Experimental Techniques for Biomaterials and Tissue Engineering – 4800:445

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Course Description
Approximately 50 years after decoding the molecular structure of DNA, the human genome has been published, the gene chip has revolutionized the discovery of novel genes, and disciplines such as bioinformatics, functional genomics, and tissue engineering have emerged. New scientific knowledge is accumulating at an unprecedented rate and the focus of many research programs is shifting toward a multidisciplinary approach to address complex diseases. This pace of scientific discovery and the shift towards multidisciplinary research are challenging many established educational paradigms for science and engineering. In Dr. C. Lenfant’s article “Training the Next Generation of Biomedical Researchers: Challenges and Opportunities” published in Circulation (vol. 102, p 368-370, 2000) that the next generation of biomedical engineers and scientists will require more than ever the breathe of knowledge and skills from both pure and applied sciences. This class is design to equip the next generation of biomedical engineers with molecular techniques behind this revolution and to train them for multidisciplinary research.

Course Outcomes
Upon successful completion of this course, students will be able to:
1. Understand lab safety and wet laboratory techniques (Measured)
2. Understand and use common equipment utilized in BME laboratory
3. Analyze data obtained from lab exercises and experiments
4. Write a technical laboratory report (Measured)
5. Present their data in a poster presentation format (Measured)

Prerequisites
Advanced Biomaterials

Grading Policy
Reports and Presentation
70% (25% of the grade will be from peer evaluation)
   Report 1 – 20%
   Report 2 – 20%
   Poster Presentation – 30%
Midterm –15%
Lab notebook – 15%

Textbooks
Lab manual handouts
Lab notebook
The Craft of Research (W. C. Booth, G. G. Colomb, and J. M. Williams)
The Elements of Style (W. Strunk Jr. and E. B. White)
Any English grammar manual such as Harbrace College Handbook
Laboratory Notebook

Course Outline

1. Fundamentals laboratory practices and notebook
2. Laboratory safety
3. Review of data analysis
4. Laboratory exercises (not in order)
   Lab 1: Basic laboratory exercise (Lab report from Pipette exercises)
       a. Balances
       b. Pipettes exercises
   Lab 2: Spectroanalysis (Lab report from Spectrophotometer assays)
       - Absorbance analysis for endpoint, spectrum, and kinetic assays
   Lab 3: Principles of Microscopy
       a. Theoretical information for light microscopy
       b. Basic adjustments
       c. Cell count
       d. Principle of fluorescence
   Lab 4: Fluorescence Assay
       a. Nuclear
       b. Actin
       c. Focal adhesion
   Project: Biomaterial Evaluations (Report and presentation)
       a. Material overlay assay
       b. Cellular metabolic assay
       c. Apoptosis assay
5. Poster Presentation