The Integrated Mechanobiology of Plants and Animals
CAMB 711 - Fall 2020

Each class session will include a 20 min discussion period and a 1 hr lecture
Questions for discussion will be pre-assigned; students must submit their answers in advance (by 9pm CST/10pm EST the previous day).

Module 1- Preparatory lectures (these will be recorded as background/review lectures)

Sept 1:
- Course introduction
- ***Pre-recorded lecture Basic biochemistry (structure of proteins, lipids, CHO), including concepts of scale (Paul Janmey - Penn)

Sept 3:
- Basic cell structure/anatomy (similarities and differences) of plant and animal cells, including concepts of scale (Ram Dixit - Wash U)

Sept. 8:
- Introductory concepts in mechanics; include time and length scales (Anders Carlsson – Wash U)

Sept. 10:
- Animal ECM and plant cell walls (key components, structure-property-function relationships, connections to solid mechanics and concepts of stress, strain, and modulus, matrix piezoelectricity) (Rebecca Wells - Penn and Marcus Foston – Wash U)

Module 2- Basic cell biology and mechanics

Sept. 15:
- Membrane trafficking and vesicle transport (Charlie Anderson – Penn State)

Sept. 17:
- Cytoskeleton (Mike Ostap – Penn)

Sept. 22:
- Motor proteins (Yale E. Goldman – Penn)

Sept. 24:
- Solid mechanics, fluid mechanics, and diffusion (Guy Genin – Wash U)

Sept. 29:
- Membrane physiology and ion channels, electrophysiology (Liz Haswell – Wash U)

Oct. 1:
- Mechanical properties of biological materials (Vivek Shenoy – Penn)
**Oct 6:**
- Journal Club

**Module 3: Tissue and nuclear mechanics**

Oct 8 (tentative):
- Adhesion receptors and signal transduction (Rick Assoian - Penn)

Oct. 13 (tentative):
- Tissue structure and mechanics in plants and animals (Paul Janmey - Penn and Siobhan Braybrook – UCLA)

Oct. 15:
- Statistical Mechanics (Guy Genin – Wash U)

Oct. 20: *** Pre-recorded
- The nucleus and chromatin structure (include lamins/nuclear membrane, chromosome territories, etc; including connections to polymer physics and nuclear mechanics) (Melike Lakadamyali - Penn)

Oct. 22:
- Nuclear Mechanics (Dennis Discher - Penn)

Oct. 27:
- Journal Club

Oct. 29
- Review Session

Nov. 3: OFF

Nov. 5:
- EXAM 1

**Module 4: Integrating biology and mechanics – big questions**

Nov. 10:
- Memory, the nucleus, and the ECM (Rob Mauck – Penn)

Nov. 12:
- Discussion: cell wall polymers, mechanics, and assays (Dan Cosgrove – Penn State)

Nov. 17:
- Integrating biology and mechanics through materials (Jason Burdick – Penn)

Nov. 19:
- Cell migration and movement (including at tissue and intercellular level) (Amit Pathak – Wash U)
Nov. 24- No class

Nov 26- Thanksgiving Holiday

Dec 1:
- Mechanical deformations of membranes (Ravi Radhakrishnan - Penn)

Dec 3:
- Journal Club

Dec 8:
- Final project prep

**FINAL PROJECT PRESENTATIONS** (Wells/Genin) – dates to be determined depending on site requirements/restrictions

25% for daily discussion submissions (genuine attempt, not necessarily right answer)
25% for journal club participation; students must submit written comments in advance, and participate during the class session
25% mid-term exam
25% final presentations

Live lectures via Zoom, recorded and posted.
Mid-term exam on Canvas (1 attempt within 24-hr window)
Daily discussion and journal club written submissions will be via Google docs