Course Number: BioE115

Course Title: Cell Biology Laboratory for Engineers

Instructor: Michael Conboy (conboymj@berkeley.edu); office hours Monday 4-5pm, Stanley B108B

GSIs: Tiama Hamkins-Indik (tiama@berkeley.edu), Tamanna Shobha (tamanna.shobha@berkeley.edu).

Units: 4 units

Lectures: Monday, Latimer 102, 2-4pm

Lab: Stanley B144, Thursday and Friday, 2-6pm.

Final Exam: Stanley 177, 5-8-18

Course Format: 2 hour lecture per week and two 4 hour labs per week.

Prerequisites: BioE114, Bio1A or BioE11; or consent of instructor

Grading: Letter Grade

Textbook: Freeman Biological Sciences (reference).

Course Description: This class provides a conceptual and practical understanding of cell and tissue bioengineering that is vital for careers in medicine, biotechnology, and bioengineering. Students are introduced to cell biology laboratory techniques, including immunofluorescence, quantitative image analysis, protein quantification, protein expression, gene expression, and cell culture. The course culminates with a group project provided by the lecturers, and are developed via theory, experimental design and biomedical significance. The project proposals are followed by guided experimental work, synthesizing literature review, experimental design, implementation, troubleshooting, and analysis of results. Homework consists of directed reading and presentation of relevant research papers for the directed research projects. The aims of the course are to: introduce basic cellular bioengineering laboratory techniques, develop a conceptual and theoretical understanding of the reliability and limitations of these techniques; to support students in developing research questions, defining project goals and designing experiments that can be addressed within the constraints of the course; to promote skills in collaborative project development and execution, and to engage students in public speaking and productive critical evaluation of their own results and those produced by their peers (through presentations and guided discussion of 1-2 research papers). The main goal is to enable students to apply their gained knowledge and research skills to future professional activities, such as internships, scholarships and Honors' Thesis - undergraduate research in the laboratory setting.

Grading:

Class participation and Notebook keeping: 10%.

Homework (paper presentation, data analysis: 20%).

Proposal and Detailed Experimental Plan: 20%

Final presentation: 50% (40%: clarity, accuracy, self-critique, answers about the projects; 10% questions from the Hat – covered in lectures).

Schedule:

Date	Lecture	Lab	Homework
1-15	1-15: No Lecture	1-18, 1-19 Lab 00: Introduction to the lab	Read and copy into notebook: Lab 01: Cell culture basics (due before lab)
1-22	1-22: Introduction to the class	1-25, 1-26 Lab 01: Cell culture basics	Read and copy into notebook: Lab 02: Setting up the experiment (due before lab)
1-29	1-29: Overview of the field of cell and tissue engineering and introduction of the final project. Overview of lab experiment.	2-1, 2-2 Lab 02: Setting up the experiment	Read and copy into notebook: Lab 03: Preparing for readouts (due before lab)
2-5	2-5: Tissue regeneration in health and disease, and biomedical approaches for deliberate regulation of tissue repair. Adhesion substrates, Young's modulus, morphogenic gradients, 2d vs. 3d cultures as these apply to the final project. Overview of western blot, immunofluorescence, qRT-PCR.	2-8, 2-9 Lab 03: Preparing for readouts **Sign up Paper Pro and Con groups**	Read and copy into notebook: Lab 04: Immunofluorescence (due before lab) Download FIJI.
2-12	2-12: Examples of figure presentations from the research papers. How to read a paper and identify pros and cons. Immunofluorescence quantification.	2-15, 2-16 Lab 04: Immunofluorescence Protein quantification.	Analyze images taken in class (due before lab) Read and copy into notebook: Lab 05: qRT-PCR (due before lab)
2-19	2-19: No class, President's Day	2-22, 2-23 Lab 05: qRT-PCR	Analyze qRT-PCR data (due before lab) Read and copy into notebook: Lab 06: Western Blot 01 (due before lab)

2-26	2-26: Tissue regeneration in health and disease, and biomedical approaches for deliberate genome editing. CRISPR, CRISPRa, CRISPRi and application to the more detailed discussion of the 4 projects. **Sign up for final project groups.** qRT-PCR quantification.	3-1, 3-2 Lab 06: Western Blot 01	**Paper Presentation Due: 3-5-17** Read and copy into notebook: Lab 07: Western Blot 02 (due before lab)
3-5	3-5: **Paper Presentations pro and con groups.** Western blot quantification.	3-8, 3-9 Lab 07: Western Blot 02	Analyze western blot data (due before lab). **Proposal Presentation: Due 3-15 or 3-16**
3-12	3-12: Discussion of composing proposals.	3-15, 3-16 **Proposal Presentation**	**Detailed Experimental Plan: Due 3-19**
3-19	3-19: **Detailed Experimental Plan Review.**	3-22, 3-23 Finalize experimental plan, order reagents.	
3-26	SPRING BREAK	SPRING BREAK	
4-2	Final project lab time	Final project lab time	
4-9	Final project lab time	Final project lab time	
4-16	Final project lab time	Final project lab time	
4-23	Data analysis overview	Final project lab time	
4-30	Reading week. Data analysis, prepare final presentation	Reading week. Data analysis, prepare final presentation	
5-8	**5-8-17: 11:30 a – 1:30 p Final Presentation**		