ADVANCED BIOMATERIALS
ME/BMED/ChBE/MSE 6777, Spring 2016
T/Th 9:35-10:55 AM, MoSE 1222

Pre-requisites: ME/BMED 4751 or permission from the instructors. Basic knowledge of chemistry, materials science and engineering, & biochemistry/cell biology concepts.

Instructors: Prof. Andrés García
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Objectives:
1. Provide graduate-level foundation on contemporary biomaterial principles.
2. Discuss concepts of surfaces & interfaces in biomaterial function.
3. Introduce biomimetic & rational design approaches to biomaterial engineering.
4. Discuss cellular and molecular aspects of host responses to biomaterials.
5. Develop critical analyses of biomaterials through grant proposal writing & review.

Reference: *Biomaterials Science: An Introduction to Materials in Medicine*, B.D. Ratner, A.S. Hoffman, F.J. Schoen, and J.E. Lemons, 3rd Ed, Academic Press, 2012.

Web Page: Log in to https://t-square.gatech.edu/portal using GTID.

Exams: Two in-class exams (Feb 25, April 21).

Homework: Assigned reading of research articles and/or resource material required PRIOR to class. Assigned homework will serve as basis for class discussions. An IMPACT STATEMENT for each assigned paper must be submitted on the T-square site by 9AM prior to class.

Impact Statement: For each assigned paper, provide a short paragraph (2-4 sentences) summarizing the main point of the paper and its impact/significance. The impact statements must be submitted via the Assignment Tab in T-square by 9AM prior to class. For formatting, list SENIOR AUTHOR (in CAPS) followed by the impact statement for each paper.

Class Discussions: Student teams will lead class discussions based on assigned readings. Teams must provide context for reading and critical analysis. Simple presentation of results in papers is not sufficient.

Grant Proposal: Each student is required to submit a NIH-style research proposal to address a significant fundamental or device-related biomaterial problem. The proposal must include (i) objective, hypothesis, and specific aims of the proposed research, (ii) a statement of significance and critical review of relevant literature, and (iii) experimental design and methods outlining proposed experiments, including experimental variables and appropriate controls, expected outcomes, and potential problems and alternative solutions. Students are required to submit a proposal topic (1/2 page) by February 16 for approval. Students are required to submit the specific aims section (1 page) by March 8 for feedback from the instructors. Final proposals (4 collated, bound copies) are due in class on April 26.

Study Section: Students will be assigned to one of two study sections (chaired by instructors) that will review grant proposals based on NIH merit criteria (see webpage). Each student will prepare a written evaluation for 2-3 proposals and submit them to the instructors by May 3. Each study section panel will meet to discuss the proposals (final exam slot, May 5). Peer- and instructor-reviewed scores will be factored into final grade.

All students are expected to abide by the Georgia Tech Honor Code.

Grading:

15%	Class participation
40%	Exam (20% each)
5%	Specific aims
30%	Grant proposal
10%	Study section score

BMED/ChBE/ME/MSE 6777: Advanced Biomaterials
Tentative Schedule

DATE	TOPIC	ASSIGNMENT
	Surfaces & Interfaces	
12-Jan	Surfaces: concepts & characterization	
14-Jan	Protein adsorption I	
19-Jan	Protein adsorption II	
21-Jan	Cell adhesion to surfaces	
26-Jan	Biomaterial modulation of cell responses	
28-Jan	**SHARK TANK: MINI-PROJECT**	**Mini-project**
	Biomimetic & Engineered Materials	
2-Feb	Hydrogel basics	
4-Feb	Biomimetic materials I	
9-Feb	Biomimetic materials II	
11-Feb	Stimulus-responsive materials	
16-Feb	Drug Delivery I	**Paper topic**
18-Feb	Drug Delivery II	
23-Feb	Self-assembly & nanobuilding	
25-Feb	**EXAM 1**	
	Host Reactions to Materials	
1-Mar	Blood coagulation I	
3-Mar	Blood coagulation II	
8-Mar	Blood-material interactions I	**Specific Aims**
10-Mar	Blood-material interactions II	
15-Mar	Wound healing I	
17-Mar	Wound healing II	
22-Mar	SPRING BREAK - NO CLASS	
24-Mar	SPRING BREAK - NO CLASS	
29-Mar	Wound healing III	
31-Mar	Inflammation I	
5-Apr	Inflammation II	
7-Apr	Inflammation III	
12-Apr	Inflammation IV	
14-Apr	Immune response I	
19-Apr	Immune response II	
21-Apr	**EXAM 2**	
26-Apr	Immune Response III	**Proposal**
3-May	**(electronic submission)**	**Reviews**
5-May	**Study Section - 8:30-10:30**	