

## **BIOS 4340: Medical Microbiology**

**Lectures:** Tuesdays & Thursdays

**Instructors:** Steve Diggle plus special guests  
Office hours: After class or by appointment

**Teaching Assistants:** None

### **Course description**

Microbial pathogens are a major source of mortality and morbidity world-wide. Microbes also play a role in host health, as recognized by the rapidly expanding human microbiome literature. In this course, we will address central topics in how microbes cause disease and impact host health, and in turn how we can better manage our microbial connections to promote health. In the context of microbial pathogens, we will explore recent and ongoing viral challenges such as Ebola and COVID-19, and key bacterial (eg. *Staphylococcus aureus*, *Clostridium difficile*, TB) and eukaryotic pathogens (eg. *Plasmodium* sp., *Candida* sp.). We will discuss important questions such as how can we control chronic polymicrobial infections? How can we manage drug selection pressures to minimize the evolution of antibiotic resistance? To help answer these questions, we will explore bacterial cell-to-cell signaling (quorum sensing), biofilm formation and novel therapeutic interventions. Course lectures and journal article discussions will draw heavily from the primary literature in the overlapping fields of microbial pathogenesis and microbial ecology / evolution.

### **Learning Objectives:**

*By the end of this course, students will be able to:*

- Identify key bacterial, viral, fungal and parasite pathogens and describe how they cause disease and how to treat them
- Identify molecular and ecological mechanisms by which interactions with microorganisms shape host disease
- Describe the molecular and evolutionary mechanisms driving antibiotic resistance
- Understand new therapeutic interventions and the challenges of getting these into clinical use
- Effectively synthesize and present primary research papers

### **Course organization:**

Course meetings will involve a combination of lectures (1/2) and student presentations/group discussions (1/2) focused on key primary literature. Group discussions will be based on the weekly reading of research articles from the primary literature and review articles. Literature readings, lectures and review papers will be made available as PDFs and posted on **Canvas**.

**Class attendance:** Class time will be used for lectures, presentation/group activities, and exams. If you miss a lecture, you are responsible for obtaining all notes, announcements, and assignments. Written confirmation of a legitimate excuse, such as a severe illness, will be required if any assessment is missed. **The institute's excused absence policy will be enforced in this course (<http://www.catalog.gatech.edu/rules/4/>). No exceptions!** Lecture is a time when we all work together, so be courteous to your fellow students and do not disrupt class by entering and leaving the room, reading, talking, allowing cell phones to ring, etc. In addition, do not use your electronic devices (laptops, tablets, smartphones, etc.) for non-class use.

Research articles will be chosen by Dr. Diggle to complement the lecture schedule and to reflect recent substantive advancements in the field. These articles will be presented to the class through

graded student presentations (30 min; one or two presentations per student depending on enrollment), followed by student-led group discussions (30 min). Discussion sessions will contribute to graded participation scores. The format for the presentations is flexible but should be designed to both summarize the content of the paper and also present ideas for discussion. Instructors will provide guidelines for what to include in the presentation and will give an example presentation in week 1.

**Exams:** Two take home exams, consisting of short answer questions, based on a particular topic. The exams will test your ability to look up and to present information. Exams can only be missed if proper documentation is presented. Make-up exams will be different from the original exams. Attendance in class is mandatory. The most stringent scale used for grading will be 90-100% an A, 80-89% a B, 70-79% a C, 60- 69% a D, and 59% or less an F. This scale is subject to adjustment at the professor's discretion. All problems regarding grades on assignments must be handled through the regrade system.

**Graduate students** will be required to submit a term paper (due at the end of the semester) in the form of an NIH research proposal outline. These proposals should be focused on an understudied or novel question in medical microbiology. This project is designed to foster critical thinking in the field of Medical Microbiology and also to develop important skills in experimental design, hypothesis testing, and proposal writing. Proposal writing will follow a format defined by the NIH (11 point arial, half inch borders), and will initially involve the submission of a one-page 'specific aims' page prior to the final submission. Final submissions should be no more than 4 double-spaced pages in length (Ariel, 11 Point font), not including Figures/Tables and References. **Late assignments will NOT be accepted.** Examples of NIH grants will be provided by the instructors.

**Prerequisites:** Undergraduate Semester level BIOL 3380 Minimum Grade of D

**A special note on the use of technology:** Machine learning language processing and artificial intelligence is becoming common in the generation of text. These tools are sophisticated enough that they can now generate answers to some basic questions (answers, do not necessarily mean correct answers!). The use of AI/ML-generated textual response is not allowed for generating text or scripts for any assignment in this class. We will utilize tools to detect AI generated text and, frankly, the ability to generate critical and well-referenced text is still poor. You can use any tools you would like to help study or understand concepts, but we encourage you to treat these tools critically.

### **Grading:**

#### ***Undergrad***

Two take home exams (35% each) – 70%

Paper presentation – 30%

#### ***Grad***

Two take home exams (30% each) – 60%

Research proposal – 30%

Paper presentation – 10%

**Honor policy:** Your conduct in the course should conform to the Student Honor Code (<http://www.honor.gatech.edu/>). Students caught cheating will be reported to the College for disciplinary action.

**Americans with Disabilities Act:** Students with disabilities needing academic accommodation should (1) register with and provide documentation to the Office of Disability Services (<http://disabilityservices.gatech.edu/>) and (2) bring a letter to the Professor during the first week of class indicating and describing the need for accommodation. Appropriate accommodations will then be provided as needed.

**Regrade policy:** The only way that changes to your grades will be considered is through the procedure below. Do not approach the Professor or a TA and ask for credit for an already-graded question without a written description of the problem.

**Regrades can be requested if:**

- (1) There has been an error in adding together your score.
- (2) You did not receive credit for an answer as given on the key.
- (3) There is a difference between your score and that of another student who gave the same answer.
- (4) You did not receive credit for an answer that differs from that on the key, but which is nevertheless correct.

In general, regrades will not be considered for issues concerning the amount of credit awarded for an answer. For example, questions such as ‘Why did I receive only two points for this answer instead of three?’ will not be addressed unless you find evidence of the issue (see point 3).

To have an assignment regraded, you must submit a hard-copy, typewritten explanation of the problem along with your original exam directly to the professor (email appeals will not be considered). For issues (1) and (2), it will generally suffice to simply describe the problem. For issue (3) you will need to submit an explanation of the problem, as well as both copies of the material. For issue (4) you must give a detailed and explicit account as to why your answer is correct.

The Deadline for the submission of regrade requests is one week after the assignments are handed back. No regrades will be considered after the deadline. Note that if you request a regrade for a particular question, your entire exam may be regraded, which could result in a lowering of your overall score.

Week	Date	Topic	Instructor	Grad students only
1		Introduction to course  Introduction to journal club: <i>Harrison et al. (2015) mBio</i>		
2		Lecture: <i>Background to infectious disease</i> Journal club: <i>Piewngam et al. (2018) Nature</i>		

3		Lecture: <i>Bacterial pathogens</i> Journal club: <i>Bland et al. (2024) PLOS Biology</i>		
4		Lecture: <i>Viruses</i> Journal club: <i>Pekar (2021) Science</i>		
5		Lecture: <i>Parasites 1 (Protozoa)</i> Journal club: <i>Paton et al. (2019) Nature</i>		
6		Lecture: <i>Parasites 2 (Helminths)</i> Journal club: <i>Wammes et al. (2014) Lancet Infect Dis</i>		
7		Lecture: <i>Pathogenic fungi</i> Journal club: <i>Lopez (2025) Clin. Infect. Dis.</i>		
8		FALL BREAK Journal club: <i>Casadevall et al. (2019). mBio</i>		
9		Lecture: <i>Diseases of high consequence</i> <b>Take home exam</b> on material up to this point		Proposal outline deadline
10		Lecture: <i>Bacterial quorum sensing</i> Journal club: <i>Mazzolini (2023) Nat Biotech</i>		
11		Lecture: <i>Antibiotics</i> Journal club: <i>Ling et al. (2015) Nature</i>		
12		Lecture: <i>Biofilms and chronic infections</i> Journal club: <i>Cao et al. (2023) Nature</i>		
13		Lecture: <i>Evolution of drug resistance</i> Journal club: <i>Toprak et al. (2012) Nature Genetics</i>		
14		Lecture: <i>Novel therapeutics</i> Journal club: <i>Fabijan et al. (2020) Nature Microbiology</i>		

15		Journal club: <i>Rao et al. (2021) Nature</i> Thanksgiving break		
16		<b>Exam</b> on topics since the last exam		Proposal submission

### Campus Resources for Students

In your time at Georgia Tech, you may find yourself in need of support. Below you will find some resources to support you both as a student and as a person.

#### Academic support

- Center for Academic Success <http://success.gatech.edu>
  - 1-to-1 tutoring <http://success.gatech.edu/1-1-tutoring>
  - Peer-Led Undergraduate Study (PLUS) <http://success.gatech.edu/tutoring/plus>
  - Academic coaching <http://success.gatech.edu/coaching>
- Residence Life's Learning Assistance Program  
<https://housing.gatech.edu/learning-assistance-program>
  - Drop-in tutoring for many 1000 level courses
- OMED: Educational Services (<http://omed.gatech.edu/programs/academic-support>)
  - Group study sessions and tutoring programs
- Communication Center (<http://www.communicationcenter.gatech.edu>)
  - Individualized help with writing and multimedia projects
- Academic advisors for your major  
<http://advising.gatech.edu/>

#### Personal Support

##### Georgia Tech Resources

- The Office of the Dean of Students: <http://studentlife.gatech.edu/content/services>; **404-894-6367**; Smithgall Student Services Building 2<sup>nd</sup> floor
  - You also may request assistance at [https://gatech-advocate.symplicity.com/care\\_report/index.php/pid383662?](https://gatech-advocate.symplicity.com/care_report/index.php/pid383662?)
- Counseling Center: <http://counseling.gatech.edu>; **404-894-2575**; Smithgall Student Services Building 2<sup>nd</sup> floor
  - Services include short-term individual counseling, group counseling, couples counseling, testing and assessment, referral services, and crisis intervention. Their website also includes links to state and national resources.
  - *Students in crisis may walk in during business hours (8am-5pm, Monday through Friday) or contact the counselor on call after hours at 404-894-2204.*
- Students' Temporary Assistance and Resources (STAR):  
<http://studentlife.gatech.edu/content/need-help>
  - Can assist with interview clothing, food, and housing needs.
- Stamps Health Services: <https://health.gatech.edu>; **404-894-1420**
  - Primary care, pharmacy, women's health, psychiatry, immunization and allergy, health promotion, and nutrition
- OMED: Educational Services: <http://www.omed.gatech.edu>
- **Women's Resource Center:** <http://www.womenscenter.gatech.edu>; **404-385-0230**
- **LGBTQIA Resource Center:** <http://lgbtqia.gatech.edu/>; **404-385-2679**

- Veteran's Resource Center: <http://veterans.gatech.edu/>; 404-385-2067
- Georgia Tech Police: 404-894-2500