

1. Course number and name: BMED 3600 Physiology of Cellular and Molecular Systems
2. Credits and contact hours: (3-0-0-3)
3. Prepared by: Shannon Barker
4. Textbook: Molecular Biology of the Cell, 5th edition, Alberts et al, Garland Science, Taylor & Francis Group, LLC (2008)
5. Specific course information
 - a. Catalog description: 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.
 - b. Prerequisites or co-requisites: BMED 3100
 - c. Required
6. Specific goals for the course
 - a. Understand the structure and functional organization of cell organelles, especially membrane, cytoskeleton, extracellular matrix and nucleus (Student Outcome 1)
 - b. Understand the quantitative aspects of membrane transport and cell signaling pathways (Student Outcome 1)
 - c. Understand mechanisms regulating cell growth, division & death (Student Outcome 1)
 - d. Understand basic regulatory mechanisms of gene expression and protein synthesis and apply them to problems in biomedical engineering (Student Outcome 1)
 - e. Understand homeostasis and how it is achieved in cell systems and be able to apply this information to product design problems (Student Outcome 1)
 - f. Understand how cells interact with their substrate and apply this knowledge to the design of cell-scaffold constructs for tissue engineering (Student Outcomes 1)
 - g. Know basic constituents of the extracellular matrix produced by cells and how they contribute to the mechanical properties of cells and tissues (Student Outcome 1)
 - h. Read and understand the scientific literature (Student Outcome 7)
 - i. Apply course outcomes 1-8 to the study of applications in biomedical engineering (Student Outcome 1)
 - j. Design rational hypotheses and experimental approaches toward a biomedical problem (Student Outcome 6)
 - k. Generate written and oral communications explaining the rationale of experimental approaches (Student Outcome 3)
7. Brief list of topics to be covered:
 - a. The central dogma of biology
 - i. Cells and molecules

- ii. Transcription
- iii. Translation
- iv. Proteins
- b. Cell receptor-ligand interactions and cell signaling
- c. Membranes, cellular compartmentalization, and transport
- d. Adhesion, cytoskeleton, and migration
- e. The cell life cycle
- f. Proliferation
- g. Apoptosis
- h. The extracellular matrix
- i. Molecular biology techniques
- j. Manipulation of cells, proteins, and DNA/RNA
- k. Design a rational approach to a biomedical problem in cell biology
- l. Using literature to generate a logical hypothesis
- m. Design appropriate experimental approach toward logical hypothesis