Cell mechanobiology topics including cell structure, mechanical models, and chemo-mechanical signaling. Review and apply methods for controlling and analyzing the biomechanics of cells using traction force microscopy, AFM, micropatterning and cell stimulation. Practice and theory for the design and application of methods for quantitative cell mechanobiology. Weekly lecture and hands-on laboratory sessions.

Website: Coursework

Attendance: mandatory at all labs, makeup sessions will not be available

Homework: Homework assignments due as specified

Location: Shriram 114

Enrollment: By permission of instructor. Limited enrollment by laboratory constraints.

Prerequisites: The course is structured to be accessible to graduate students in life sciences who have a strong physics and math background and engineering graduate students with basic biology knowledge. All students must signup via Axess STARS and complete the following safety trainings, then send a screenshot of your certifications from Axess STARS to Sasha > 1 day before the first lab

- General Safety and Emergency Preparedness (EHS-4200)
- Compressed Gas Safety (EHS-2200)
- Life Sciences Research Laboratory Safety Training (EHS-4875)
- Bloodborne Pathogens Safety Training (EHS-PROG-1600)
- Biosafety (EHS-1500)

Credit: 3 units. This is a 3-unit lab and lecture course with 80 min lecture Tuesdays 3-4:20pm and Thursdays 1:30-5:50.

Instructors: Office: Office Hours:
Prof. Beth Pruitt 520-228 after lecture or by appointment, pruitt@stanford.edu
Dr. Alexandre Ribeiro 520-258 after lecture or by appointment, aribeiro@stanford.edu

Lab Instructors: Office: Office Hours:
Sasha Denisin 520-259 after lab or by appointment, adenisin@stanford.edu
Robin Wilson 520-259 after lab or by appointment, robin2@stanford.edu

Required Text:
Jacobs, Introduction to Cell Biomechanics and Mechanobiology, Garland Science

Recommended Reference Texts:
Barker, At the Bench
Philips, Physical Biology of the Cell
Howard, Mechanics of Motor Proteins

Learning Objectives. By the end of the class students should be able to:
- Describe elements of cells which govern cell mechanical properties and force generation
- Catalog features of cell measurement methods and describe advantages and disadvantages of each
- Model cell mechanics using standard material models and force-balance equations
- Measure cell and material mechanical properties
- Measure displacements produced by cells and analyze forces using traction force analysis methods
- Define an open research problem in the context of the literature and propose appropriate methods to test a mechanobiology hypothesis
• Develop a clear and concise research proposal including synthesis of prior art, aims, hypotheses and methods

**Grading:**
*Participation and Discussion of Readings: 10%*
*Homework including pre- and post- lab analyses: 60%*
*Research Proposal and Critiques: 30%* Work in teams to compile and present a short proposal to test a mechano-biological hypothesis. Provide critical review of other team’s proposals.

**Honor Code:** Please review Stanford’s honor code:

Collaboration and discussion are encouraged on lab and project components, however:

1. Do not copy or paraphrase any source, including from a labmate, paper, or work you have done that is not associated with this class. All written work presented for this class must be original work for this class.
2. Properly reference all figures or ideas taken from another source (literature, web, personal communication, etc.)
3. You are welcome to discuss readings and laboratory materials with other students, but do not share written work unless a group deliverable is specified.

**Students with documented disabilities:** Students who may need an academic accommodation based on the impact of a disability must initiate the request with the Student Disability Resource Center (SDRC) located within the Office of Accessible Education (OAE). SDRC staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an Accommodation Letter for faculty dated in the current quarter in which the request is being made. Students should contact the SDRC as soon as possible since timely notice is needed to coordinate accommodations. The OAE is located at 563 Salvatierra Walk (phone: 723-1066, 723-1067 TTY).