

BE 437 NANOMETER SCALE
PROCESSES IN LIVING SYSTEMS (Fall 2021)

The world at the nanometer-scale is full of dynamic phenomena whose behavior can be described by a set of rules that are vastly different than those encountered at the macro scale. Many biological processes that are of interest for their relevance to bio-engineers, such as cell differentiation, cell mechanical properties, and neuronal signaling, are stimulated by the activity and interaction of biomolecules at the nanoscale. Thus, an understanding of the physics and the tools that engineers have designed to study such systems is a vital component toward overcoming an immense array of challenging problems in the biological and medical sciences. This course will focus particularly on two topics: the underlying biophysics that explain molecular behavior at this length scale and a conceptual understanding of technologies that permit the study of events at the nanometer scale.

Course information: The class meets from 2:30 to 4:15pm Mondays and Wednesdays in CAS B36. Prerequisites for this class include probability (EK381 or equivalent), chemistry (CH101 or CH131), and physics (PY212). Attendance is required for all lectures.

<u>Instructors:</u>	Prof. Michael Smith	Xingjian Zhong
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	Office hrs: 11am to Noon Tuesday	4 to 5pm Thursday

Textbooks: A variety of selected readings, in addition to the course notes, will be provided to the students using Blackboard.

Grading:	Homework	45%
	Tests	35%
	Presentation	10%
	Project	10%

8 Sept	Course Introduction: A Day in the Life	
13 Sept	Active Learning Demo / The Scallop Theorem	
15 Sept	Diffusion	
20 Sept	Diffusion 2	(Homework 1 Due)
22 Sept	Tissue Mechanics	
27 Sept	Cell Mechanics I	
29 Sept	Cell Mechanics II	
4 Oct	Intracellular Structures	(Homework 2 Due)
6 Oct	Intracellular Structures (cont.)	
11 Oct	<i>No Class: Indigenous Peoples' Day</i>	
12 Oct	<i>Substitute Monday Class: Test 1</i>	(Test 1; 10%)
13 Oct	Active Learning I	
18 Oct	Active-Learning I	
20 Oct	Intracellular Structures (cont.)	
25 Oct	Extracellular matrix	
27 Oct	No Class: Smith out	
1 Nov	Mechanobiology/Microrheology	(Homework 3 Due)
3 Nov	Microrheology, continued	
8 Nov	Micro- and nano-machines I	
10 Nov	Micro- and nano-machines II	(Homework 4 Due)
15 Nov	Test 2	(Test 2; 10%)
17 Nov	Receptor/Ligand interactions I	
22 Nov	Receptor/Ligand interactions II	
24 Nov	<i>No Class: Thanksgiving</i>	
29 Nov	R/L interactions for Diagnostics	
1 Dec	Active Learning Presentations	(Homework 5 Due)
6 Dec	Active Learning Presentations	
8 Dec	Nano challenges and fears	(Project Due)
14 Dec	3 to 5pm: Test 3	(Test 3; 15%)