

# **BMED 4500 Cell and Tissue Engineering Laboratory**

**Credit:** 1-6-3

**Prerequisite(s):** (BMED 3160 or BIOL 3331) and BMED 3300 and BMED 3400

## **Catalog Description**

The principles of cell and tissue engineering will be presented in a hands-on laboratory experience. Cell engineering topics include receptor/ligand interactions, cell cycle/metabolism, cell adhesion, cellular mechanics, cell signal transduction, and cell transfection. Tissue engineering topics include applications, biomaterials/scaffolds and cells for reparative medicine, bioreactors and bioprocessing, functional assessment, and in vivo issues.

## **Text**

*Tissue Engineering*, Bernhard O. Palsson, Sangeeta N. Bhatia, Pearson Prentice Hall, Inc., Upper Saddle River, NJ, (2004).

## **Objectives**

The overall objective of this course is to present the engineering, biological and basic science aspects of cell and tissue engineering through an active learning laboratory approach to stress the research nature of this field. Furtherance of this objective includes familiarity with a set of techniques and experimental skills, translation of theoretical concepts to the development of practical materials and devices and evaluation of the critical issues and choices needed in developing a tissue engineered construct.

## **Outcomes**

Specifically at the end of the course students will be able to:

1. apply their acquired laboratory skills and experimental design skills to cell and tissue engineering experiments through the use of experimental variables and controls and gain experience in data generation, analysis (including statistical analysis) and presentation (Program Outcomes 1, 2, 4 & 5)
2. identify the engineering and biological issues relevant to cell and tissue engineering (Program Outcomes 1 & 9)
3. evaluate the critical issues and choices needed in developing a tissue engineered construct (Program Outcomes 2 & 9)
4. evaluate the governing principles of cell and tissue engineering through comparison of what is physically performed in the laboratory with what is presented in the corresponding lecture component (Program Outcomes 2 & 4)

## **Topical Outline**

The cell engineering topics (*and experiments*) are:

- Cell culture (*Tissue culture fundamentals*)

- Cell cycle/Metabolism (*Cell viability assays - MTT assay, LIVE/DEAD™ assay, trypan blue*),
- Receptor/ligand interactions (*EGF binding to A431 cells – Scatchard plot*),
- Cell adhesion (*Centrifugation assay for cell adhesion to fibronectin gradients*),
- Cellular migration (*fibroblast scratch assay*).

The tissue engineering topics (*and experiments*) are:

- Applications – cardiovascular, orthopedic, nervous system, metabolic organs,
- Biomaterials/scaffolds for reparative medicine (*Preparation of PLGA scaffolds*),
- Cells for repair (*Seeding scaffolds with a bone cell line*),
- Bioreactors and bioprocessing (*Culture under static versus dynamic conditions, assessment of cell growth and function*),
- Functional assessments (*Cell growth using a DNA assay, alkaline phosphatase activity and calcium deposition using alizarin red staining*),
- *In vivo* issues (*Host response and bone formation in tissue engineered bone constructs using light microscopy*).