

BME 6334 Tissue Engineering

Credits: 3 credits

Textbook, Title, Author, and Year: **Tissue Engineering** Saltzman W. Mark Oxford, University Press, New York, 2004.
[The book is not followed strictly, but is essential. It's okay to order a used book online]

Reference Materials: **Tissue Engineering** Bernard O. Palsson and Sangeeta Bhatia Pearson Education, Inc., 2004, Upper Saddle River, NJ, 07458

Specific Course Information

Catalog Description: Principles and newest concepts of tissue engineering: concise and comprehensive. Learning and studying molecular, cellular, and tissue culture aspects of TE and Laboratory work and high level of instrumentations that helps this Laboratory work to grow the tissues

- Emphasis will be stressed on the mechanical functions of the cells, extracellular matrix, types, quality and purposes of scaffolds and signaling molecules that “engineer” cellular events toward differentiation and integrative complexity of tissues. Stem cell research in its fundamental re-generative purposes will be considered. Tissue barriers to molecular and cellular transports, cell interaction with polymers, and case studies in Tissue Engineering will be discussed. The Computer aid TE with inventive Ink-jet methodology in connection with robotics and nano-robotics will be among the topics. For the time being there will be NO actual lab. Only conceptual experiments will be elaborated during the classes.

Prerequisites: permission of instructor. No prior Biology background assumed. Prior BME 5000 Introduction to Bioengineering will help.

Specific Goals for the Course:

- Understanding global and particular tissue development, architecture, control mechanisms and quantitativization in engineering procedures.
- Studying fundamental processes in signal transduction, related to sensorial tissues and organs, with emphasis on excitable tissues (muscle and neural tissues).
- Understanding basic principles of Tissue Engineering, at molecular, cellular and tissue level

Brief List of Topics to Be Covered:

1. CELLS AND TISSUES

Microscopy: scaling visual field

Elements of Embryology-Tissue Development

Tissue Engineering Fundamentals with Sensorial

System:

- Cell differentiation
- Describing cell differentiation mathematically
- Cell Migration
- Describing cell migration mathematically

Tissue Engineering Practice:

- Approaches to Tissue Engineering
- Case studies in Tissue Engineering
- Scaling up *ex vivo* cultivation
- Computer Aided Tissue Engineering

2. SCAFFOLDS

- Tailoring Biomaterials
- Biomaterial scaffolds
- Properties
- Surface properties
- Bulk properties
- Mechanical Properties
- Biological Properties

Further Readings

3. SIGNAL MOLECULES

- To be chosen and restricted to necessary

4. TISSUE ENGINEERING STUDY PROBLEMS

- Quantitative Cell and Tissue Biology
- Cell and Tissue Characterization
- Engineering methods and Designs in Autoimmune and Cancerous Diseases Clinical Implementation