

## **Microbial Physiology 11:682:503**

Instructor: Prof. Jeff Boyd

Email: [jmboyd@AESOP.rutgers.edu](mailto:jmboyd@AESOP.rutgers.edu)

Address:

Department of Biochemistry and Microbiology

Lipman Hall

76 Lipman Dr.

New Brunswick, NJ 08901

Office hour: Tuesday at 4 PM.

### **Format:**

Spring semester

Two 80 minute lectures per week. Monday and Thursday from 9:15-10:35.

### **Course Description:**

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 instructors 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. It will also enhance the student’s ability to engage the public on microbiology issues.

**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.

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

-Weekly literature summary (140 points): Every Thursday one or two primary literature article will be provide via the Sakai site. Typically only one article will be provided, but if the articles are short and on the same subject two articles will be provided. Graduate students are required to read the article and write a succinct report about the article. The report should be between 400 and 800 words in length and include a brief background of the topic and a synopsis of the significance of the topic and findings. Note that the article summaries are a significant portion of your grade so take them seriously.

-Pre-proposal (100 points): An NSF style pre-proposal will be due May 2nd. The topic of the pre-proposal will be: "Exploring the physiology of [my favorite microbe]." The proposal should: 1. provide background on the organism; 2. articulate the key question that you are asking and state your hypotheses; and 3. provide a brief description of your experimental approach. The pre-proposal should be between 3-5 pages in length.

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

Two exams	200
One final exam	150
Weekly literature summary	140
Pre-proposal	100
In class participation	50

-----  
Total 640 points (plus 14 possible extra credit points)

**Textbook and course material:**

The Physiology and Biochemistry and Prokaryotes forth addition by David White. Lecture notes and readings will be posted on Sakai prior to individual classes, but lecture notes may be subject to change before the lecture itself. The changes, if any, will not be drastic.

**Short description for course catalog:**

Microbial Physiology is an advanced undergraduate 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.

**Exam Dates**

Exam 1. February 24

Exam 2. April 10

Final Exam: to be announced

Topic outline and Working syllabus:

**Topics to be covered in Section 1:**

What is life? What is a cell? What is physiology?, Eukaryotic and Prokaryotic cell structure and function, thermodynamics and oxidation/reduction reactions, Chemiosmotic theory, proton motive force, Electrochemical energy, Respiration, ATP generation, Photosynthesis, Fermentation

**Topics to be covered in Section2:**

Central metabolism; glycolysis, TCA cycle, Entner-Douderoff, Pentose Phosphate Pathway, beta-oxidation

**Topics to be covered in Section three:**

Nitrogen Cycles, Sulfur Cycle, Iron oxidation/reduction, acetogenesis, methanogenesis, C1 metabolism.

**Topics to be covered in Section four:**

locomotion, cellular adhesion, cell-to-cell communication, environmental sensing, physiological adaptation