

BMED 3600 Physiology of Cellular and Molecular Systems (Required)

Catalog Description: BMED 3600 Physio Cell & Mol Syst (3-0-3)
Prerequisite(s): BMED 3100
In depth cell and molecular physiology focused on cellular responses to stimuli, including cell organization/ reorganization, membrane transport/kinetics, cell signaling/ molecular biology, mechanobiology and energy requirements.

Textbook: Molecular Biology of the Cell, 5th edition, Alberts et al, Garland Science, Taylor & Francis Group, LLC (2008)

Prepared by: Shannon Barker

Topics Covered:

1. The central dogma of biology
 - a. Cells and molecules
 - b. Transcription
 - c. Translation
 - d. Proteins
2. Cell receptor-ligand interactions and cell signaling
3. Membranes, cellular compartmentalization, and transport
4. Adhesion, cytoskeleton, and migration
5. The cell life cycle
 - a. Proliferation
 - b. Apoptosis
6. The extracellular matrix
7. Molecular biology techniques
 - a. Manipulation of cells, proteins, and DNA/RNA
8. Design a rationale approach to a biomedical problem in cell biology
 - a. Using literature to generate a logical hypothesis
 - b. Design appropriate experimental approach toward logical hypothesis

Course outcomes:

Students who complete this course will:

1. Understand the structure and functional organization of cell organelles, especially membrane, cytoskeleton, extracellular matrix and nucleus (Student Outcome a)
2. Understand the quantitative aspects of membrane transport and cell signaling pathways (Student Outcome a)
3. Understand mechanisms regulating cell growth, division & death (Student Outcome a)
4. Understand basic regulatory mechanisms of gene expression and protein synthesis and apply them to problems in biomedical engineering (Student Outcome a)
5. Understand homeostasis and how it is achieved in cell systems and be able to apply this information to product design problems (Student Outcome a)
6. Understand how cells interact with their substrate and apply this knowledge to the design of cell-scaffold constructs for tissue engineering (Student Outcomes a)

7. Know basic constituents of the extracellular matrix produced by cells and how they contribute to the mechanical properties of cells and tissues (Student Outcome a)
8. Read and understand the scientific literature (Student Outcomes i and j)
9. Apply course outcomes 1-8 to the study of applications in biomedical engineering (Student Outcome j)
10. Design rational hypotheses and experimental approaches toward a biomedical problem (Student Outcome b)
11. Generate written and oral communications explaining the rationale of experimental approaches (Student Outcome g)

Correlation between course outcomes and student outcomes:

BMED 3600											
	Biomedical Engineering Student Outcomes										
Course outcomes	a	b	c	d	e	f	g	h	i	j	k
1	X										
2	X										
3	X										
4	X										
5	X										
6	X										
7	X										
8									X	X	
9										X	
10		X									
11							X				

The Wallace H. Coulter Department of Biomedical Engineering Student Outcomes:

- a. an ability to apply knowledge of mathematics, science, and engineering;
- b. an ability to design and conduct experiments, as well as to analyze and interpret data;
- c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, societal, political, ethical, health and safety, manufacturability, and sustainability;
- d. an ability to function on multidisciplinary teams;
- e. an ability to identify, formulate, and solve engineering problems;
- f. an understanding of professional and ethical responsibility;
- g. an ability to communicate effectively;
- h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;
- i. a recognition of the need for, and an ability to engage in life-long learning;
- j. a knowledge of contemporary issues;
- k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice;