BME 510: Cellular Systems Engineering
Units: 3
Lecture: Tues, Thurs, 12:30-1:50pm
Location: Online (Zoom)

Instructor: Prof. Megan L. McCain
Office: Online (Zoom)
Office Hours: Fri, 12:30-1:50pm or by appointment
Contact Info: mlmccain@usc.edu

Course Description

In-depth survey of the cells, materials, and techniques used to engineer microscale human tissue models ("Organs on Chips") for applications in disease modeling and drug screening.

Learning Objectives

(1) Describe the key features of cells and extracellular matrix that are pertinent to the form and function of human tissues.
(2) Describe, compare, and contrast common types of stem cells, biomaterials, and fabrication techniques for engineering 2-dimensional (2-D) and 3-D human tissues.
(3) Describe the ongoing challenges limiting the translation of Organs on Chips, including ethical considerations and commercialization bottlenecks.

Course Outcomes

(1) Interpret and critique data from research papers related to tissue engineering.
(2) Collaborate with classmates to communicate important findings from research articles.
(3) Summarize the current state of tissue engineered products for disease modeling and drug screening in society today.
(4) Evaluate the ethical implications of different tissue engineering strategies.

Course Preparation

Pre-/Co-Requisites: Chem 322A: Organic Chemistry

Course Notes

Lecture slides are posted on Blackboard (Bb) at least 24 hours before each lecture. All other course materials (syllabus, reading and video assignments, assignment descriptions, etc.) will also be posted on Bb.

Technological Proficiency and Hardware/Software Required

Students are required to use an internet-enabled device with browser capabilities, such as a laptop or tablet. The course will be delivered over Zoom with breakout rooms for group work. Bb will be used for in-class quizzes, polls, and group work. Thus, a cell phone is not recommended for accessing the class.

Required Reading and Video Assignments

Students should read or view the assigned materials (posted on Bb) before each lecture. Because this course does not follow a standard textbook, students are highly encouraged to take notes during lecture and use the reading and video material to clarify concepts from lecture.

Description and Assessment of Assignments:

In-Class Work: Open-note or closed-note quizzes, polls, or other similar assignments will be given in class throughout the semester and will be administered using Bb. If you are going to miss class, contact the instructor as soon as possible to discuss make-up work options.

Journal Write-Ups: Students will prepare a one-page summary and critique of an assigned article. More details will be distributed in a separate document.

Take-Home Quizzes: Throughout the semester, take-home quizzes will be assigned using Bb. Students will have at least 24 hours to complete each quiz. Quizzes will be open-book and open-note. Each quiz should be completed individually.

Individual Presentation: Throughout the semester, each student will present a journal article and prepare discussion questions. More details will be distributed in a separate document.

Group Presentation: At the end of the semester, groups of 2-4 students will be assigned a pair of articles. Each pair of articles describes two "Organ on Chip" systems for a single organ system. That student group will present both articles to the class and lead a discussion. More details will be distributed in a separate document.

Students are expected to spend 6 hours per week on work outside of class, on average.

Assignment Submission Policy
Assignments are to be submitted via Bb **before the start of class on their indicated due date.** Assignments will be accepted late, but 10% of the total possible points will be subtracted every 24 hours (including holidays and weekends), starting immediately after the due date and time. Late individual and group presentation files will not be accepted.

Grading Timeline
All assignments will be graded, and grades will be posted on Bb within one week of the due date.

Regrade Policy
Regrade requests are due within one week of the date they are returned to the students. Students must type a justification for their request and submit it to the instructor, stapled to the original assignment. Each student is limited to two regrade requests for any type of assignment throughout the semester. This does not include administrative errors (incorrect point additions, etc.), which should be brought to the attention of the instructor immediately for correction without penalty.

Grading Breakdown

Assessment	% of Grade
In-class work	25
Journal Write-Ups	20
Take-Home Quizzes	25
Individual Presentation	10
Group Presentation	20

Grading Scale
Final letter grades will be assigned based on the following scale:

90-100%	A
85-90%	A-
80-85%	B+
75-80%	B
70-75%	B-
65-70%	C+
60-65%	C
55-60%	C-
40-55%	D
0-40%	F

Collaboration Policy
Unless the assignment is specified as group work, students should not work together on assignments. Any identical (or nearly identical) assignments will be given zero points. The Turnitin feature on Blackboard will be used to check for plagiarism. Plagiarism or other forms of academic misconduct will result in a zero grade for the assignment and will be reported to USC's Office of Student Judicial Affairs and Community Standards, as detailed at the end of the syllabus.

Technology Policy
During class time, students should use devices only to participate in activities guided by the instructor or for note-taking. Use of devices for other purposes is not permitted. Device use for non-academic purposes that distracts the instructor or other students will result in no credit for in-class work for the day.

Communication Policy
If a student has a question outside of class time, he/she should ask during class time or follow these steps in order: (1) consult the syllabus; (2) ask a classmate; (3) review lecture slides and reading material; (4) ask the instructor at office hours; (5) email the instructor. Emails that require short responses (at the discretion of the instructor) will be answered within 24 hours between 9am-5pm on business days. Responses received on weekends or holidays will be delayed to the next business day. Emails that require a long response (at the discretion of the instructor) will not be answered over email. Instead, the student will be directed to office hours.

Attendance Policy
Class time will be used for in-class individual and group work and discussions. Thus, attendance for class is mandatory and will only be excused in case of an emergency, at the discretion of the instructor. If a student knows in advance that he/she will be absent on the day of an exam or presentation for an important occasion (at the discretion of the instructor), notify the instructor as soon as possible.

Course Schedule (Tentative)

Date	Topic
8/18	Course Introduction
8/20	Human Tissues, Cells, and Chromatin
8/25	Cell Culture Technologies
8/27	Embryonic Stem Cells and In Vitro Differentiation
9/1	Adult Stem Cells and Organoids
9/3	Induced Pluripotent Stem Cells and Transdifferentiation
9/8	Gene Editing with CRISPR/Cas9
9/10	Properties of Biomaterials
9/15	Individual Journal Presentations, 1
9/17	The Extracellular Matrix and Natural Biomaterials
9/22	Synthetic Hydrogels
9/24	Degradable Polymers and Fibrous Scaffolds
9/29	PDMS and Photolithography
10/1	Microfluidic Devices
10/6	Printing Tissues, Part 1
10/8	Printing Tissues, Part 2
10/13	Individual Journal Presentations, 2
10/15	2-Dimensional Organs on Chips
10/20	3-Dimensional Organs on Chips
10/22	Multi-Organ Chip Systems
10/27	Organs on Chips for Virology
10/29	Reproductive Tissues on a Chip
11/3	Commercialized Organs on Chips
11/5	Group Presentations, 1
11/10	Group Presentations, 2
11/12	Group Presentations, 3

Statement on Academic Conduct and Support Systems

Academic Conduct: Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention and Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call   studenthealth.usc.edu/sexual-assault
Free & confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED)- (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following *protected characteristics*: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations. The university prohibits sexual assault, non-consensual sexual contact, sexual misconduct, intimate partner violence, stalking, malicious dissuasion, retaliation, and violation of interim measures.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity |Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776   dsp.usc.edu
Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710   uscsa.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101   diversity.usc.edu
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.