BIM 273: INTEGRATIVE TISSUE ENGINEERING AND TECHNOLOGIES

COURSE DESCRIPTION

An examination and quantitative characterization of the fundamental principles involved in the design of engineered tissues and organs. Both biological and engineering fundamentals will be considered. There is an emphasis on team-based study and application of advanced technologies applied to tissue engineering.

COURSE OBJECTIVES

Students will learn the basic biological and engineering principles involved in the design and engineering of tissues.
Students will develop an understanding of the advanced technologies applied to tissue engineering and the fundamental principles underlying their use.
Students will analyze current research as described in the literature and develop the ability to critically evaluate these findings.

PREREQUISITES

Students should have successfully completed an undergraduate course in transport (fluid mechanics and/or mass) and (bio)materials. No previous formal training in tissue engineering is required.

REFERENCES

No textbook is required. All material will be posted on Canvas.
Transport Phenomena in Biological Systems [Truskey, Yuan, Katz]
Tissue Engineering [Palsson and Bhatia]

GRADING

Your grade will be determined based on your performance in several areas:

Midterm exam	30%
Project (written & oral component)	30%
Homework assignments	20%
Journal article presentation	20%

FINAL PROJECT

The final project will replace the final exam, and will be due in Week 9. Students will prepare an NIH R21-styled research proposal using an advanced technology discussed in class or approved by the instructor for developing an *in vitro* platform of therapeutic testing. Students will prepare a Specific Aims page and a 6 page proposal (total of 7 pages; 0.5" margins, single spaced, Arial size 11). Students are expected to describe a clinical challenge, the state of the art of the technology and description of how it has been previously used, and then elaborate on their own research project. Students will give a 15 min presentation describing their final project in the last week of class.

CLASS POLICIES

1. Observe class decorum (no cell phones, only class use of computers, *etc.*).
2. Homework must be submitted by the start of class. **No late homework is accepted.**
3. Makeup exams will be considered on a case-by-case basis and granted at the instructor's discretion. If you MUST miss an exam, notice must be given and arrangements made with the instructor PRIOR TO the exam. Failure to abide by this policy will likely result in **NO SCORE** for a missed exam.
4. Exam regrading policy: At the student's request, the instructor will review a graded exam in its entirety and reassess points as merited.

CODE OF ACADEMIC CONDUCT

This class adheres to the UCD Code of Academic Conduct which requires that "all members of the academic community (that's you and me) are responsible for the academic integrity of the Davis campus" (http://sja.ucdavis.edu/cac.htm). The purpose of the exercises is to help you achieve course objectives. Students are not allowed to

consult previous exams or homework. Your fellow students can be of great value in learning the subject matter in this course. You are encouraged to discuss physical interpretation or unclear points about material with your classmates on the bulletin board or in person. However, it is expected that any final solutions submitted for a class exercise or assignment will represent each student's own efforts. Possession of another student's course materials is considered a violation of the Code and will be reported as such. International students are cautioned to know American standards of ethics (*e.g.*, plagiarism). Questions about plagiarism can be answered by visiting the website for Student Judicial Affairs (http://sja.ucdavis.edu/avoid.htm).

STUDENTS WITH DISABILITIES

UC Davis is committed to ensuring equal educational opportunities for students with disabilities. Students must request academic accommodations prior to or at the beginning of each quarter by visiting the Student Disability Center (54 Cowell Building • 425 California Avenue) and completing an SDC Accommodation Request Form. The University is not required to provide any academic accommodation that would result in a fundamental alteration of the academic program. Please note that it can take up to two weeks to process accommodation requests, so it is very important to submit the request form early. If classroom or examination accommodations are approved, the student will receive an accommodation letter with instructions regarding notifying instructors of the accommodations authorized.

Topics (not set in stone, but a reasonably good guide)

Date	Lecture Topic	Case Study
Week 1	Course introduction, Stem cell fundamentals and technologies (pluripotent stem cells (ES and iPS) and mesenchymal stem cells)	
Week 2	Novel biomaterials (photocrosslinkable, click chemistry, materials with dynamic properties)	
Week 3	Cell transplantation strategies	Application of technologies to treat diabetes
Week 4	Techniques for precisely patterning cells, growth factors, and other elements	
Week 5	Microfabrication, 3D printing and **Midterm**	Spatial gradients to model development
Week 6	Tissue engineered models of disease, development, and for long-term replacement	
Week 7	Bioreactors for long-term culture and maturation	Generating functional engineered tissues
Week 8	Organ-on-a-chip technologies	
Week 9	Imaging tools applied to tissue engineering	
Week 10	Project Presentations	