The Integrated Mechanobiology of Plants and Animals  
Fall 2021

Tuesdays/Thursday 11:00-12:20 ET; 10:00-11:20 CT; 8:00-9:20 PT

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 ET the previous day).

Module 1- Introduction

August 31:
- Course introduction
- Basic biochemistry (Paul Janmey - Penn)

Sept 2:
- Basic cell structure/anatomy (similarities and differences) of plant and animal cells (Ram Dixit - WashU)

Sept. 7:
- Mechanics, force balances, and polymerization forces (Anders Carlsson – WashU)

Sept. 9:
- Animal ECM and plant cell walls (Rebecca Wells - Penn and Marcus Foston – WashU)

Module 2- Basic cell biology and mechanics

Sept. 14:
- Journal club and homework help

Sept. 16:
- Membrane trafficking and vesicle transport (Charlie Anderson – Penn State)

Sept. 21:
- Cytoskeleton (Mike Ostap – Penn)

Sept. 23:
- Perpendicular and lateral forces from cytoplasmic filaments (Anders Carlsson – WashU)

Sept. 28:
- Membrane physiology and ion channels, electrophysiology (Liz Haswell – WashU)

Sept. 30:
- Motor proteins (Yale E. Goldman – Penn)
Oct 5:
   – Mechanical properties of biological materials (Farid Alisafei – NJIT)

Oct 7:
   – Myosin motors and fundamentals of osmotic forces (part I) (Anders Carlsson – WashU)

Oct. 12:
   – Penn journal club and homework help (Wash U Fall break)

Oct. 14:
   – Wash U journal club and homework help (Penn Fall break)

**Module 3: Tissue and nuclear mechanics**

Oct. 19:
   – Developmental mechanobiology and tissue mechanics (Joel Boerckel – UPenn)

Oct. 21:
   – Adhesion receptors and signal transduction (Amit Pathak – WashU)

Oct. 26:
   – Osmotic forces (part II) and force distributions within cells (Anders Carlsson – WashU)

Oct. 28:
   – Tissue structure and mechanics in plants and animals (Paul Janmey – Penn and Siobhan Braybrook – UCLA)

Nov. 2:
   – Diffusion and statistical mechanics (Guy Genin – WashU)

Nov. 4:
   – The nucleus and chromatin structure (Melike Lakadamyali - Penn)

Nov. 9:
   – Nuclear Mechanics (Dennis Discher - Penn)

**Nov. 11:**
   – Journal club and homework help

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

Nov. 16:
   – Mechanics and models of regeneration/engineered microenvironments (Chris Chen – BU)

Nov. 18:
   – **Discussion:** cell wall polymers, mechanics, and assays (Dan Cosgrove – Penn State)
Nov. 23:
- Integrating biology and mechanics through materials (Jason Burdick – Penn)

Nov. 25
- NO CLASS: Thanksgiving

Nov. 30:
- Mechanical deformations of membranes (Ravi Radhakrishnan - Penn)

Dec. 2:
- Memory, the nucleus, and the ECM (Rob Mauck – Penn)

(discretion on final project presentation dates by site)

Dec 7:
- Final project presentations

Dec. 9
- Final project presentations (LAST DAY OF CLASS)

25% for homework (x3) and food-for-thought submissions
25% for journal club participation and written comments in advance
50% final presentations

Live lectures via Zoom, recorded and posted.
Daily discussion and journal club written submissions will be via Google docs