BME 652 (3-0-3)
Cellular and Molecular Tissue Engineering

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Class Times:
Thursday 1:00-3:55pm

Office hours:
By appointment

Textbooks and materials:

1. Required: The Molecular Biology of the Cell, Fifth Edition, Bruce Alberts editor, Garland Publishing, Inc.

Course Description:
The tissues and organs of the body are comprised of cellular and extracellular components that form a harmonious environment. This course will explore molecular, cellular and tissue level interactions that are an important component of all tissue engineering strategies. We will consider how a cell moves, reacts and maintains viability and function based on it surroundings. We will discuss how to engineer our materials, tissue grafts and implants to integrate with the body. We will also learn about bodily reactions and the biocompatibility of tissue engineered devices such as immunoreactivity and blood coagulation. Furthermore, we will review clinical and engineering implications through the presentation and discussion of some peer reviewed literature.

Assignments and Grading:
Over the semester, you will develop and perfect a research report focused on a topic in tissue engineering. Rather than exams, we will regularly submit assignments based on the development of this report. We will begin by narrowing down topic ideas and performing literature searches. We will then develop the report by researching the lecture materials as they relate to your chosen tissue engineering topic. Developing report will also be a process of addition and revision. At the end, we will have group presentations by combining similar topics where you will be able to share a bit of your knowledge with the rest of the class. Assignments will be submitted in electronic form through Moodle. We will also have a few quizzes throughout the semester. These will be issued through Moodle with a timeframe in which to complete the quiz.

Course Grading:

(6) Individual assignments	30%
(5) Peer reviews	25%
(6) Quizzes	20%
Group presentation of lecture topic	5%
Group presentation on topic	10%
Final Report	10%

Week	Date:	Topic	Reading
1	Sept 6	Course information	Syllabus
		What is Tissue Engineering?	Articles: 1) 'Tissue Engineering – Current Challenges and Expanding Opportunities', Griffith and Naughton 2) 'Tissue Engineering and Reparative Medicine', Sipe 3) 'Tissue Engineering', Langer and Vacanti
		Review of biomaterials; definition, classes, surface modification, clinical relevance. FDA definitions. Define biocompatibility. Biomaterial – tissue interactions.	4) 'Revisiting the Definition of Biocompatibility' & 'Combination Products: Challenges and Progress'
2	Sept 13	Some biochemistry basics.	Ch2: The Chemical Components of a Cell
		Enzymes, Free energy, Biological reactions	Ch 2: Catalysis and the Use of Energy by Cells
		Protein structure, conformation	Ch3: The Shape and Structure of Proteins
3	Sept 20	Protein function, Enzyme kinetics	Ch3: Protein Function
		Protein-surface interactions, substrate modifications.	Ch10: The Lipid Bilayer and Membrane Proteins
4	Sept 27	Signal transduction	Ch15: Cell Communication
5	Oct 4	Cytoskeletal filaments, cell structure, motor proteins, force generation	Ch16: The Cytoskeleton
6	Oct 11	Tensegrity model of cell architecture, cell spreading, cell shape and cell motility	Article: 'Tensegrity: the architectural basis of cellular transduction'
		Discussion on Tensegrity Cell behavior; signal transduction and decision making	
7	Oct 18	Tissue Engineering: Engineering cells, tissues and organs	Ch.8: Isolating Cells and Growing them in Culture & Fractionation of Cells Ch9: Looking at the Structure of Cells in the Microscope & Visualizing Molecules in Living Cells
8	Oct 25	The extracellular matrix and cell adhesion	Ch19: The Extracellular Matrix of Animals and Integrins

9	Nov 1	Tissue Engineering: Engineering cells and tissues	Ch23
10	Nov 8	Wound healing	Ch23
		Circulatory system, coagulation	Supplemental Material
11	Nov 15	Inflammation	Ch24
		Immune system	Ch25
12	Nov 20	Tissue Engineering: Engineering cells, tissues and organs	
		Mass Transfer in Tissue Function	Supplemental Material
13	Nov 29	Project Presentations	
14	Dec 6	Project presentations	
15	Dec 17	Final Report Due	

*****Additionally assigned material can be found on Moodle**

Grading policy:

Students are expected to abide strictly to the NJIT code of honor which can be viewed at http://www.njit.edu/academics/honorcode.php.

Quizzes: There will be 5or 6 quizzes during the semester. The lowest grade will be dropped. There will be no make-up quizzes. If you miss a quiz, that is the quiz that will be dropped.

Assignments: Reports are submitted though Moodle and through Turn-it-in by the due date indicated. Assignments will not be accepted after the due date. Turn-it-in will give you a similarity score (see the website for definition). You may use the originality report to see if you need to revise your report so that it does not include plagiarized material. It is your responsibility to ensure your report does not have plagiarized material. In the same manner, copied work from piers is unacceptable and will result in both/all students not receiving credit for the assignment. Work that has been cut and paste from other sources will receive a zero. If it can be considered plagiarism, then the case will be turned over to the Dean of Students.

Team Projects: There will be two team projects assigned. The project will be graded by team participation, team presentation, class evaluation and written report. Details will be discussed at a later time.