

BIOL 506: Molecular and Cellular Basis of Human Disease (2 credits)

INSTRUCTOR/COURSE DESIGNER: Dr. Kelly McDonald, Ph.D.

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TEXT: Assigned readings from open-access online resources (journals, texts, websites) will be posted during Spring 2010.

COURSE FORMAT:

The last decade has seen revolutionary advances in basic and medical research, from the sequencing of the human genome to the identification of over 15 million human DNA variations, to the use of those variations to track down elusive disease genes. The wealth of genomic information combined with cutting-edge technologies hold the promise of new therapies based on stem cell treatments, tissue regeneration, and gene therapy, to name a few. The future of healthcare will likely see a shift toward personalized medicine, and will certainly rely on an understanding of the molecular, cellular and genetic factors associated with health and disease. This course will examine the molecular and cellular basis of a common disease, connecting the cellular processes with the physiology and pathophysiology at the tissue and whole organ level. This is a graduate-level course, and significant work is expected of the participants (and the instructor). This course will follow a hybrid format and will require at least 50 hours of coursework, divided into three components as outlined below.

1. The first part of the course will be online, and participants will use the ANGEL course management tool (similar to Blackboard or WebCT) to access readings, assignments, and engage in online discussions. This component will primarily consist of directed readings in molecular and cellular biology with a strong emphasis on the underlying basis, detection and treatment of human disease. (20-25 hours)
2. The second part of the course will consist of two face-to-face workshops at the 2010 HAPS Conference in Denver, May 29th – June 3rd. (6 hours)
3. The final component of this course will involve a project to be completed independently and submitted online via the ANGEL course management system. Participants will research a disease of their choosing and create a presentation, case study, computer-based activity or similar learning tool that emphasizes the molecular and cellular aspects of a physiological disorder. (20-25 hours)

COURSE DESCRIPTION:

BIOL 506 is designed to provide college-level instructors with the opportunity to expand their understanding of key molecular and cellular concepts and processes as they relate to physiology and human disease. Participants, who begin their preparatory background work prior to the first course meeting, will subsequently participate in discussions and activities that examine diabetes mellitus from the molecular to the whole organism level. Basic molecular and cellular concepts will be explored within the context of this disease (or group of diseases), and participants will be introduced to publically available tools and databases that they can use for their research-based project. Participants will apply what they've learned from the preparatory and face-to-face instruction to design a learning activity that integrates molecular and cellular biology into their A&P courses. Participants will be evaluated on the basis of a variety of criteria (see Evaluation, below), including attendance, participation in preparatory and workshop activities, and quality of final submitted materials.

COURSE OBJECTIVES

Upon completion of this course, participants should be able to:

- Explain the structure and function of cell membranes, cytoskeleton and organelles.
- Discuss examples of cell-to-cell communication and interactions of cells with the extracellular environment.
- Explain the molecular flow of information from DNA to RNA to protein in cellular structure and function.
- Describe how different mutations affect protein and cellular function
- Discuss the relationship between genotype and phenotype (e.g., how a mutation at the DNA level affects protein structure and function, cellular activity and ultimately tissue/organ function and physiology.)
- Interpret scientific literature and employ scientific communication skills.
- Utilize open-access Internet resources and tools to study the molecular and cellular basis of disease.
- Design a learning tool, appropriate for undergraduate A&P students, that enhances understanding of key molecular and cellular concepts as they relate to physiology and human disease.

*Participants will also gain specific knowledge related to the molecular, cellular, and physiological nature of diabetes mellitus, as the course objectives will be taught in the context of this complex group of diseases. Current and future diagnostics and therapeutics for diabetes will also be introduced.

EVALUATION

Participants may earn a total of **100 points** in the course, which will be graded on a pass/fail basis, with a "pass" grade requiring 65% of total points. Points will be assigned on the basis of the following criteria:

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Completion of background reading and assignments	30
Attendance and participation in scheduled workshop sessions	30
Final Project	<u>40</u>
	100

- 1. Completion of background assignments:** Participants are expected to be reasonably prepared for the workshop activities, which includes (at minimum) completion of background reading and preparatory assignments. The course instructor will be available via e-mail to address questions on background material prior to the conference.
- 2. Attendance/Participation:** Attendance is required at all workshop sessions (6 hours). While in the workshop sessions, participants are expected to engage in the activities and contribute to discussions.
- 3. Final Project:** Following the HAPS conference, participants are expected to submit a culminating project that supports integration of molecular and cellular concepts within a college-level A&P course. This project may take the form of a presentation, case study, computer-based activity, or related learning tool, but must be researched and creatively designed by the participant. Submissions will be peer-reviewed by selected HAPS members. It is expected that these projects will be made available to the HAPS membership as a whole for use in their classrooms and laboratories.