

BENG186A: Principles of Biomaterials Design
Spring 2021

Instructor: Professor Ester J. Kwon (ejkwon@ucsd.edu)
Office Hours: Tuesdays 5-6 pm
Recorded via Zoom (link found on Canvas)

Class time and location: **Please see schedule below**

Teaching Assistants: Marianne Madias (mmadias@eng.ucsd.edu)
Josh Mesfin (jmesfin@eng.ucsd.edu)
Shivani Shukla (srshukla@eng.ucsd.edu)
Jason Wu (jaw014@eng.ucsd.edu)

Discussion sections:

Teaching assistants will be available on Zoom to answer your questions during discussion sections.

W 9-9:50 AM – Jason Wu

W 12-12:50 PM – Shivani Shukla

W 3-3:50 PM – Josh Mesfin

W 4-4:50 PM – Marianne Madias

Text: Biomaterials Science: An Introduction to Materials in medicine
Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons
Available online from UCSD library

Instructor's note

Dear students,

Welcome to the online version of BENG186A. As measure to prioritize the health and safety of UCSD's students and the community in response to the COVID-19 pandemic, the Spring 2021 quarter of BENG186A will conducted online. All class communication will occur through Canvas. In order to maximize flexibility, lecture audio and slides will be posted asynchronously so students may 'attend' lecture at their convenience. At the same time, interactions are the major benefit of the university classroom so we will facilitate as many interactions as we feasibly can, given technical limitations. My office hours will be held "live" via Zoom during the scheduled class time to ensure there are no schedule conflicts. Discussion sections held by TAs will be held on Canvas Discussion boards where you can get real-time answers to your questions.

A major component of this course is a written project in teams of four students. In order to guide you through the writing process, there will be four writing activities scheduled (see syllabus). Your TAs will organize an online meeting for each group to complete their writing assignment during the scheduled class time. Although it is highly recommended that at least some members be present during the real-time instruction in order to receive useful feedback, groups may arrange their own time to work on the assignment and submit the document by the end of the week for full credit if there are schedule conflicts. Real time TA assistance for the writing workshops will not be available outside of the scheduled times. For more guidance, please see the project handouts.

Prof. Ester J. Kwon

Course Objectives

At the end of this course you should be able to:

- Describe what a biomaterial is.
- List the major classes of biomaterials and their applications.
- Know major methods for the characterization of biomaterials.
- Be able to provide a rational justification for recommendation of the best material for an application.
- List different strategies to modify and/or design biomaterials.
- Explain how biomaterials interact with the “host”.
- Understand basic principles of federal regulation, intellectual property protection, and economics of biomaterials implementation.
- Read, understand, and analyze scientific publications pertaining to the field of biomaterials and have a broad understanding of biomaterials research.
- Learn how to write an effective proposal.

Canvas.ucsd.edu

Canvas (canvas.ucsd.edu) will be used as the main source of class resources and communication. In order to facilitate fair access to information for all students, all questions related to class material must be asked via Canvas. Log into Canvas to do the following:

- Download lecture notes and recordings
- Take weekly quizzes
- Get access to syllabus, reading, and assignments
- Check exam dates and due dates
- Receive general course announcements
- Writing instruction
- Turn in assignments

Course related questions will only be answered on Canvas discussion board to ensure fair access to information. Keep all posts professional and related to the course.

Please direct personal matters to Prof. Kwon by email.

Discussion boards policy

All questions regarding the course should be answered on the Discussion boards on Canvas and not by direct email. If you have a question, one of your classmates probably have the same question.

Discussion boards will be moderated between Monday 9 am to Friday 5 pm. The turnaround time for any question will be 24 hours. For example, a question asked Friday at 6:45 pm will not necessarily be answered until Tuesday morning. It is strongly recommended you answer each other's questions on the discussion board – there has been very good explanations by other students and in-depth discussions in past years. The accuracy of content will be moderated by Prof. Kwon and TAs.

Guidelines for the online classroom

When using video meetings, use headphones to reduce audio feedback.

Keep your microphone on mute unless you are actively speaking to minimize noise so everyone can hear.

Keep all posts online professional and related to the course.

Be mindful of your background and your screen during video calls so you do not accidentally share anything you don't want to.

Office hours and review sessions will be recorded.

Integrity of Scholarship

Academic dishonesty will not be tolerated. This applies to quizzes, exams, and the project. All quizzes and exams will be the sole work of individual students. Projects will be completed in groups of up to 4 students and no content will be taken directly from any source, including past projects.

The Department of Bioengineering adheres to the UCSD Policy on Integrity of Scholarship. An excerpt of this Policy states that "*Students are expected to complete the course in compliance with the instructor's standards. No student shall engage in any activity that involves attempting to receive a grade by means other than honest effort....*" Any suspected incident will be dealt with in accordance with UCSD policy, which includes reporting the misconduct to the Dean. More information on UCSD's academic dishonesty policy can be found at: <http://senate.ucsd.edu/Operating-Procedures/Senate-Manual/Appendices/2>

Class Policies

The following policies help ensure that the class is run fairly and efficiently.

- Post all non-personal questions on Canvas
- Grading: If there is a grade discrepancy, submit the original assignment along with a written request for a re-grade within one week from the date the assignment is returned. If re-grading is desired, then the entire assignment or project is subject to re-grading.
- Exams may not be missed without prior instructor approval.
- You may not reproduce, distribute or display any course materials (lectures, lecture notes, tests, project outlines, etc.) without my express prior written consent. All course materials are protected by U.S. copyright law and by University policy. You may only use the materials for your own use.

Course Evaluation

10%	Weekly Quizzes
25%	Midterm exam (Blue)
25%	Final exam (Blue)
10%	Writing exercises (Yellow)
10%	Proposal drafts (Green)
20%	Final proposal (Green)

Class Schedule

Week	Date	Lectures	Reading	Due Date (5 PM PST)	Real time activity (5-6:20 PM PST)
1	3/30	Syllabus, course overview, introduction			Dr. Kwon OH (5-6 PM PST)
	4/1	Material Properties	I.1.1-I.1.3		
2	4/6	Metals, Ceramics	I.2.3-I.2.4	Submit project groups	Dr. Kwon OH (5-6 PM PST)
	4/8	Polymers	1.2.2		Background & Significance
3	4/13	Hydrogels and Natural Materials	I.2.5, 1.2.7		Dr. Kwon OH (5-6 PM PST)
	4/15	Degradation of Biomaterials			Specific Aims
4	4/20	Surface and Biological Interactions	II.4		Dr. Kwon OH (5-6 PM PST)
	4/22	Structures of Biomaterials	I.1.5, II.1.2, I.2.12	B&S	
5	4/27	Cell Interactions	I.2.14-16		Dr. Kwon OH (5-6 PM PST)
	4/29	Inflammation and Wound healing	II.1.3		Review Session
6	5/4	Midterm (Week 1-4 of material)			
	5/6	Immune response	II.2.2	Specific Aims	Research Design and Methods
7	5/11	Proposal workshop	II.2.3-4		Proposal workshop/Dr. Kwon OH (5-6 PM PST)
	5/13	Proposal workshop	II.2.5-8, II.4.5		Proposal workshop
8	5/18	Potential Problems in Biomaterial Implantation			Dr. Kwon OH (5-6 PM PST)
	5/20	Sterilization and Biomaterials Testing	III.1.2,		Human & Animal Subjects
9	5/25	FDA and Biomaterials	III.2.9		Dr. Kwon OH (5-6 PM PST)
	5/27	Applications: Drug delivery systems	II.5.16		
10	6/1	Applications: Tissue Engineering	II.6		Dr. Kwon OH (5-6 PM PST)
	6/3	Final proposal due		Full proposal due	Review Session
	6/10	Final exam			

Access Guide

Your guide on how to access everything you need for the course and the due dates

Weekly lectures

Recorded video and lecture slides will be available at the start of each week.

Access lecture notes on Canvas via the “Files” link in the menu.

Access links to video files for each week via “Modules.”

Weekly quizzes

Weekly quizzes cover that week’s lecture material and checks for basic knowledge. Take your quiz every week before the following Monday at 11:59 PM.

We will drop your lowest quiz grade.

Access quizzes on Canvas via the “Quizzes” link in the menu.

Due dates: Following Monday at 11:59 PM

Exams

Exams will be open for 24 hours on the scheduled date (see schedule).

Exams will be posted onto Canvas through the Quizzes link.

*If you are unable to take the exam during the schedule time or format, you may contact Prof. Kwon to schedule an oral examination. You must coordinate your oral examination at least one week prior to the exam date.

Writing exercises

Writing exercises should be completed real-time when possible through the Zoom link on Canvas. Passcode is 1862021.

Sign onto the link sent by your TA during the time noted on the Syllabus. Sign into Zoom to receive verbal feedback from your TA. For those students/groups with conflicts, the exercises can be done separately.

Access your Google Doc and Zoom meeting via the e-mail link sent by your TAs.

All students – turn in your writing assignment on Canvas via the “Assignments” link in the menu.

Due date: Friday 11:59 PM in the noted week; see schedule

Proposal drafts and final proposal

All instructions for the proposal drafts and final proposal can be found in the handouts.

Access handouts on Canvas via the “Files” link in the menu.

Turn in your proposal draft and final proposal on Canvas via the “Assignments” link in the menu.

Due date: 5 PM on the noted date; see schedule

Dr. Kwon’s Office Hours

Every Tuesday 5-6 pm PST via Zoom, passcode 1862021.

Access Zoom on Canvas via the “Zoom” link in the menu.