

Microbial Physiology 11:680:481

Description:

Microbial physiology is a 3 credit course with two 1 hour 20 minute lectures each week. The course is taught by one instructor whom is faculty in the department of Biochemistry and Microbiology.

Microbial Physiology is an intensive course with the goal of integrating biochemistry and genetics to enhance the understanding of the microbial cell and the robust and diverse nature of life. This course is intended to be a capstone class for the microbiology major. It will provide the instructor with the opportunity to re-address the learning goals of the microbiology major and address general scientific misconceptions before student graduation. This course is targeted to “advanced” juniors or seniors majoring in microbiology, biochemistry, biotechnology, and related fields, as well as graduate students.

Microbial physiology is a broad subject area and this course will attempt to provide a balance between the breadth of subjects addressed and the depth at which the subjects are discussed. The course has three overarching topics: 1. central metabolism and energy conservation, 2. macromolecular biogenesis and function and, 3. integration of metabolic events. The introductory lectures will address metabolic functions that are common to most organisms. The lectures will then progress to address metabolic functions that are the “exception to rule” to highlight the diversity of the microbial world. Students will learn about current events in the subject of microbial physiology and modern techniques used to examine metabolism. They will also learn about how the metabolic potential of micro-organisms has been harnessed to address problems facing society. Active teaching techniques, such as think-pair-share questions will be employed throughout the semester to aid in discussions, help improve student retention, assess student learning, and address common scientific misconceptions.

After completing this class, students will have the theoretical background and understanding of microbial physiology that is necessary to conduct microbiological laboratory research or attend professional school. It will also enhance the student’s ability to engage the public on microbiology issues.

Prerequisites:

Biochemistry course: (11:115:403, 11:115:301, 01:694:301, or 01:694:407)
General Microbiology 11:680:390

Faculty:

Instructor: Prof. Jeff Boyd

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Department of Biochemistry and Microbiology

Lipman Hall Room 122

76 Lipman Dr.

New Brunswick, NJ 08901

Prerequisites:

Biochemistry course: (11:115:403, 11:115:301, 01:694:301, or 01:694:407)
General Microbiology 11:680:390

Textbook and course material:

Lecture slides will be posted on Sakai prior to the initiation of the semester and should be used alongside lectured notes as a study guild. Lecture notes may be subject to change before the lecture itself, but he changes, if any, will not be drastic. A textbook is not required for this course, but student may wish to purchase The Physiology and Biochemistry and Prokaryotes forth addition by David White to aid in studying.

Basis for evaluation:

-Three written examinations (350 points total): Two 100 point exams and one 150 point final exam. One-half of the material covered in the final exam will be new material.

-Two problem sets (25 points each): The problem sets are intended to prepare students for the first two examinations.

-In class participation (50 points): This includes attendance and participation in discussions. Each class missed without prior notification or a valid excuse will result in a 10 point deduction.

-Extra credit: Confusing topics questions (1 point per week for a total of 14 points). Students can submit an email to the instructor on or before Monday outlining areas of confusion from the topics that were covered in the lectures from the previous week. The instructor will re-address these topics prior to the start of the first lecture of the week.

Two exams	200
One final exam	150
Problem sets	50
Participation	50

Total 450 points (plus 14 possible extra credit points)

Overall Learning Goal:

Students are expected to gain a fundamental understanding of the organization and metabolism of microbial cells to further comprehend the robust and diverse nature of life.

Learning Goals for Microbiology Physiology:

After completion of the lecture component of the course, successful students will:

1. Demonstrate an understanding of cellular superstructure and the functional components of cells.

2. Demonstrate an understanding of how organisms build and maintain a proton motive force.
3. Comprehend the how cells metabolize the nutrients necessary for life including carbon, nitrogen, sulfur and phosphorus.
4. Appreciate how biochemical pathways and processes are integrated into a network, which provides robustness to life.
5. Comprehend how cellular physiology is altered by interactions between microbes and the environment.
6. Appreciate that the diversity of life is driven by the metabolic diversity of microbes.

Lecture Topics:

What is life?
Microbial Cell Structure/Function
Thermodynamics and oxidation/reduction reactions
Chemiosmotic theory and chemical energy
Fermentation
Photosynthesis
Cellular respiration
Bacterial Genetics
Overview of central metabolism and the 12 essential precursors
Glycolysis
Pentose phosphate pathway
TCA cycle
Nitrogen, phosphorus and sulfur assimilation
Nitrogen cycle
Sulfur cycle
Acetogenesis
Methanogenesis
One carbon metabolism
Syntrophy
Locomotion
Environmental sensing and response
Cell-to-cell communication