Scope and theme: This course focuses on fundamental science as well as contemporary issues affecting the design, fabrication, characterization and performance of current biomaterials used in medical components, surgical implants, prosthetics and diagnostic devices. Course content assumes a basic background in chemistry/physics, materials science, physiology, cell biology, and would benefit from an introduction to biomaterials or bioengineering. The lectures are intend to promote critical review of the “state-of-the-art” biomaterial technologies by graduate students to identify the significant knowledge gaps required to overcome challenges and further biomaterials development. Primary topics to be discussed constitute several of the independent parameters that may influence design of novel multi-functional biomaterials in biomedical systems. A research-oriented problem-solving perspective is featured.

Instructor: Michael Yu, Associate Professor of Bioengineering

Instructor Contact Information:
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Lecture Time: Tuesdays and Thursdays, 10:45am-12:05pm
Location: WEB 1248

Objectives:
1. Provide graduate-level basic foundations on contemporary biomaterial principles.
2. Discuss concepts of polymers, surfaces, and tissues in the context of biomaterials functions.
3. Introduce biomimetic & rational design approaches to biomaterials engineering.
4. Discuss diverse elements controlling biological responses to materials.
5. Develop critical analyses of biomaterials through grant proposal writing & review.

Readings: Required reading & analysis of research papers & material posted on webpage. Readings form basis of in-class discussions and integral part of class participation.


Optional:

Web Page: Log on to Canvas

In-Class Exams: Two in-class exams (March 7, April 25)

Research Grant Proposal Requirement: Each student is required to create and submit their own original NIH-style (R21) research proposal (see guidelines in class website) to address a significant fundamental or device-related biomaterials problem.

The proposal must include original (i) objective, hypothesis, and specific aims of the proposed research, (ii) a statement of significance and critical review of relevant literature, and (iii) original
experimental design and specific techniques and methods for proposed experiments, including experimental variables and appropriate controls, expected outcomes, and potential problems and alternative solutions. Students are required to submit their chosen proposal topic (1/2 page summary abstract) by **February 9** for approval by the instructor. Students are also required to submit the specific aims section (1 page) by **March 21** for scientific and technical feedback from the instructor. Final proposals (4 collated, bound copies) are due on **April 18**.

**Study Section peer-review session**: Students will be assigned to reviewing “study sections” (chaired by instructors) that will review grant proposals based on NIH merit criteria (see webpage). For each assigned proposal, students will critically review, provide a quality “score” and present a written and verbal critique at the panel discussion session (final exam week, **May 3**). Peer- and instructor-reviewed scores are factored into the final grade for both the proposal and the course.

**Terminal behavior objectives**

By completing this course, students should be able to:

- understand the fundamental science that are critical to designing and studying biomaterials
- understand the issues facing the biomaterials field and potential of new technical approaches to biomaterials design to address these problems
- understand emerging techniques currently used to improve biomaterials
- participate in active engaged dialog in class to address current problems in the field

Further, students will learn to prepare and critique scientific proposals in biomaterials:

- written proposal preparation similar to current national grant submissions
- written critical technical peer evaluations of proposals from fellow students
- exercise in group peer-reviewing and critique dynamics

**Assessment and Grading Criteria**

10% Class participation and homework
58% Exams (29% each)
5% Specific aims
20% Grant proposal
5% Study section score
2% Study section participation

**Late homework** (must be submitted within one week after the due date) will be given 65% of the score.

**Attendance**: Students are expected to arrive on time, fully attend and participate in ALL class sessions. Extenuating circumstances causing absence should be discussed with the instructor **before** the absence occurs, not post-facto.

**Academic Conduct**: All students are expected to abide by the Student Code for academic integrity and dishonesty such as cheating as defined by the National Academy of Sciences and specifically in the University of Utah Student Code: http://www.regulations.utah.edu/academics/6-400.html.

**Accommodations for Disabled Students**: The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you require such accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for necessary and appropriate accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.