

BIM 211: Design of Polymeric Biomaterials and Biological Interfaces

M, W 10:00-11:50 am
Instructor: Prof. Kent Leach

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COURSE DESCRIPTION

Biomaterials are widely employed in medicine and biotechnology. The goal of this course is to introduce and survey concepts important for the design, selection, and application of polymeric materials for biomedical and biotechnology applications. Given the interdisciplinary nature of the subject, principles of polymer science, surface science, materials science, and biology will converge to explore topics of the course. This course will establish an understanding of basic principles of biomaterials and biointerface science through didactic lectures, review of seminal and current research literature, case studies, and individual and team-based activities.

COURSE OBJECTIVES

Students will learn the basic biological and engineering principles involved in the design and engineering of polymeric biomaterials.
Students will develop an understanding of the application of polymeric biomaterials in medicine and engineering.
Students will analyze current research described in the literature and develop the ability to critically evaluate these findings.

PREREQUISITES

Students should have successfully completed an undergraduate or graduate course in biology and some training/exposure to (bio)materials.

REFERENCES

No textbook is required. All material will be posted on Canvas. Other references include [Polymer Chemistry: An Introduction \[Stevens\]](#), [Essential Biomaterials Science \[Williams\]](#), [Biomaterials Science \[Ratner, Hoffman, Schoen, Lemons\]](#)

GRADING

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

Midterm exam	30%
Project (30% written; 10% presentation)	40%
Homework assignments	10%
Journal article participation	20%

FINAL PROJECT

The final project will replace the final exam and will be due in Week 10. Students will prepare an NIH R21-styled research proposal using an advanced biomaterial discussed in class or approved by the instructor. Students will prepare a Specific Aims page and a 6 pg proposal (total of 7 pgs; 0.5" margins, single spaced, Arial size 11; references not included). Students are expected to describe a clinical challenge or objective, the state of the art of the technology and description of how it has been previously used (max 1.5 pg), and then elaborate on their own novel idea, providing descriptions of experiments, control groups, success criteria, expected outcomes, and alternative methods.

CLASS POLICIES

1. Observe class decorum (avoid technology – be engaged in class).
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	Notes
Week 1 (1/8)	Introduction to polymeric biomaterials Polymer basics and polymerization	
Week 2 (1/15)	Mechanical properties of polymeric biomaterials	No class on 1/15 [MLK Day]
Week 3 (1/22)	Hydrogels in biological applications (natural vs synthetic, crosslinking methods, applications)	
Week 4 (1/29)	Applications in drug delivery (<i>Guest lecture on 1/31 – Prof. Silva</i>)	
Week 5 (2/5)	Blood-material interactions	MIDTERM [2/7]
Week 6 (2/12)	Body-material interactions (biocompatibility) Biologically-derived materials	LOI describing project proposal [2/14]
Week 7 (2/19)	Cardiovascular and ophthalmic applications	No class on 2/19 (Presidents’ Day) SA page + 1 pg outline [2/21]
Week 8 (2/26)	Biomaterials in immunomodulation and cancer (<i>Guest lecture on 2/26 – Prof. Lewis</i>)	Revised SA and outline [2/28]
Week 9 (3/5)	Orthopaedic applications of polymeric systems Tissue engineering applications of biomaterials	
Week 10 (3/12)	Project presentations	Proposal [3/14]