

MSE 104
Engineering Living Systems
Fall, 2017
3 units

Professor Dr. Kara McCloskey
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TA There will be no TA for this course.

Lecture **M/W 1:30-2:45, COB 272**

Office Hours Dr. Kara McCloskey, Monday 11-12

Required Text: No text, required readings will be posted on CatCourses (with quizzes)

Course Overview: Engineering Living Systems is an interdisciplinary field focused on developing strategies for using cells with material scaffolds towards assembly of tissues and organs. Fundamental topics will include: cell source (including stem cells, plasticity, cloning, cell differentiation and purification), cell culture, cell adhesion and migration, cell patterning, materials design and fabrication, as well as, design of bioreactors, on-chip diagnostic platforms including mini-organs.

Course Objectives/Student Learning Outcomes: *By the end of this course, students will be able to:*

1. Describe and use the fundamental tools and techniques used in tissue engineering.
2. Compare and contrast various strategies for tissues assembly and repair.
3. Show mastery of fundamental topics in tissue engineering: issues related to the cell source, cell culture, cell adhesion and migration, cell patterning, biomaterials design and fabrication, as well as design of bioreactors and on-chip diagnostic platforms like mini-organs. At the end of the course, the students should be able to converse with scientists and read technical literature on these topics.
4. Learn the basic concepts of cell culture and critical components of bioreactor/tissue design.
5. Articulate the scientific vocabulary used in communicating information in materials and tissue engineering, including ethical concerns.

Relation to the following MSE Program Learning Outcomes (PLOs):

The course learning outcomes relate to the following MSE program learning outcomes:

1. An ability to apply knowledge of mathematics, science, and engineering (Course Objectives #2 and 4)
2. An ability to design and conduct experiments, as well as to analyze and interpret data. (Course Objectives #4 and 5)
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (Course Objectives #2 and 4)

4. An ability to function on multidisciplinary teams (Course Objective #4)
5. An ability to identify, formulate, and solve engineering problems (Course Objective #2)
6. An understanding of professional and ethical responsibility (Course Objective #5)
7. An ability to communicate effectively (Course Objective #5)
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (Course Objective #1)
9. A recognition of the need for, and an ability to engage in, lifelong learning ((Course Objectives #1 and 5)
10. A knowledge of contemporary issues (Course Objective #1)
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. (Course Objective #4)

Prerequisites by Topic: MATH 024, PHYS 009, BIO 001, ENGR 045 (includes CHEM 002)

Grading for MSE 104

60% Exams (3 exams plus a final)

20% Project

10% Quiz

10% HW and class participation

100 % Total

Course Policies:

1. Students are expected to attend each class as scheduled, and to be on time. Attendance may be taken at the beginning of each class.
2. Students may use during lectures: laptops, notebooks, handhelds, etc. for purposes related to the session content only.
3. All cell phones turned OFF or in silent mode.
4. Students are expected to read their e-mails at least once every 12 hours, and are responsible for any class-related announcements or directives from the instructor that might be distributed on UCMCROPS.

Note: I am a single mother, and may need to cancel class if my little girl is sick and I cannot make other arrangements. This may happen once per semester, so please check your emails regularly for potential notifications.

5. Students are expected to be attentive and respectful of speakers and fellow students at all times.
6. For exams and quizzes, no notes allowed. A calculator may be needed.

Academic honesty:

1. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by the student in this course must be the student's own work.
2. However, you are encouraged to study together and to discuss information and concepts in lecture with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else (THIS INCLUDES ONLINE SOLUTIONS), in the form of an e-mail, and e-mail attachment, a diskette, or a hard copy. Should copying occur, both the student who copied work and the student who gave material to be copied with both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.

Lecture Schedule – Fall, 2018			
	Date	Lecture	Instructor
Week 1	17-Jan	Introduction/Biology of the Cell	McCloskey
Week 2	22-Jan	No class	
	24-Jan	No class	
Week 3	29-Jan	Tissue Organization and Dynamics	McCloskey
	31-Jan	Tissue Organization and Dynamics	McCloskey
Week 4	5-Feb	Morphogenesis	McCloskey
	7-Feb	Cell Characterization	McCloskey
Week 5	12-Feb	Cell Sources: Stem Cells	McCloskey
	14-Feb	Cell Sources: Stem Cells	McCloskey
Week 6	19-Feb	President's Day - No class	
	21-Feb	Exam I	
Week 7	26-Feb	Scaling up: Bioreactors/Time Constants	McCloskey
	28-Feb	Scaling up: Bioreactors/Time Constants	McCloskey
Week 8	5-Mar	Modeling of Cellular-Fate Processes	Jose
	7-Mar	Biomaterial Scaffolds: Characterization	McCloskey
Week 9	12-Mar	Biomaterials Design	McCloskey
	14-Mar	Material Stiffness and Fate	McCloskey
Week 10	19-Mar	Mechanical Forces and Cells	Lian
	21-Mar		McCloskey
Week 11	26-Mar	Spring Break	
	28-Mar	Spring Break	McCloskey
Week 12	2-Apr	Organ on a Chip: Microfluidic Devices	McCloskey
	4-Apr	Bioprinting Organs	McCloskey
Week 13	9-Apr	Cryopreservation/Host Integration	McCloskey
	11-Apr	Biological Machines-Topics Integration	McCloskey
Week 14	16-Apr	Cardiovascular TE	McCloskey
	18-Apr	Neural TE	McCloskey
Week 15	23-Apr	Project Presentations	Students
	25-Apr	Project Presentations	Students
Week 16	30-Apr	Project Presentations	Students
	2-May	Project Presentations	
	TBA	Final Exam	McCloskey

Disability Statement: Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.