Biological Frameworks for Engineers

ME 411 / ME511
University of Washington, Seattle Autumn Quarter 2012

Location: Loew 101 **Time:** MWF, 2:30 – 3:30 PM

Instructor: Nathan J. Sniadecki
MEB 318
Phone: 206.685.6591
e-mail: nsniadec@uw.edu

Office Hours: Mon 1:30-2:30 PM

Website: *http://courses.washington.edu/nsniadec/ME411/A12*

Course Description:

Introduction to the fundamentals of biology for an engineer. Mechanisms and biomechanics of DNA, proteins, cells, connective tissue, musculoskeletal tissue, and cardiovascular tissue, integration principles of living systems, structure-function relationships, techniques used to study biology and medicine, and tissue engineering.

Prerequisites: None

Required Text: None. Lecture notes and lecture material will be available on the course webpage

Recommended Texts:

1) Ethier and Simmons, *Introduction to Biomechanics: From Cells to Organisms*, Cambridge University Press, ISBN: 0521841127
2) Bray, *Cell Movements*, 2nd Edition, Garland Press, ISBN: 0815332823
3) Alberts et al. *Molecular Biology of the Cell*, Garland Science, ISBN: 0815332181
4) Lodish et al. *Molecular Cell Biology*, Freeman, ISBN: 0716776014

Grading:

ME411 (Undergraduate Students)	
Assignments	30%
Lab Reports	20%
Exams	50%

ME511 (Graduate Students)	
Assignments	25%
Lab Reports	15%
Exams	50%
Project	10%

Course Schedule:

Date	Lecture	Scale	Topic	Assignments	Due
9/24	1	nm - m	Functions of Life; DNA basics		
9/26	2	Nm	Information Transfer (DNA)	Hw #1	
9/28	3	nm - m	DNA to RNA	Project (ME511 Only)	
10/1	4	μm	Cells		
10/3	5a	nm	Proteins	Hw #2	Hw #1
10/5	5b	nm	Proteins		
10/8	6	nm	Protein Structure (Lab 1)	Lab #1	
10/10	7	nm	Decoding DNA and Mutations	Hw #3	Hw #2
10/12	8	μm	Decoding Proteins and Protein Function		
10/15	9	μm	Immunology		Lab #1
10/17	10	μm	Lab-on-chip (Lab 2)	Lab #2	Hw #3
10/19	11	nm - m	Micro and Nano Fabrication		
10/22	12	μm	Cell-Cell interactions	Exam #1	
10/24			*No Class*		
10/26	13a	μm	Cell Signaling		Lab #2
10/29	13b	μm	Cell Signaling		
10/31	14	μm	Cellular Energetics	Hw #4	
11/2	15a	μm	Cell Movement		Exam #1
11/5	15b	μm	Cell Movement	Hw #5	
11/7	16	mm	Integrating Cells into Tissue		Hw #4
11/9	17	mm	Muscle Cells to Tissue	Hw #6	Hw #5
11/12			*Veteran's Day*		
11/14	18	cm	Muscle Signaling and Control Lab (Lab 3)	Lab #3	
11/16	19	cm	Connective Tissue		
11/19	20a	m	Musculoskeletal System		Hw #6
11/21	20b	m	Musculoskeletal System		Lab #3
11/23			*Thanksgiving Holiday*		
11/26	21	m	Cardiovascular System	Hw #7	
11/28		m	Project: Tiny Workhorse Presentations	Exam #2	
11/30		m	Project: Tiny Workhorse Presentations		
12/3	22	nm	Engineering Applications - Tissue Replacement		Hw #7
12/5	23	nm - m	Biological Applications - Tissue Engineering		
12/7	24		Big Picture Wrap-up		Exam #2

Project (ME511 students only):

Motor proteins generate motion for biological tasks. Their operating parameters have been highly evolved and can efficiently transduce chemical energy to mechanical work. For this project, you will research a motor protein in depth and devise a system that utilizes it to produce movement or power at the nanoscale. You will give a short presentation to the class and write a compact, but clear report. For both deliverables, you will communicate your biological knowledge of your chosen motor protein and describe how it can be used for engineering applications.

Course Policy:

All assignments must be handed in before class starts on the due date. You may discuss projects and homework with your fellow students, and even collaborate on the solution, but you must list on the homework the person(s) that collaborated with you on the solution. Please cite any material that you copied or you rewrote in your own words.

Late Policy:

First day late = 10% off, two days late = 25% off, three days late = 50%, four days late = no credit (a day is defined as the 24 hour period starting at 4:30pm on the due date).

Course Outcomes and Assessment:

This course offers weekly assignments, laboratory experiences, analytical and computational assessment of biological systems, and interactive lectures to facilitate the students' exposure to the field of biology and biomechanics.

Specific learning outcomes for the course:

1) To be able to identify and describe the components of a biological system,
2) To explain how biological systems work and interact,
3) To be able to apply problem-solving skills to biological systems, and
4) To develop a working knowledge of the laws of physics, chemistry, and thermodynamics as they pertain to biological system.