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