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