UCLA Department of Bioengineering

BIOENGR 167L: Bioengineering Laboratory (Fall 2018)

Instructor: Prof. Aaron Meyer (ameyer@ucla.edu), 4121G Engineering V
Class Hours: Lecture (Monday: 8:00–9:50 am, Boelter Hall 5440)
Lab Hours: MW 12:00–2:50 pm, TR 12:00–2:50 pm, or TR 3:00–5:50 pm

Teaching Assistants:

- LAB 1A (MW 12:00–2:50 pm): Jesse Liang (jesse.liang92@gmail.com)
- LAB 1B (TR 12:00–2:50 pm): Eva Chen (evachen96@ucla.edu)

Office Hours:

- Prof. Meyer: Mondays 4–5 PM or by appointment, Eng. V 4121G
- TAs: by appointment

Lab Location: Labs will always meet in Boelter Hall 7732

Website: https://ccle.ucla.edu/course/view/18F-BIOENGR167L-1

1. Required Supplies

Text:

Required:

None. Handouts will be provided as needed and posted on the website.

Recommended:

Barker, K. At the Bench: A Laboratory Navigator. Updated Ed. Cold Spring Harbor Laboratory Press. Cold Spring Harbor, NY. 2005.

McMillan, VE. Writing Papers in the Biological Sciences, 5th Ed. Boston, MA. Bedford/St. Martin's. 2012.

Personal Protective Equipment (PPE): Each student is required to bring a lab coat (preferably 100% cotton) and lab notebook to each lab session. PPE can be purchased on campus (AXE Office; 1275 Young Hall or Ackerman Book Store) or online (e.g., http://www.scrubsunlimited.com/, Amazon). You must bring your PPE with you to Lab 1 and all future labs.

Lab Notebooks: You must purchase a bound notebook and bring it to every lab session. You will need to maintain records your experiments in your notebook according to the requirements posted on CCLE.

2. Course Description

This class will focus on development of practical laboratory skills and analytical techniques of use for bioengineering research. At the end of this lab you will have learned how to successfully pattern cell growth on a surface into an arbitrary pattern of your choosing. This will involve step-by-step laboratories investigating various aspects of bioengineering including bioconjugation, soft lithography, surface modification, microcontact printing, cell and tissue culture, and microscopy. Lectures will be synchronized with your laboratory

investigations to provide a broader context to the experimental techniques and provide valuable opportunities for analysis of current scientific writing and research practices.

Learning Outcomes: By the end of the quarter you will be able to do the following:

1. **Critical Laboratory Skills**: Gain a diverse skill set of bioengineering skills useful for current biomedical engineering research and practice.
2. **Critical Thinking and Analysis**: Understand the process of scientific experimentation, analysis of current research, and developing logically sound experimental processes.
3. **Scientific/Engineering Documentation**: Document experimental progress in a laboratory notebook, understand the preparation of scientific papers.
4. **Manage and Work in Teams**: Learn to work and communicate effectively with peers to attain a common goal.

3. Safety Requirements for Working in a Laboratory at UCLA

There is an online training courses that must be completed outside of scheduled class time in order to be legally allowed by UCLA Environmental Health & Safety (EH&S) and HSSEAS to be physically present and work in the teaching labs. There are no exceptions—*every student must complete these requirements* in order to continue enrollment in BE167L.

Required Training Courses:

Before the first laboratory meeting time (Lab 0) please have taken the following online class and uploaded your certificate to CCLE.

Instructions follow:

1. Go to UCLA Worksafe: https://worksafe.ucla.edu/UCLA/Programs/Standard/Control/elmLearner.wml?portalid=Learnerweb
2. Sign in with your UCLA account.
3. Go to the "course catalog" tab on the left-hand side.
4. Find "LAB-LSFC-OL" – "Lab Safety Fundamentals Course – Online". Click the "launch" link in the rightmost column to start the course.
5. Complete the course.
6. Once you are done with the course, go to the "My Transcript" tab from the worksafe menu. Print your transcript or save a screenshot (showing completion of LAB-LSFC-OL).
7. **Upload your worksafe transcript to CCLE by Lab 1.**

Do not take course/quiz for others!

4. Grading and Assignments

23% Participation
27% Lab Reports 1-3
10% Lab Practical Exam
12.5% Exam 1
12.5% Exam 2
15% Final Lab Report Manuscript

We expect that the class will be graded on a flat scale:

- 90-92, 93-96, 97+ = A-, A, A+
- 80-82, 83-86, 87-89 = B-, B, B+
- 70-72, 73-76, 77-79 = C-, C, C+
- 60-62, 63-66, 67-69 = D-, D, D+
- below 60 = F

4.1. Participation Grade (23%)

Participation is graded out of a total of 46 points based on the following.

- Lab Attendance and Performance
  - Lab notebooks (12 points)
  - Working productively and respectfully with my lab partner (6 points)
  - Pre-lab preparation and quizzes (12 points)
- Case Studies and In-Class Discussions
  - Summary paragraphs (9 points)
  - Participation in class discussions (class attendance will be taken on these days) (3 points)
- Independent Project Planning
  - Turn in your 1st independent lab proposal and discuss with your TA (2 points)
  - Turn in your final independent lab proposal on time (2 points)

4.1.1. Laboratory Attendance and Performance:

Pre-lab preparation and quizzes (12 points)

Students are expected to be on time to and attend every lab session. *One-question quizzes will be given at the beginning of each lab section on the prelab assignment.* Quiz questions will be based on information provided in lab session protocols, supplemental reading and video content that will be posted on CCLE by 6 PM the previous Friday. Each lab session (Labs 1-12) will be work 1 pt towards your final participation grade. **You must bring lab protocols with you to lab and be prepared to work independently.**

Working productively and respectfully with my lab partner (6 points): Your TA will assign you to a lab partner with whom you will work on Labs 1–12 and your independent project. This part of the class is a lesson in learning how to work productively with other people. Please be respectful to your lab partner by engaging fully and making contributing to your team.

Lab notebooks (12 points): In BE167L, the purpose of your Lab Notebook is to record your experiments ***while you are doing them***. You should have an entry for each lab session including your methods and raw data. You can print out and paste in protocols from online; however, you must make notes on any changes in your notebook during your lab session. Your raw data must also be recorded when you get the data during your lab session. Your TA will check your notebook to make sure you have recorded everything during each lab session. Each lab session (Labs 1–12) will be work 1 pt towards your final participation grade.

Additional information about lab attendance: You expected to attend and participate in every lab session. As detailed above, your participation grade will depend largely on your attendance. If you have conflicts with a lab session, you must notify your TA, lab partners and Dr. Meyer in advance and arrange a time to make-up the lab. Ideally, this will be in another lab session when the lab you need to miss is already being performed. For example, if you will be out on a Monday, try to make-up in the Tuesday session the very next day. If you will be attending another lab session, you must notify the TA for that lab session in

addition to your normal TA. *Please notify us at least 48 hrs in advance so we can ensure lab materials are available.* If it is impossible for you to attend another lab session due to an illness or family emergency, there will be an opportunity for make-ups during week 9. If you plan to make up a lab on this date, please discuss arrangements with the head TA and Dr. Meyer. If you do end up needing to make-up a lab session, we will re-grade your revised Lab Report (including the missed section) after the make-up lab.

4.1.2. Experimental Case Studies:

We will review several recent experiments and papers in the recent literature that relate to the laboratory techniques that will be used. During lecture we will critically analyze and discuss the results and experimental methods used in these papers. To prepare for the discussion you will be required to read the papers before class and turn in a half-page to one-page discussion of the paper online including:

1. How was the study designed? What were the control experiments? Were experiments repeated? What process was used to collect data? Were data qualitative or quantitative?
2. How was data analyzed and presented? What statistical methods were used? Was data extracted and how was it extracted from images? How was data presented to be easy to understand?
3. How did the authors draw conclusions from the data? Is their logic sound? What assumptions were made? Are these assumptions identified by the authors?

These case studies must be worked on individually and turned in individually at the beginning of class. Any duplicate text or other plagiarism will result in a zero for the assignment. **Case studies must be uploaded to CCLE by 8 AM the day of the in-lecture discussion.**

There will be three case studies, and each summary paragraph will be worth a maximum of 3 participation points, for a total of 9 points. Participation in class discussion of the case studies will be worth 1 point per lecture discussion, for a total of 3 points.

Grading for Case Study Summary Paragraphs:

3 student has accurately summarized the manuscript and provided insightful, critical interpretations of the results and presentation
2 student satisfactorily understands the manuscript content and provides at least some critical analysis/interpretation
1 student does not appear to understand content of the manuscript and provides no insight into the study
0 student did not turn in a summary

The following manuscripts will be evaluated as case studies. PDFs of the papers will be posted on CCLE.

Case Study 1: Fraley *et al*. A distinctive role for focal adhesion proteins in three-dimensional cell motility. *Nature Cell Biology* **2010**, *12(6)*, 598-604.
Case Study 2: Engler *et al*. Matrix Elasticity Directs Stem Cell Lineage Specification. *Cell* **2006**, *126*, 677–689.
Case Study 3: Burdick *et al*. Synthesis and orthogonal photopatterning of hyaluronic acid hydrogels with thiol-norbonene chemistry. *Biomaterials* **2013** *34(38)*, 9803-9811.

4.1.3. Independent Project Proposals:

Labs 13, 14 and 15 will be dedicated to your Independent Project research. More details will be provided in lecture. Briefly, you and your lab partner will propose your own hypothesis, design an experiment to test this hypothesis, and perform your experiments during lab sessions. Your Final Lab Reports will be based on these experiments. You will turn in a first draft of your proposals, discuss with your TA and make adjustments as

necessary, and then turn in a final draft of your proposal. Proposal drafts will be worth 2 participation points each.

4.2. Lab Reports (27%):

There will be *three Lab Report assignments* due throughout the quarter. For Lab Reports assignments, you will use data collected from the labs and answer critical thinking questions about your data. Specific information about the Lab Report requirements will be posted on CCLE. Reports are due by 12 PM on the due date (uploaded to CCLE).

Lab Report 1: Labs 1-4
Lab Report 2: Labs 5-8
Lab Report 3: Labs 9-12

4.3. Final Laboratory Report (15%):

For the final lab report, you will present analysis of your independent lab experiments in the format of a short journal paper. More details on the exact requirements will be provided on CCLE and in the week 5 lecture.

Although data from your group will be identical, laboratory reports must be worked on and turned in independently. Duplication of text or figures between laboratory reports will result in a zero on the assignment for both parties. Duplication of text or figures from reports from previous years also will result in a zero on the assignment. Slight or moderate variations in word choice, addition of words, word order, or sentence order is also considered duplication. It is just easier to start from scratch, than to work off of another report.

Your final report *will be due during finals week, Thurs., December 13, 2018 at noon.* This will be 15% of your final grade.

4.4. Exams (35%):

The course will have 3 exams. These include two exams during the lecture time and a "practical" exam during week 8 in your lab sessions.

4.4.1. Lab Practical Exam:

The lab practical will be an exam of your laboratory skills learned up to week 8 and will be conducted by your TA. This will involve a written exam concerning laboratory practice conducted during the laboratory period. This is worth 10% of your final grade.

4.4.2. Lecture Exams:

Two exams will be given in lecture on topics covered in lecture. Each of these will be 12.5% of your final grade. Exam 1 will cover lecture topics from weeks 1–4 and Exam 2 will cover lecture topics from weeks 5–8.

Title IX

Title IX prohibits gender discrimination, including sexual harassment, domestic and dating violence, sexual assault, and stalking. If you have experienced sexual harassment or sexual violence, you can receive confidential support and advocacy at the CARE Advocacy Office for Sexual and Gender-Based Violence, 1st Floor Wooden Center West, CAREadvocate@careprogram.ucla.edu, (310) 206-2465. In addition, Counseling and Psychological Services (CAPS) provides confidential counseling to all students and can be reached 24/7 at (310) 825-0768. You can also report sexual violence or sexual harassment directly to the University's Title IX Coordinator, 2241 Murphy Hall, titleix@conet.ucla.edu, (310) 206-3417. Reports to law enforcement can be made to UCPD at (310) 825-1491.

Faculty and TAs are required under the UC Policy on Sexual Violence and Sexual Harassment to inform the Title IX Coordinator should they become aware that you or any other student has experienced sexual violence or sexual harassment.

Center for Accessible Education

Students needing academic accommodations based on a disability should contact the Center for Accessible Education (CAE) at (310) 825-1501 or in person at Murphy Hall A255. When possible, students should contact the CAE within the first two weeks of the term as reasonable notice is needed to coordinate accommodations. For more information visit http://www.cae.ucla.edu.