

**BIOE 298 Cellular Bioengineering  
Fall 2010**

Instructor:

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Recommended text:

Molecular Cell Biology (6<sup>th</sup> edition), Lodish et al.

Description :

Bioengineering 298 offers basic molecular and cellular biology training to sophomores in Bioengineering major. The course integrates engineering principles with biology by incorporating quantitative measurement and instrumental techniques. Students will learn to view cellular biology as a tool set for advancing human medicine. Final project involves team work where each group would investigate a human disease and propose a research plan for developing a diagnosis or a treatment plan and also present pertinent bioethical issues.

Homeworks :

1. Reading and summary of five scientific journal articles assigned (uploaded on Compass)
2. 4-5 problem sets based on the article reading
3. In class question-answer session

Exams:

Two midterms (6<sup>th</sup> and 12<sup>th</sup> week of the semester)

Final group presentation (15<sup>th</sup> week) and written proposal (**Due 5:00pm Dec 10<sup>th</sup>**)

Course Objective: (ABET objectives in parentheses)

During the course, I plan to

1. Introduce students to relevant biomedical problems (j)
2. Teach students how scientific discovery contributes to human medicine (e, h, i, k)
3. Implement advanced biotechnological measurement technique (b)
4. Teach students to conduct experiment and analyze data quantitatively (a, c)
5. Discuss bioethical issues (f)
6. Build nurturing team work experience and professional presentation skills (d, g)

Grading:

Exam/projects

Midterm I	25%	must be present in person
Midterm II	25%	must be present in person
Homework	20%	article summary, problem sets, in-class discussion
Final presentation	15%	must show team work
Final written proposal	15%	Due by final week of class (Dec 9)

Syllabus and Schedule :

Week	Weekly topic	Lecture 1	Lecture 2	Lecture 3
1 (8/23)	Introduction to molecules and cells	Introduction to biology course logistics, survey (Chap 1)	Molecules of Cells Nucleic acid, Amino acid etc *PAGE, SDS-PAGE (Chap 1)	Overview of cellular <i>organelle</i> (Chap 2, 10)
2 (8/30)	DNA, RNA, Protein Structure and function	DNA, RNA *PCR, qPCR, FISH (Chap 4)	Protein *Western, IMP, IMF (Chap 3)	NO LECTURE
3 (9/8)	Replication and Transcription	LABOR DAY	Central dogma, replication (Chap 4)	Transcription *AZT, RT-PCR (Chap 7)
4 (9/13)	Post transcriptional control, translation	<b>Homework #1</b> a. Article 1 summary b. In class discussion c. problem set due Friday	Post-transcriptional control (Chap 8)	Translation, post-translational regulation, Genetic code table (Chap 4)
5 (9/20)	Recombinant biotechnology, cell imaging techniques	<b>Homework #2</b> a. Article 2 summary b. In class discussion c. problem set due Friday	Recombinant techniques Genetic engineering DNA library construction (Chap 5)	*Drug discovery, cellular imaging techniques STORM Midterm I preparation
6 (9/27)	Human diseases	<b>MIDTERM I</b> (week 1-5 material)	Molecular basis of human diseases	Presentation of group disease topic, 5-7 min/group
7 (10/4)	Ion and small molecule transport	Membrane proteins, ion channels	Osmosis, Action potential	NO LECTURE
8 (10/11)	Signal transduction	<b>Homework #3</b> a. Article 3 summary b. In class discussion c. problem set due Friday	Vesicular traffic and secretion Secretory, nonsecretory ER targeting Nuclear targeting	G protein signaling First, second messenger Kinases, phosphatases *Viagra signaling
9 (10/18)	Cellular energetics Enzyme kinetics	Glycolysis, Citric acid cycle (Chap 12)	Electron transport chain (Chap 12)	Enzyme kinetics Michaelis-Menten kinetics (Chap 3)
10 (10/25)	Cytoskeleton ECM	<b>Homework #4</b> a. Article 4 summary b. In class discussion c. problem set due Friday	Cytoskeletal motors microtubule, actin, kinesin, myosin (Chap 17, 18)	Extra cellular matrix Homotypic, heterotypic interactions, tissue engineering (Chap 19)
11 (11/1)	Stem cells and cell cycle	<b>Homework #5</b> a. Article 5 summary b. In class discussion	Stem cells Differentiation, Cell lineage (Chap 21)	Cell cycle Mitosis, Meiosis DNA repair (Chap 20)
12 (11/8)	Apoptosis and Cancer	<b>MIDTERM II</b> (week 6-11 material)	Cancer (Chap 25)	*Cancer therapy
13 (11/15)	Viruses	DNA, RNA viruses, lifecycle (Chap 24)	Introduction to Immunology Innate and adaptive immunity	View samples of proposals and presentation
15 (11/29)	<b>FINAL PROJECT PRESENTATION</b>	Presentation, Group I, II	Presentation Group III, IV	Presentation Group V, VI

