Tissue Engineering
Fischell Department of Bioengineering
University of Maryland

Syllabus

Course: Tissue Engineering (BIOE411 & ENCH468T)
Advanced Tissue Engineering (BIOE611 & ENCH648T)

Course Location: Glenn L. Martin Hall, Room 1104

Course Hours: 2:00 pm – 4:30 pm, Wednesdays

Course Description: A review of the fundamental principles involved in the design of engineered tissues and organs. Both biological and engineering fundamentals will be considered. A project will emphasize the application of these fundamentals to the development of engineered tissues.

Instructor: Dr. John P. Fisher
Office: Jeong H. Kim Engineering Building, Room 3238
Email: jpfisher@umd.edu
Office Hours: 1:00 – 2:00 pm, Wednesdays or by appointment

Teaching Assistant: None

Online Support: All pertinent information may be accessed on the course website found here: http://www.bioe.umd.edu/~jpfisher/index_files/pcourses2.htm.

Required Text Book
Tissue Engineering
Editors: Fisher, Mikos, Bronzinio, and Peterson
Publisher: CRC Press
ISBN: 9781439874004

Suggested Texts
Tissue Engineering
Author: Saltzman
Publisher: Oxford University Press
ISBN: 019514130X

Textbook of Medical Physiology, Twelfth Edition
Author: Guyton and Hall
Publisher: Saunders Publishing
ISBN: 1416045740

Honor Code: The University of Maryland has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.studenthonorcouncil.umd.edu.

Disabled Students: In accordance with University of Maryland policies, the instructor requests that students with disabilities inform the instructor of their needs at the beginning of the semester.
Lecture Policy
Course lectures will mostly follow the text, with additions from other relevant sources. Lectures will be both written on the board and presented with powerpoint slides. PDF files containing powerpoint slides will be posted on the course website. No electronic devices, such as recording devices and computers, are allowed in class.

Attendance Policy & Assignment Submission
Lecture attendance is highly encouraged. Attendance is determined by a student’s presence in class at 2:00 pm; arrival after 2:00 pm will be considered an absence.
Assignments are due at 2:00 pm on the indicated date. No assignment will be accepted thereafter.

Course Organization
The course is organized into an undergraduate (BIOE411 & ENCH468T) and graduate (BIOE611 & ENCH648T) level. Those enrolled in the undergraduate level will be organized into groups of 2 to 3 students, and will complete all assignments, except the exam, as a group. Similarly, those enrolled in the graduate level will be organized into groups of 2 and will complete all assignments, except the exam, as a group.

Course Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture Topic</th>
<th>Text Chapter</th>
<th>Literature Handout</th>
<th>Group Presentation</th>
<th>Assign Due</th>
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<tbody>
<tr>
<td>January 23</td>
<td>Introduction</td>
<td>1</td>
<td>L1</td>
<td></td>
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<tr>
<td>January 30</td>
<td>Natural Biomaterials</td>
<td>4</td>
<td>L2</td>
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<tr>
<td>February 6</td>
<td>Synthetic Biomaterials</td>
<td>5</td>
<td>L3</td>
<td>3</td>
<td>Project 1</td>
</tr>
<tr>
<td>February 13</td>
<td>Signals</td>
<td>6, 7</td>
<td>L4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>February 20</td>
<td>Pluripotent Stem Cells</td>
<td>8</td>
<td>L5</td>
<td>8</td>
<td>Project 2</td>
</tr>
<tr>
<td>February 27</td>
<td>Mesenchymal Stem Cells</td>
<td>10</td>
<td>L6</td>
<td>2</td>
<td></td>
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<tr>
<td>March 6</td>
<td>Cell Encapsulation</td>
<td>20</td>
<td>L7</td>
<td>9</td>
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<tr>
<td>March 13</td>
<td>Bioreactors</td>
<td>22</td>
<td>L8</td>
<td>5</td>
<td>Project 3</td>
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<tr>
<td>March 20</td>
<td>Spring Break</td>
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<tr>
<td>March 27</td>
<td>Mechanics</td>
<td>14</td>
<td>L9</td>
<td>4</td>
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<td>April 3</td>
<td>Vascularization</td>
<td>24</td>
<td>L10</td>
<td>10</td>
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<tr>
<td>April 10</td>
<td>Bone Engineering</td>
<td>27</td>
<td>L11</td>
<td>6</td>
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<tr>
<td>April 17</td>
<td>Cartilage Engineering</td>
<td>30</td>
<td>L12</td>
<td>11</td>
<td>Project 4</td>
</tr>
<tr>
<td>April 24</td>
<td>Vascular Engineering</td>
<td>35</td>
<td>L13</td>
<td>7</td>
<td>Exam</td>
</tr>
<tr>
<td>May 1</td>
<td>Project Presentations</td>
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<td>Project 5</td>
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<tr>
<td>May 8</td>
<td>Project Presentations</td>
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<td></td>
<td>Project 5</td>
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Course Grading

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
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<tbody>
<tr>
<td>Presentation</td>
<td>100 pts</td>
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<tr>
<td>Project</td>
<td>200 pts</td>
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<tr>
<td>Exam</td>
<td>200 pts</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>500 pts</strong></td>
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The scale for the final letter grade is the following: > 90% A, 89% - 80% B, 79% – 70% C, 69% – 60% D, and < 60% F. In addition, +/- will be assigned for scores in the top/bottom of each range, respectively.
Exams
A take home exam will be distributed on April 17th and must be submitted by 2:00pm on April 24th. The exam will be open book, open notes and must be completed individually.

Presentation
Each group will present recent scientific literature to the class. Each group will present the pre-assigned literature handout, along with other scientific work of their own selection that is relevant to the discussion, in a 60 min presentation. Be prepared to answer questions. The presentation schedule is defined in our course schedule (please see above). A pdf version of the presentation, along with any other material, must also be distributed to the class using Canvas by noon of the day of the presentation.

Group Project
Each group will also write a research proposal during the course of the semester. The research proposal is meant to provide the motivation and research plan needed to develop an engineered tissue. Further details will be discussed in class. A series of assignments developing this research proposal are detailed below. Additional details include 1.5 line spacing, 11 point Arial font, 0.75 inch margins on all sides, bold type for major section headings, and any widely accepted reference style.

Assignment 1: Project Background (Due February 6)
Write a review of the relevant literature surrounding your field of interest within tissue engineering (5 pages). Include a description of the clinical problem, current strategies for treatment, and currently investigated tissue engineering strategies for treatment.

Assignment 2: Project Aims (Due February 20)
Propose a tissue engineering problem for investigation (1 page). Write an introductory paragraph, objective, as well as a description of the clinical problem and tissue of interest. State a global hypothesis and then three aims with three supporting hypotheses.

Assignment 3: Research Design (Due March 13)
Propose a method to develop your engineered tissue (6 pages). For each of the three aims you have developed, outline the necessary experiments to examine your proposed hypothesis; suggest alternatives and definitions for success.

Assignment 4: Engineered Tissue Proposal (Due April 17)
Develop a fully considered tissue engineering proposal (12 pages). Include an abstract, a statement of specific aims, a background section, and a research design and methods section. Address concerns raised in the earlier versions of each component of the project. Also include cited references, which are not included in the page limit.

Assignment 5: Engineered Tissue Presentation (Due May 1)
Present your proposal (20 minutes). Succinctly communicate the key points of your written proposal in a powerpoint based presentation. Include an introduction, background, statement of specific aims, and a research design.