

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