Faculty of Engineering

COURSE OUTLINE

Mech483/Mech510 – Mechanics and Energy Conversion for Living Cells

Term – SUMMER 2015 (201505)

Instructor

Dr. Stephanie Willerth
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Office Hours

Days: T or email for an appointment
Time: 11:30-12:30 pm
Location: EOW513

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Office Hours: MF 12:00 to 2:00 pm

Course Objectives

This course will cover the following topics as listed in the calendar: Engineering introduction to cell architecture. Cell components and their functions. Families of molecules used by cells. The role of water in cell architecture. Proteins -the machine systems of cells. DNA. Energy conversion and the control of metabolic processes. Mechanics of the cytoskeleton and cell membranes. Developments in diagnostic and treatment systems based on cell mechanobiology. Readings in bio-inspired engineering systems, biotechnology, tissue regeneration, molecular diagnostics and targeted drug delivery.

Learning Outcomes

1) Detail linkages between mechanics, energy conversion and control systems in the operation of the cell's protein machinery.
2) Explain how macromolecule operation and dysfunction in living cells contributes to health & disease.
3) Explain tensegrity as a design principle in engineered structures as well as in the architecture of the living cell.
4) Explain the role of water and amphipathic molecules in the architecture and transport processes in living cells.
5) Apply thermodynamic analysis to cellular processes including those involving energy conversion

6) Evaluate new engineering tools to aid new areas of fundamental research in cell biology -e.g. the roles of mechanotransduction.

Syllabus

Week 1: Introduction to Mechanics & Energy Conversion for Living Cells. (Chapter One)
**note instead of class on Friday May 5th, students will attend a special seminar on tissue engineering
Week 2: Chemical components of cells (Chapter 2)
Weeks 3-4: Proteins, the Machine Systems of Cells: Structure & Functions (Chapter 4)
Week 5-6: DNA -Structure, Function, Elements of Replication (Chapter 5 and 6)
June 10th - Quiz One in class covering biomolecules
Week 7: Energy conversion – review of thermodynamics
Week 8: Energy conversion and chemical reactions in cells
Week 9: Energy Conversion -Metabolism (Chapter 13,14)
Week 10: Cytosketon -Intermediate Filaments and Mictrotubules. (Reading: Ch 17)
July 15th - Quiz Two in class covering energy conversion
Week 11-12: Synthetic Biology and Projects

A-Section(s): A01 / CRN 30570 B01 W 11:30-12:20 TA
Days: TWF
Time: 10:30-11:20 am
Location: ECS 104

Required Text

Title: Essential Cell Biology – 4th edition
Author: Alberts, Bray, Hopkin, Johnson, Lewis, Raff, Roberts, Walter
Publisher: Garland Science
Year: 2014

Assessment:

Assignments:	25%
Quizzes	40%
Final Project	35%

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

Problem sets, lecture notes and supplemental material will be posted on the Coursespaces site available at http://coursepaces.uvic.ca.

Note to Students:

Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

Accommodation of Religious Observance
See entry in current Undergraduate Calendar

Policy on Inclusivity and Diversity
See entry in current Undergraduate Calendar

Standards of Professional Behaviour

You are advised to read the Faculty of Engineering document Standards for Professional Behaviour in current Undergraduate Calendar, which contains important information regarding conduct in courses, labs, and in the general use of facilities.

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult entry in current Undergraduate Calendar for the UVic policy on academic integrity.

Course Lecture Notes

Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.