BE 209: Principles of Molecular and Cell Biology
Department of Biomedical Engineering, Boston University
Mon/Wed 10:10 AM -11:55 AM, Photonics 206

Lecture Syllabus, Spring 2018
(for lab policies and schedule please consult the lab syllabus)

Description

Credits: 4.0, Prerequisites: high school biology and one semester of college chemistry, Introduction to the molecular, physical and computational principles of cell function in the context of cutting-edge applications in bioengineering and medicine. Biological concepts include: molecular building blocks, energetics, transport, metabolism, nucleic acids, gene expression and genetics. Applications include bioenergy, synthetic biology, the human genome project, and gene circuit engineering. Labs will teach fundamental techniques of molecular biology including a multi-week module where students build and quantify bacterial gene expression system. Labs emphasize the experimental, problem solving, and analytical skills required in modern engineering and research.

Contact Information

General Inquiries be209spring2018@gmail.com
For the quickest response, please send general questions regarding the lecture content, assignments, and exams to the email above, which will be routinely checked by the lecture instructor and TAs.

Instructor Prof. John Ngo (jtngo@bu.edu)
Office: Kilachand Center, Room 505A
Office Hours: by appointment, and by announcement before each exam
Generally, I will be available for 10-15 minutes after after each lecture.

Lecture TAs Chris Sloas (sloas@bu.edu)
Remy Peace (repeace@bu.edu)
Office Hours: Wed 1:30 – 2:30 and Fri 2:30 – 3:30
Office Hours Location: Kilachand Center, Room 609

Textbook

Essential Cell Biology, 4th Edition. Alberts et al., Garland Science (2013)

Grading

30% - Lab component
20% - Midterm 1
20% - Midterm 2
20% - Final Exam
10% - Assignments

Class Policies

Lecture Slides

- Slides will be posted to Blackboard 24 h after the lecture.

Exams

- The exams will emphasize material from the lectures and their associated readings, however questions from the laboratory component may also appear.
- **Midterm 1** will cover content from lectures 1 - 10, the associated readings, and labs 1-4.
- **Midterm 2** will cover lectures 11 - 19, the associated readings, and labs 5-9.
- The **Final Exam** will be cumulative.

Assignments

- Class assignments will be divided into two categories: homeworks and in-class worksheets. These assignments will account for a total of 10% of your grade.

- **Homeworks** will be posted to Blackboard and the assignments will be due at the beginning of class on the date listed on the homework. A homework schedule will be posted to Blackboard during the second week of class.
- Homeworks will account for 8% of your grade. Late homeworks can be submitted up to 24 h after the due date (send by email to be209spring2018@gmail.com), but a 50% penalty will be applied.

- **Short "pop" in-class worksheets** will also be assigned. These assignments are meant to encourage to you attend lecture and also help you prepare for the exam. In certain cases you will be allowed to work in teams on these assignments.
- In-class assignments will account for 2% of your final grade. There will be no make-up for missed "pop" in-class assignments. You will be given 1 of these assignments as a "freebie" in case you are sick, etc.

Tips on How to do Well in BE 209

- **Come to lecture, pay attention/take notes, and do the assigned readings!!** *A lot of content will be covered in this class and it will be very hard to cram the material the night before an exam. The easiest way to make sure you are staying up-to-date with the material is to simply come to class and do the reading during the week of the lecture.*
- **Do the assignments**. *The assignments will give you an idea of what the exam will look like. Do them on time!*
- **Attend the labs.** *Some of the questions on the exams will be on content covered in the lab. If you don't know the lab material by the time of the exam, it will be hard to get an A.*

- **Form a study group.** *Many new concepts will be covered before each exam. Form a study group to discuss the material and test one another. Work together to make sure you have a comprehensive understanding of the material.*

Schedule (subject to change)

Date	Lect	Topic	Text
M 1/22	1	**Introduction** **Cells: the fundamental unit of life** *features of organisms and cells, kinds of cells, components, compartments, organelles, visualizing cells using microscopes*	**ECB Ch 1**
W 1/24	2	fluorescence imaging and cell staining **Chemical Components of Cells** *interactions between atoms and molecules, molecular building blocks, macromolecules*	**ECB Ch 2**
M 1/29	3	**Energy, Catalysis, and Biosynthesis** *energy sources, carriers, and storage* **Protein Structure and Function** *composition and structure*	**ECB Ch 3-4**
W 1/31	4	*molecular recognition, ligand binding, allostery and cooperative binding, enzyme catalysis*	**ECB Ch 4**
M 2/5	5	**DNA: Chromosomes, Replication, and Repair** *overall information flow, structure and packaging, replication, repair*	**ECB Ch 5-6**
W 2/7	6	**From DNA to Protein: How Cells Read the Genome** *transcription, translation, and the genetic code*	**ECB Ch 7**
M 2/12	7	*post-transcriptional control, protein breakdown* **Metabolism—How Cells Obtain Energy from Food** *breakdown of sugars and lipids, metabolic regulation*	**ECB Ch 13-14**
W 2/14	8	**Energy Generation in Mitochondria and Chloroplasts** *oxidative phosphorylation, electron transport, photosynthesis*	**ECB Ch 14**
T 2/20	9	**Molecular Medicine and Biotechnology** *the molecular and genetic origins of disease, medicinal agents (small molecules, macromolecules, engineered cells)*	
W 2/20	10	**Catch-up, Midterm Preview, and Review**	
M 2/26		**MIDTERM 1**	
W 2/28	11	**Recombinant DNA Technology**	**ECB Ch 10**

		manipulating and analyzing DNA, cloning DNA, PCR and sequencing	
M 3/12	12	*DNA sequencing, gene expression analyses, discovering gene function* **Membrane Structure** *lipid bilayers, membrane proteins*	**ECB Ch 11**
W 3/14	13	**Transmembrane Transport** *Membrane potential, ion transport, nerve cell signaling*	**ECB Ch 12**
M 3/19	14	**Intracellular Compartments and Protein Transport** *organelles, protein sorting, trafficking pathways*	**ECB Ch 15**
W 3/21	15	**Cell Signaling** *how cells communicate, G-protein coupled receptors, kinases*	**ECB Ch 16**
M 3/26	16	**The Cytoskeleton** intracellular scaffolds, muscle contraction	**ECB Ch 17**
W 3/28	17	**The Extracellular Matrix (ECM) and Connective Tissues** *ECM components and function, cell adhesion, cell-cell junctions*	**ECB Ch 18 (p 603-632)**
M 4/2	18	**The Cell Cycle** *phases (G1, S, M, mitosis, cytokinesis), progression, regulation*	**ECB Ch 18 (p 603-632)**
W 4/4	19	**Catch-up, Midterm 2 Preview, and Review**	
M 4/9		**MIDTERM 2**	
W 4/11	20	**The Cell Cycle (continued)** *apoptosis: programmed cell death* **Stem Cells** *tissue development and renewal*	**ECB Ch 18 (p 633-643)** **ECB Ch 20 (p 702-711)**
M 4/16	21	**Cancer** *general overview, mechanisms, and therapy*	**ECB Ch 20 (p 712-726)**
W 4/18	22	**Humans and Bacteria** *innate immunity, bacterial infection, antibiotics, microbiome*	**TBA**
M 4/23	23	**Adaptive Immunity** *mechanisms underlying immunological memory, antibodies, HIV*	**TBA**
W 4/25	24	**Special Topic: Genome Editing and Engineering**	**TBA**
M 4/30	25	**Special Topic: Synthetic Biology**	**TBA**
W 5/2	26	**Final Exam Preview and Review**	
M 5/7		**FINAL EXAM, 9:00 AM – 11:00 AM, location TBD**	