Biological Frameworks for Engineers

ME 411 / ME511
University of Washington, Seattle — Autumn Quarter 2014

Location: MEB 242 **Time:** MWF, 2:30 – 3:30 PM

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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

Recommended Texts:

1) Alberts et al. *Molecular Biology of the Cell, 4th Edition*. Garland Science, ISBN: 0815332181
(or) Lodish et al. *Molecular Cell Biology, 6th Edition*, Freeman, ISBN: 0716776014
2) Ethier and Simmons, *Introduction to Biomechanics: From Cells to Organisms*, Cambridge University Press, ISBN: 0521841127

Grading:

ME411 (Undergraduate Students)	
Assignments	25%
Lab Reports	25%
Exams	50%

ME511 (Graduate Students)	
Assignments	20%
Lab Reports	20%
Exams	50%
Project	10%

Course Schedule:

Date	Day	Topic	Assignments	Due
9/24	W	Functions of Life; DNA basics		
9/26	F	Information Transfer (DNA)	Hw 1	
9/29	M	DNA to RNA	Project (Grads Only)	
10/1	W	Cells		
10/3	F	Protein Form	Hw 2	Hw 1
10/6	M	Protein Function		
10/8	W	Protein Structure (Lab 1)	Lab 1	
10/10	F	Decoding DNA and Mutations	Hw 3	Hw 2
10/13	M	Decoding Proteins and Protein Function		
10/15	W	Immunology		Lab 1
10/17	F	Lab-on-chip (Lab 2)	Lab 2	Hw 3
10/20	M	Micro and Nano Fabrication		
10/22	W	No Class		
10/24	F	Cell Signaling	Exam 1	no Hw
10/27	M	Cell Signaling		Lab 2
10/29	W	Cellular Energetics		
10/31	F	Cell Cytoskeleton	Hw 4	Exam 1
11/3	M	Cell Movement		
11/5	W	Cell-Matrix and Cell-Cell Interactions		
11/7	F	Integrating Cells into Tissue	Hw 5	Hw 4
11/10	M	Connective Tissue		
11/12	W	Muscle Cells to Tissue		
11/14	F	Muscle Lab (Lab 3)	Lab 3	Hw 5
11/17	M	Skeletal System		
11/19	W	No Class	Hw 6	
11/21	F	Human Locomotion and Gait Analysis		Lab 3
11/24	M	Tiny Workhorse Presentations		
11/26	W	Tiny Workhorse Presentations	Hw 7	Hw 6
11/28	F	Thanksgiving		
12/1	M	The Vascular System		
12/3	W	The Heart	Exam 2	Hw 7
12/5	F	Big Picture Wrap-up		
12/10	W	Final Examination		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:

Up to one day late = 10% off, up to two days late = 25% off, up to three days late = 50%, up to four days late = no credit. A day is defined as the 24 hour period from the start of class 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.