

Mechanical Engineering Master's Program Info Session

Prof. Rajat Mittal

Director of Master's Studies

Mike Bernard

Academic Program Manager



Degree Requirements



Department of Mechanical Engineering

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:

- 2-4 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 / Internship

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.

Mr. Luke Thorstenson 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 Bachelor's/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 to plan 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.



Co-Op / Internships



Department of Mechanical Engineering



JOHNS HOPKINS

WHITING SCHOOL
of ENGINEERING

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

Luke Thorstenson, Senior Director Strategic Initiatives



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 assignment is six months, January-June and July-December schedule
- The company will provide a project proposal and expected deliverables for the student's tenure
- The company will retain any IP rights resulting from the student's work and appropriate CDA/NDA will be in place
- The student will be paid a competitive salary

Admissions

- The application package will include a **cover letter, resume, and two professional recommendations.**
 - BS-MS students can apply their 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.
- Applications will be reviewed by a committee consisting of INBT representatives.
- Candidates will be interviewed.
 - INBT staff will provide feedback and support to improve resume and cover letter
- Selected applications will be forwarded to participating companies who will make the final selection.
- Students are encouraged to apply to positions on their own, especially for fields or companies not listed on our website.

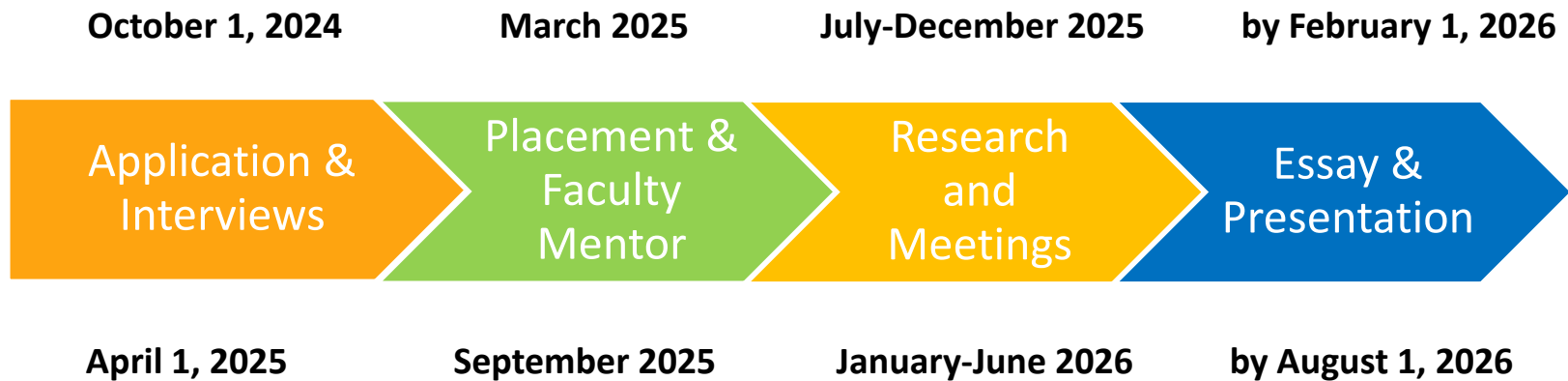
Mentoring

- The student will find a JHU faculty advisor, within their home department, that has experience with the company's research area.
- Students are assigned a research 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/presentation subject to agreement between Hopkins and the company.
 - The essay is expected to be comparable to the Master's Essay.

Corporate Partners



Sample Timeline



Research Projects



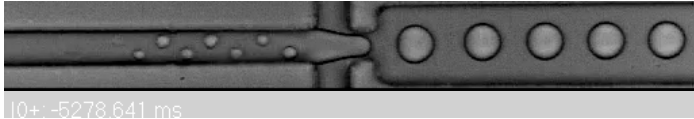
Department of Mechanical Engineering



JOHNS HOPKINS

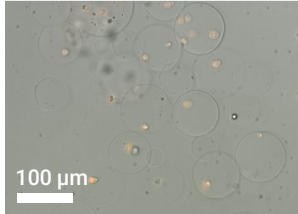
WHITING SCHOOL
of ENGINEERING

Cell encapsulation in functional gel

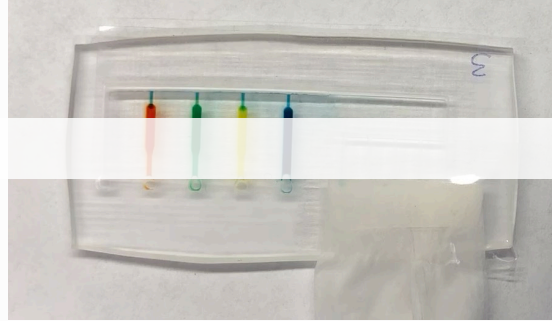


Injectable cell-therapy w/
Luo Gu and Sangwon Kim

Single-cell secretomics
w/Rebecca Schulman

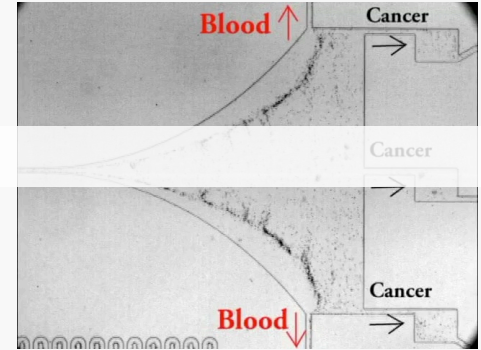


Pumpless flow control



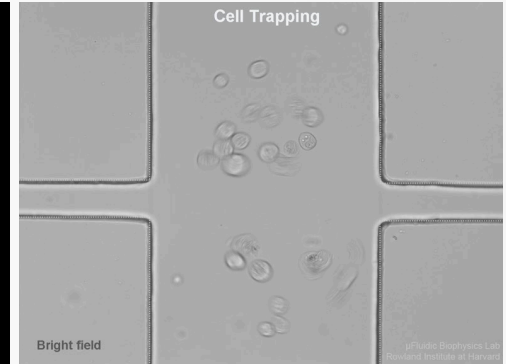
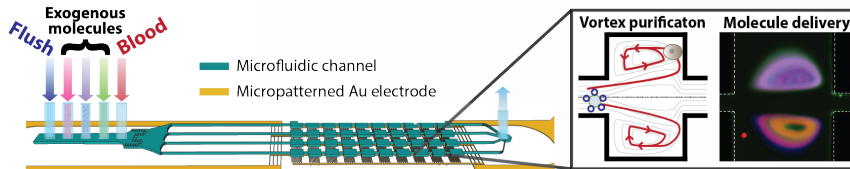
POC diagnostics
w/ Jamie Spangler and Netz Arroyo

Label-free cell sorting



Retina transplantation w/ Don Zack

Vortex-mediated multi-molecular delivery



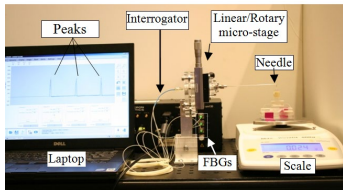
	CTC Cell Line Creation 	Immune Cell Cancer Vaccine <p>CRISPR-Cas9 genome editing</p>	Extracellular Vesicles Targeted Delivery
--	-----------------------------------	--	---

AMIRo Profile

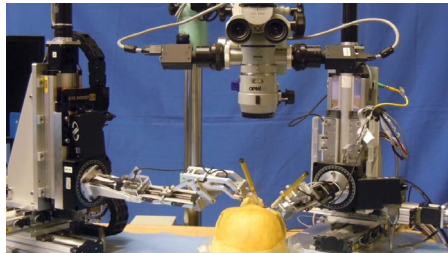
The **Advanced Medical Instrumentation and Robotics Research Laboratory (AMIRo)** conducts *research to aid and support the robotic assisted medical technology* encompassing medical diagnosis and therapy, and clinical research. The *main goal* is to create the *future medical robots and devices* that will *help clinicians to deliver earlier diagnosis and less invasive treatments at lower cost and in shorter time.*



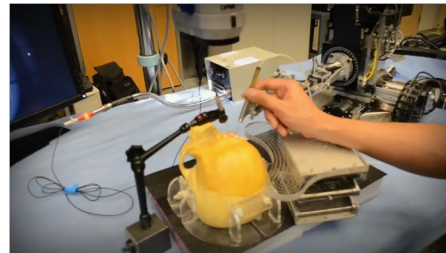
MRI-guided Robot for Percutaneous Interventions



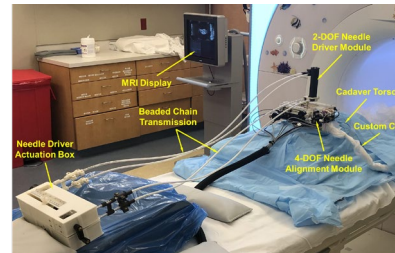
Real-Time Shape Sensing-Based Flexible Needle



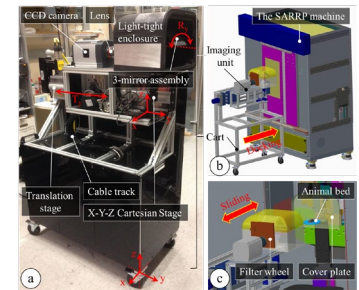
Robot-Assisted Retinal Surgery



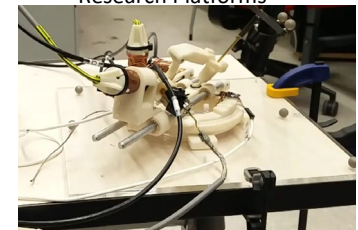
Force-sensing Tools for Retinal Surgery



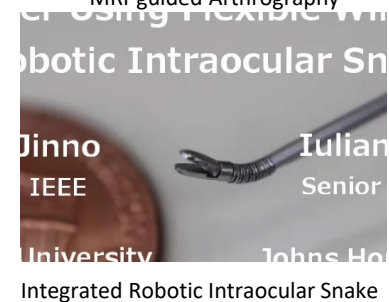
Robot for MRI-guided Lower Back Pain Relief Injections



Small Animal Research Platforms



Shoulder-mounted Robot for MRI-guided Arthrography

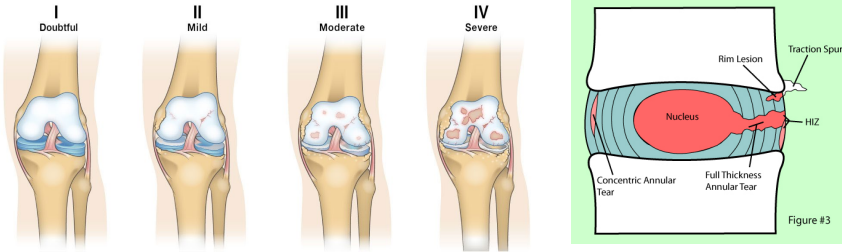


<https://amiro.lcsr.jhu.edu/>

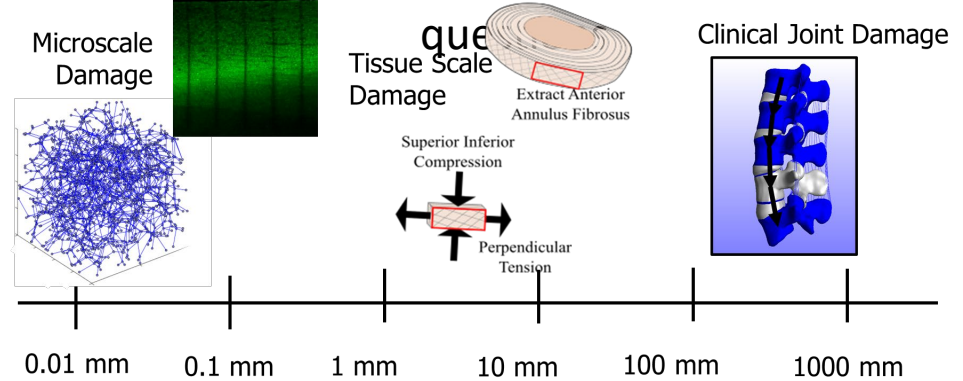
Understanding the Mechanics Associated with Arthritis and Pain

Jill Middendorf
jmidden1@jhu.edu

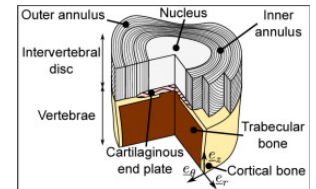
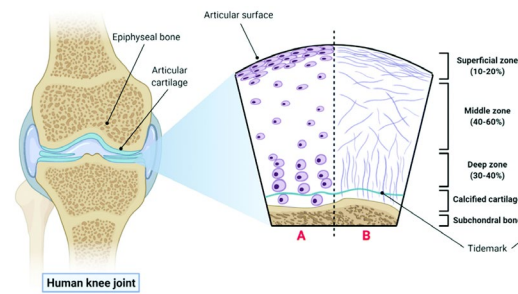
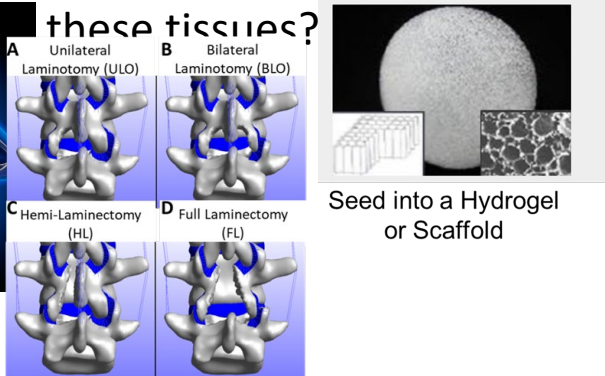
Why does cartilage, ligaments, and the intervertebral disc degenerate?



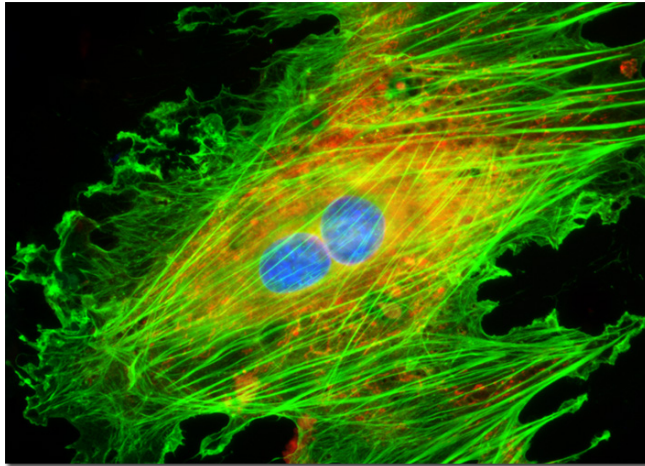
Multiscale experimental and computational mechanics approach to answer these



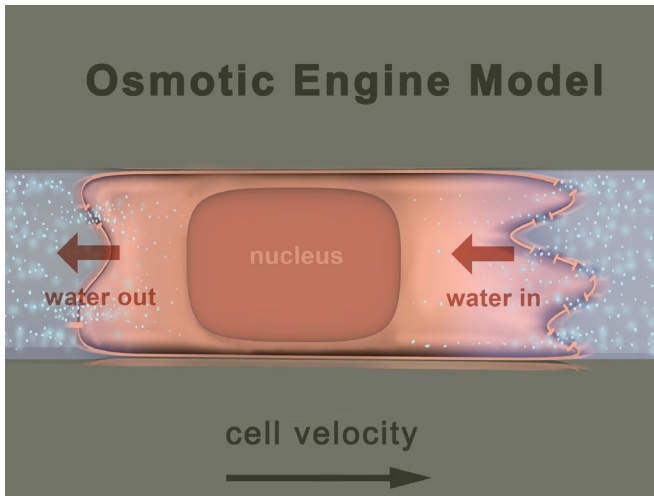
How can we treat and repair these tissues?



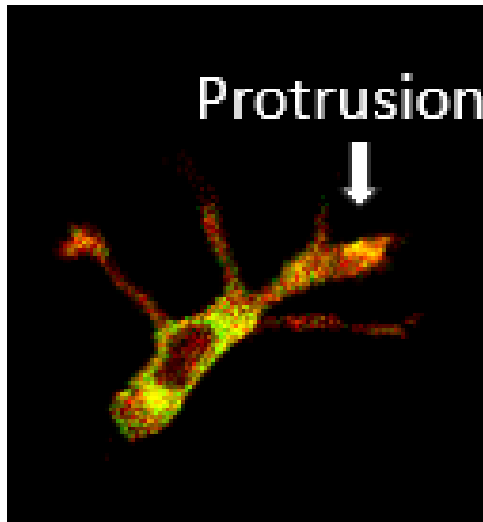
Mechanobiology of the Cell: Sun Cell Mechanics Lab



Cytoskeleton dynamics and cell movement.

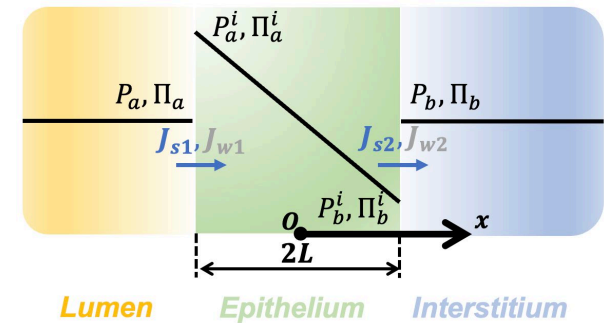
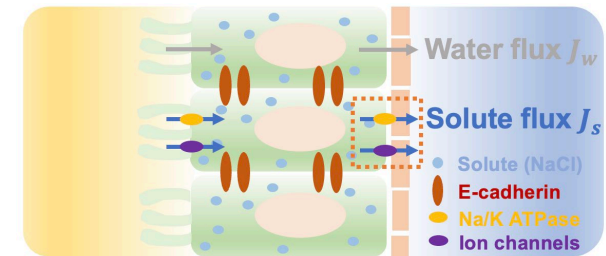


Cell shape and osmotic engine model of cell migration



Cell electromechanics and cancer metastasis

Sun's lab is interested in how forces are generated at the molecular scale and the application of mechanical theory in cells. Some systems of interest are cell size regulation, cell mechanics, cell movement, and cancer mechanobiology. Primary tools are microfluidics, microscopy, biochemistry, gene editing, AI and computational modeling and simulations. We are interested in fundamental principles as well as mechanistic explanations.



Computational model of fluid flow in cells and tissues

For further information, contact Sean Sun

ssun@jhu.edu

<https://www.suncellmechanics.org>

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



**Prof. Rajat Mittal,
Director of Master's Studies**
mittal@jhu.edu

**Mike Bernard,
Academic Program Manager**
me-academic@jhu.edu

Department of Mechanical Engineering