

# BACTERIAL PHYSIOLOGY, ANTIBIOTICS, AND GENETICS

**GMS 6108**

**3 CREDIT HOURS**

**IN-CLASS AND ONLINE**

**COURSE DIRECTOR:**

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**OFFICE HOURS:** Generally MWF 9:00-5:00 Eastern time by email, but email may be answered at any time at the discretion of the faculty member.

**COURSE WEBSITE:** TBD

**COURSE COMMUNICATIONS:** Specific questions are best asked by email to the appropriate faculty member. If a discussion/forum page is set up, questions that would benefit other students should be posted there.

**REQUIRED TEXTS:** Molecular Genetics of Bacteria, 4th Edition, Snyder et. al., ASM Press; Antibiotics: Actions, Origins, Resistance, 1st Edition, Christopher Walsh, ASM Press.

**ADDITIONAL RESOURCES:** A good microbiology textbook, such as the required textbook from GMS 6121 (Schaechter's Mechanisms of Microbial Diseases, 5<sup>th</sup> ed., Lippincott William & Wilkins), would be helpful since the assigned text focuses exclusively on genetics, whereas structure, physiology, metabolism, antibiotics, and antibiotic

resistance are also part of the course. There are also excellent online resources to help fill in gaps.

**COURSE DESCRIPTION:** This course is a compendium of three one-credit courses that are often taught in succession over a semester: GMS 6038 Bacterial Genetics and Physiology, 6169 Antimicrobial Strategies, and GMS 6153 – Advanced Bacterial Genetics.

**PREREQUISITE KNOWLEDGE AND SKILLS:** This course is designed to follow GMS 6121 Infectious Diseases, which includes a very brief introduction to bacterial structure, physiology, and genetics aimed at students who have not taken formal microbiology courses. GMS 6108 builds upon that introduction. Therefore, this course is also appropriate for students who either majored in microbiology or took a comprehensive undergraduate microbiology course. The introductory lecture materials from GMS 6121 are provided online so that students can bring themselves up to speed before beginning this course. Finally, an online quiz as a preliminary assignment will ensure that students comprehend the prerequisite knowledge, even those who took GMS 6121. If a prospective student has concerns about taking GMS 61088, they should contact the course director.

**COURSE GOALS AND/OR OBJECTIVES:** By the end of this course, students will be able to:

- describe differences in cell structure among different classes of bacteria
- relate how cell structure and composition affect the biology and genetics of the bacteria
- describe in detail the process of gene expression from transcription to translation to secretion and identify the genetic elements involved with these processes
- relate chromosomal DNA replication to different models of plasmid DNA replication and use this information to explain the biology and use of representative plasmids
- describe the life cycles and replication mechanisms of representative bacteriophages
- creatively use plasmids and phages in manipulation of bacterial genomes
- describe the regulation of transcription from the most basic paradigms to more complicated models of regulation
- use models of transcriptional regulation in solving problems of gene expression
- understand history of antibiotics
- describe mechanisms of antibiotic action
- explain acquired and intrinsic resistance mechanisms
- explain the concept of ancient resistance
- describe the use of phage as non-conventional therapeutic agent

**TEACHING PHILOSOPHY:** Our teaching philosophy for graduate students is that we are a team moving forward in education. We will do our best to teach the relevant material in the most effective manner. We expect students to participate in their own education by studying assigned materials, completing assignments, and asking for help in a timely manner having attempted to seek answers on their own using available resources.

**INSTRUCTIONAL METHODS:** This course is being offered as both in-class and online. Even with in-class instruction, there will be a significant amount of "flipped" lectures in which an online lecture is presented with a corresponding homework. For the online course, recorded lectures in the form of narrated PowerPoints will be posted along with a brief homework/quiz to enforce timely viewing and study of the lecture. Latter parts of the course will also involve reading primary research papers with online homework/quizzes and discussions of the papers.

## COURSE POLICIES:

**ATTENDANCE POLICY:** For the in-class section, because class time will include interactive discussion of the material, attendance at class is mandatory. Students are expected to attend and participate unless they obtain permission of the instructor ahead of time. For the online section, attendance constitutes viewing lecture videos, completing homework/quizzes, and participating in discussions within the set time frames. If a student cannot attend lecture or participate online in the set times, they should communicate the issues with the relevant faculty member. Course attendance policies are in accordance with UF policy on attendance: (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>).

### HOMEWORK/QUIZ/EXAM POLICY:

**Homework/Quizzes:** Online homework and quizzes are aimed at encouraging timely mastery of assigned course material. They are open book, open note.

**Exams:** There are three exams – one for each five-week section of the course. The exams are closed book, closed note. For in-class sections, the exams will be in the Health Science Center testing center. For online sections, exams will be via ProctorU.

**MAKE-UP POLICY:** If a student misses an assignment such as a homework or quiz, it may be made up according to University of Florida policy for allowable excused absences (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>).

**ASSIGNMENT POLICY:** There are assigned homework and quizzes designed to help students keep up with studying and to ensure that they have an understanding of the material. Unless a student has a university-allowed reason for missing an assignment (see above), a grade penalty of at least 10% will be levied against late assignments.

**CLASS DEMEANOR:** For the in-class section, students are expected to attend class on time and remain until class is dismissed. They should bring all necessary materials

including the textbook, notes, and possibly laptop. They should refrain from activities not involved with class such as texting, talking on the phone, social media, etc. They are expected to participate in discussions and to be prepared to answer questions that may be directed to students in class. For the online section, see Netiquette below.

## UF POLICIES:

**UNIVERSITY POLICY ON ACCOMMODATING STUDENTS WITH DISABILITIES:** Students requesting accommodation for disabilities must first register with the Dean of Students Office (<http://www.dso.ufl.edu/drc/>). The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation. You must submit this documentation prior to submitting assignments or taking the quizzes or exams. Accommodations are not retroactive, therefore, students should contact the office as soon as possible in the term for which they are seeking accommodations.

**UNIVERSITY POLICY ON ACADEMIC MISCONDUCT:** Academic honesty and integrity are fundamental values of the University community. Students should be sure that they understand the UF Student Honor Code at <http://www.dso.ufl.edu/students.php>.

**NETIQUETTE: COMMUNICATION COURTESY:** All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions and chats. <http://teach.ufl.edu/docs/NetiquetteGuideforOnlineCourses.pdf>

**COURSE/FACULTY EVALUATION:** Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open during the last three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

## GETTING HELP:

For issues with technical difficulties for E-learning in Sakai, please contact the UF Help Desk at:

- [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu)
- (352) 392-HELP - select option 2
- <https://lss.at.ufl.edu/help.shtml>

Any requests for make-ups due to technical issues MUST be accompanied by the ticket number received from LSS when the problem was reported to them. The ticket number will document the time and date of the problem. You MUST e-mail your instructor within 24 hours of the technical difficulty if you wish to request a make-up.

Other resources are available at <http://www.distance.ufl.edu/getting-help> for:

- Counseling and Wellness resources
- Disability resources

- Resources for handling student concerns and complaints
- Library Help Desk support

Should you have any complaints with your experience in this course please visit <http://www.distance.ufl.edu/student-complaints> to submit a complaint.

## GRADING POLICIES:

**The final grade will be calculated as follows:**

Exams 50%

Homework/quizzes 40%

Attendance and class participation (or online discussions) 10%

**GRADING SCALE:** The default grading scale for the class is: A  $\geq 90$ , A- 87-89.9, B+ 84-86.9, B 80-83.9, B- 77-79.9, C+ 74-76.9, C 70-73.99, C- 67-69.9, D+ 64-66.9, D 60-63.99, D- 57-59.9, E  $\leq 56.9$ . This scale may be shifted downward, but it will never be shifted upwards.

See the UF policy on grades at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

## COURSE SCHEDULE:

**EXAMS:** The three exams fall every 5 weeks covering the material from the previous 5 week section.

### Topical Outline

Weeks 1-5 Bacterial Genetics and Physiology

- Week 1 - Review structure, physiology, general genetics, antibiotics and resistance
- Week 2 - Transcription, translation, secretion, DNA replication
- Week 3 – Genetic exchange, mutagenesis
- Week 4 – Plasmids and bacteriophages
- Week 5 – Regulation of Expression and exam 1

Weeks 6-10

- Week 6 - Antibiotic discovery, classification, and mode of action
- Week 7 - Antibiotic target identification
- Week 8 - Antibiotic resistance: mechanisms, regulation, and acquisition
- Week 9 - Antimicrobial resistance is ancient
- Week 10 - Phage therapy: opportunities and challenges and exam 2

Weeks 11-15 Advanced Bacterial Genetics

- Week 11 - Gene cloning and functional analysis of genes
- Week 12 - Mechanisms of gene regulation
- Week 13 - Global regulatory mechanisms
- Week 14 - Molecular genetic analysis and biotechnology

- Week 15 - Genomic approaches to bacterial genetics and exam 3