student Mentee Achievements

- Have mentored 120+ students at JHU (from PhD to high school)
- 50% master, undergraduate, and high school students have earned co-authorship on conference abstracts, 20% on peer-reviewed papers
- 50% have continued onto top PhD, master, or undergraduate programs (MIT, Standord, Princeton, Berkeley, UPenn, JHU, CMU, Northwestern, UMichigan, UW, Virginia Tech, Columbia, etc.)
- 20% have continued on to top tech companies (Google, Facebook, Amazon, Agility Robotics, etc.)
- >10% of my mentees have won competitive research awards in the department, at local events, and from other universities
 - 5 PhD, 1 master, and 1 undergraduate students won best paper award finalists
 - 1 undergrad won competitive summer research scholarship
 - 5 undergrads won 8 competitive ME departmental research & scholarly and outstanding achievement awards
 - 1 high school student won 2 competitive awards at Science Fair

Learn more: <https://li.me.jhu.edu/mentoring/>, <https://li.me.jhu.edu/join/>

Lundquist Lab: Atmospheric Science & Wind Energy



Turbine-resolving large-eddy simulations



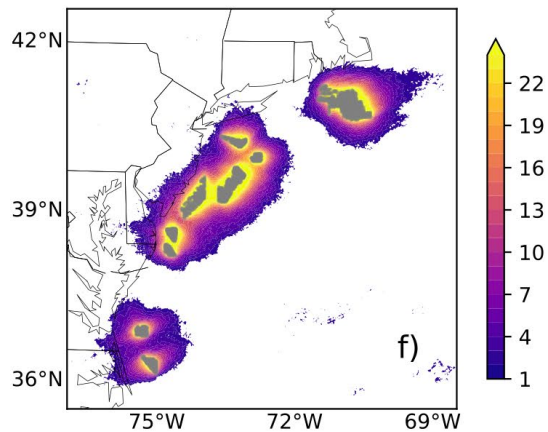
Lidar at
Perdigão
in Portugal

View of AWAKEN wind plants from D-ILAB



scanning lidar in Baltimore
(Harbor East), Sept 2025+

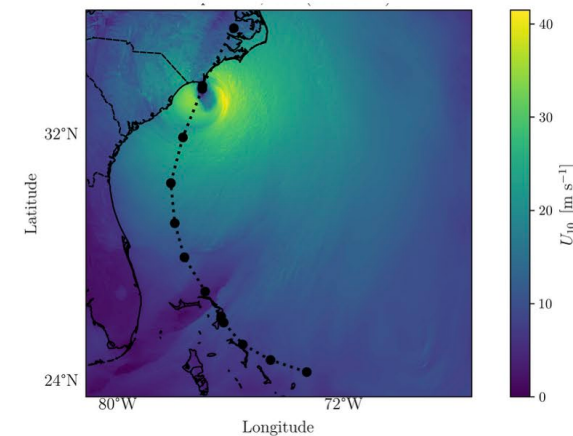
In situ, airborne, ground-based, and remote sensing boundary layer measurements



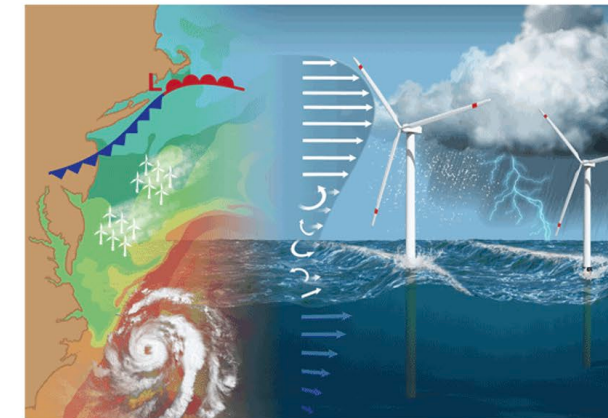
Mesoscale simulations of
wind farm dynamics



Interactions of wind
turbines with lightning



Interactions of wind turbines
with tropical cyclones



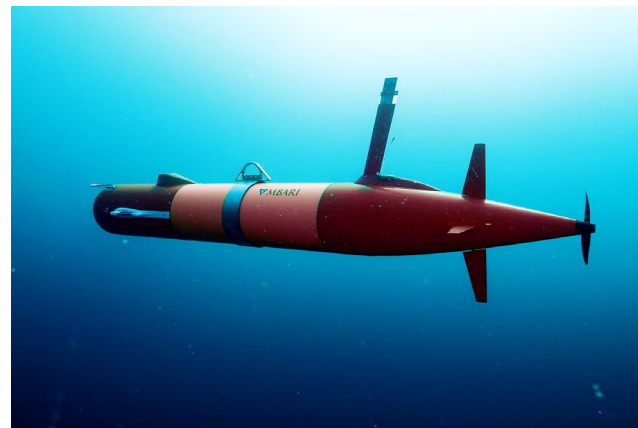
Marine atmospheric
boundary layer dynamics

Exploration Robotics Lab – Dr. James Bellingham

The Exploration Robotics Lab conducts research in developing safe and reliable robotic systems for operation in extreme environments.

Current areas of research include:

- Collaborative AUV fleets
- LLMs for vehicle fault detection
- AUV simulation
- UUV docking and towing



Open M.S. Research Positions

USV + UUV Towing & Docking Simulation

Develop model of USV-UUV system to assess vehicle towing dynamics, docking maneuvers, and system controllability in variable sea states.

USV System Design

Systems design of a towed USV, including initial mechanical design, sensor and communications components selection, power budget development, concept of operations development, and subsystem prototyping.

UUV Docking Mechanism Design Engineer

Design, manufacture, and proof-of-concept testing of a UUV docking mechanism

UUV AI Reliability

Leverage LLMs to identify, interpret, and mitigate faults within the USV–UUV towing and docking system.

For additional information, contact jbellingham@jhu.edu