

University of Arkansas – Fort Smith
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General Syllabus

BIOL 3834 Microbial Physiology

Credit Hours: 4

Lecture Hours: 3

Laboratory Hours: 3

Prerequisite: BIOL 2503/2501 General Microbiology/Lab, BIOL 3803/3801 Genetics/Lab, and CHEM 2703/2701 Organic Chemistry I/Lab.

Effective Catalog: 2018- 2019

I. Course Information

A. Catalog Description

A molecular study of the composition of prokaryotic cells, the metabolic chemistry of bacteria with emphasis on the aerobic and anaerobic energy yielding reactions, mechanisms of enzyme activity in bacterial physiology, and genetic control of bacterial processes.

II. Student Learning Outcomes

A. Subject Matter

Upon successful completion of this course, the student will be able to:

1. Discuss bacterial physiology and metabolism in molecular terms.
2. Describe bacterial structures at the molecular level and explain the processes involved in the formation of those structures.
3. Describe the molecular processes involved in the transport of metabolites across the bacterial membrane and cell wall.
4. Describe bacterial growth at a molecular level and explain how catabolic and anabolic processes make growth possible.
5. Describe energy acquisition processes and relate those processes to the availability of oxygen and other nutritional and environmental factors.
6. Explain genetic processes in bacteria and how those processes regulate bacterial life.

B. University Learning Outcomes

This course enhances student abilities in the following areas:

Analytical Skills

Quantitative Reasoning: Students will critically evaluate scientific papers obtained from primary sources. Students will utilize a number of mathematical models commonly used in bacteriology research to support scientific conclusions.

Communication Skills (written and oral)

Students will communicate factual information and reasoning in a written form via essay exam questions and written analysis of primary literature. Students will communicate factual information and reasoning verbally in a socially appropriate manner by interacting with classmates in small group settings when discussing literature.

Global and Cultural Perspectives

Students investigate how plant biotechnology will be used to solve global problems such as hunger and epidemics.

III. Major Course Topics

- A. Nature of Bacterial Physiology
 - 1. Definition of microbial physiology
 - 2. Differences between prokaryotes and eukaryotes
- B. Bacterial Structures and Structure Formation
 - 1. External cell structures
 - 2. Structure of prokaryotic cell membrane
 - 3. Internal cell structures
- C. Metabolite Transport
 - 1. Passive transport
 - 2. Active Transport mechanisms in prokaryotes
- D. Bacterial Growth
 - 1. Standard curve
 - 2. Exponential growth and binary fission
 - 3. Growth in a chemostat
- E. Catabolic Metabolism
 - 1. Glycolysis
 - 2. Various fermentation pathways
 - 3. Cellular respiration in prokaryotes
- F. Fermentation
 - 1. Fermentation products that are commercially valuable
 - 2. Industrial fermentation techniques
- G. Energy Generation
 - 1. Proton motive force
 - 2. Mitochondria and chloroplasts
- H. Protein Synthesis
 - 1. 70S ribosome structure
 - 2. Polycistronic RNA
 - 3. Transcription and translation in prokaryotes
- I. Nucleic Acid Metabolism

1. Nucleases and restriction enzymes
2. Nucleotide synthesis and polymerization
- J. Genetics and Genetic Regulation
 1. Genetic differences between prokaryotes and eukaryotes
 2. Bacterial polymerases
 3. Operons
- K. Effect of the environment on microbial growth
 1. Effects of oxygen, temperature, pH and osmotic pressure
 2. Survival mechanisms of extremophiles
- L. Physiological Implication of Antimicrobial Agents on Bacteria
 1. Modes of action for antibacterial agents
 2. Classification of antibacterial agents
- M. Chemolithotrophic Metabolism
 1. Sulfur metabolism
 2. Cave microbiology
 3. Thermological vents
- N. Phototrophic Metabolism
 1. Photosystem I in photosynthetic bacteria
 2. Photosynthesis in Cyanobacteria