

Biology 229 – General Microbiology Laboratory Spring 2018 Course Guide

A. Instructor Information

The name and contact information for the graduate teaching assistant (GTA) who will be teaching your lab will be provided to you on the first day of lab.

Communications: You need to regularly check your UTK e-mail account for emails and announcements related to this course. If you are not receiving those e-mails, there is something wrong with your account and it is your responsibility to contact OIT to get this fixed. Email is a good way to communicate with your GTA, and he/she will be happy to answer your e-mail questions, but in general you should allow up to 48 hours for a response. Also, once the GTAs leaves the office for the day they generally do not answer any e-mails until the following workday, or the first day back after a weekend.

Laboratory Supervisor:	Elizabeth McPherson, M.S.
Office:	416 Hesler Biology Building
Office Phone:	974-6230
E-mail:	edfish@utk.edu

B. Course Information

Biology 229 is designed for students interested in the microbiology and related majors. This course is required for the major in microbiology. This laboratory course provides an introduction to the study of microorganisms and their impact on humans. We will focus on the structure, metabolic biochemistry, genetics, and growth of various microorganisms. Additionally, we will focus on why microbes serve as excellent research tools.

C. Degree Objectives

Students seeking a degree in Biological Sciences (whether the concentration is in Biochemistry, Cellular, and Molecular Biology, Ecology and Evolutionary Biology, or Microbiology) are expected to be able to do the following by the time they graduate:

Explain and provide examples of each the five big ideas in Biology, using their knowledge of biological concepts gained from their course of study:

1. **Evolution:** Populations of organisms and their cellular components have changed over time through both selective and non-selective evolutionary processes.
2. **Structure and Function:** All living systems (organisms, ecosystems, etc.) are made of structural components whose arrangement determines the function of the systems.
3. **Information Flow and Storage:** Information (DNA, for example) and signals are used and exchanged within and among organisms to direct their functioning.
4. **Transformations of Energy and Matter:** All living things acquire, use, and release and cycle matter and energy for cellular / organismal functioning.
5. **Systems:** Living systems are interconnected, and they interact and influence each other on multiple levels.

Demonstrate the ability to perform the following scientific practices:

1. Formulate empirically-testable hypotheses
2. Interpret visual representations (figures and diagrams)
3. Evaluate data and come to a conclusion (with evidence) (formulate an argument)

D. Course Objectives

The learning objectives of this course are:

1. To give all students in the course hands-on experience in basic microbiological techniques and in modern experimental work in the various areas of microbiology.
2. To instill in the students the concept that microbiology is a laboratory science.
3. To develop and augment in a laboratory setting key concepts that students learn in Biology 220.
4. To prepare the students for upper division laboratory courses.

By the end of this course, all students should be proficient in the following:

- Microscopy
- Aseptic technique
- Pipetting
- Gram stain

E. Course Materials

McPherson, E. F. 2015. The Microbes Around Us, 3E. bluedoor, LLC, Minnetonka, MN.

You will also need to be familiar with Instructure Canvas. If you need help using Canvas, please visit <https://utk.instructure.com/courses/32991/pages/student-canvas-introduction>.

F. Course Format and Policies

Biology 229 is a two credit hour course consisting of two 2 hour and 45 minute laboratory sessions per week. You are expected to attend all classes. **Attendance will be recorded each day in lab.** Valid excuses for missing lab include: severe personal illness, a death in the immediate family, jury duty, car accident or personal injury, military service, or a UT sanctioned event for which UT personnel have requested in writing that the student be absent from the classroom on the scheduled lab day. Verifiable documentation (i.e. note from a physician, etc.) will be required. **Any student missing lab without a valid excuse will lose ten points from the final point accumulation for each missed class session.** Please contact your GTA if there are extenuating circumstances that contribute to your excessive absences. Additionally, it is important that you arrive to class on time. **Five points will be deducted from your final point accumulation for each late attendance.**

As a safety precaution, all cell phones/smartphones should be left in the lockers and should not be brought into the laboratory. **Having a phone in the laboratory, taking a phone call during the lab period, or texting during the lab period will result in five points being deducted from the final point accumulation in the course for each instance.** Please speak with the GTA if you are expecting an important call.

You should actively participate in the activities going on in the laboratory each day. Your GTA will monitor your participation and will penalize your final point total up to 15 points if he/she sees that you allowed your lab partners to do all the work. Finally, arriving to lab in order to take the quiz and then leaving without performing the scheduled exercises will count as an absence and will be penalized as outlined above.

G. Grading Policy

Grades for the course will be determined by overall point accumulation in the lab.

Component	Points Possible
Exam I	100
Exam II	100
Exam III	100
Oral Biofilms Lab Report	50
Growth Curve Lab Report	50
Molecular & Biochemical Analysis of Unknown Lab Report	50
Analysis of Scientific Paper	15
Presentation	50
Presentation Research Paper	25
Quizzes	50
In-Class/Homework Assignments	35
Dilution/Math Problems	15
Preparation and Performance	25
Proficiencies	20
Total Points	685

However, in calculating the final grade, remember that absences, late appearances, phone violations, etc., in lab will be taken into account and can significantly impact the final grade.

A range (including A and A-) = 90-100% of total points

B range (including B+, B, and B-) = 80-89% of total points

C range (including C+, C, and C-) = 70-79% of total points

D range = 60-69% of total points

F = <60% of total points

Grade cutoffs will be determined based on how the grades fall once all grading is completed. **There will be no extra credit and exam scores will not be curved.**

Exams. The exams will be comprised of short answer or essay questions. These will be problem-based questions which will require students to analyze a situation or data set and come up with a hypothesis or will require students to apply their knowledge to a new problem. They will not simply assess students' ability to memorize information.

If a student has an emergency or illness on the exam day, he/she should notify the GTA by phone or email no later than the day of the exam. Failure to contact the instructor within 24 hours of the missed scheduled exam will result in an assigned grade of zero for the exam. It is the student's responsibility to make every effort to take each exam at its regularly scheduled time. Only a student with a valid, documented excuse will be allowed to take a make-up exam and this will be done at the GTA's discretion within one week of the regularly scheduled exam. Excused absences from an exam include: severe personal illness, a death in the immediate family, jury duty, car accident or personal injury, military service or a UT sanctioned event for which UT personnel have requested in writing that the student be absent from the classroom on the scheduled exam day. Verifiable documentation (i.e. note from a physician, etc.) will be required. Any student missing an exam without a valid excuse will receive a zero for the exam. Please note that illnesses or emergencies that prevent a student from studying for a scheduled exam are not valid excuses and will not result in the rescheduling of an exam.

Technology: During exams and quizzes, any electronic device seen on your desk or within sight will result in a grade of zero.

Once the exams have been passed back for review during a laboratory session, a student will have one week to contact the GTA regarding any discrepancies or questions regarding grading. Once that time frame has passed, the exam grade will remain as posted on Canvas.

The writing and grading of lab reports will be discussed in the next section.

Analysis of Scientific Paper. Learning to read and decipher a scientific paper requires practice, but it also requires that the reader understand the structure of the paper. The GTA will select a paper for the class and will moderate a student-led discussion of paper. Each student in the class will be responsible for contributing to the discussion and will submit materials related to their analysis of the paper.

Presentation. Each student will be required to make a presentation in front of his/her class at the end of the semester. The presentation format will be up to the discretion of each GTA and he/she will notify the class well in advance of the presentation dates of the topics for consideration. Topics could range from new and emerging diseases to application of a common microbiological technique to a novel idea. The presentation should show evidence of the student thoroughly researching the topic. The presentation should be 20 minutes in length and should be presented to the class using PowerPoint. This presentation will be worth 50 points of the students' final grade.

Presentation Research Paper. Understanding prior research and having background knowledge in a field of study is a key part of being able to coherently present a research paper. When students have a better grasp of previous research conducted in the field or on the topic, it is much easier to select and understand the research paper selected for presentation. Thus, each student will be required to read three scientific articles and will write a 3-page double spaced synopsis of the field of research covered in the articles prior to choosing research article to present on during the final class periods of the semester. These articles must be two review articles, such as from the journal Nature Reviews Microbiology (2014 or later), and one primary research article. The two review articles will provide a foundation of past research completed in the field as well as relevant background information. These review articles should entice the student to choose a primary article that is cited in the review article. The student will then read this primary research article. After reading the primary article, the student will choose another primary research article for the presentation. The student will turn in this assignment to the GTA when the student notifies the GTA of the article he/she will present during the presentations. This paper will be worth 25 points of the students' final grade.

Quizzes. Quizzes will be given randomly throughout the semester and will be worth a total of 50 points. The quizzes will test student's understanding of the experiments, general procedures, and data analysis to be covered that laboratory period. These quizzes will not be announced, so students should be prepared for a quiz each laboratory session. If a student misses lab on the day a quiz is given, no make-up quiz will be given and the student will receive a zero for that quiz.

In-Class/Homework Assignments. Worksheets and other assignments will be distributed throughout the semester in order to assess students' understanding of experiments, math problems, data analysis, etc. Some assignments may be in-class, while others may be administered as homework. The GTA will determine what topics students are struggling with and will prepare assignments to help students master these topics or problems. If a student misses lab on the day an in-class assignment is given, no make-up assignment will be given and the student will receive a zero for that assignment. If a student misses lab on the day a homework assignment is given out, it is the student's responsibility to contact the GTA for the assignment. The student may then turn in the assignment on the due date. If the student fails to contact the GTA and does not complete the assignment, the student will receive a zero. Any homework assignments not turned in on the due date will not be accepted and the student will receive a zero for the assignment.

Dilution/Math Problems. Students have indicated that they struggle with the math required in this course and quiz and exam scores also reflect this. The only way to learn how to do the math required for science courses is to practice. Thus, students will be given math problems frequently and randomly throughout the semester. Each problem will be worth only a single point, but the hope is that through repetition students

will master the math skills needed to succeed in this course as well as other science courses. If a student misses lab for any reason or arrives to lab after the math problem is distributed, the student will receive a zero for the assignment.

Preparation/Performance. A student's preparation and performance in the laboratory will be worth 25 points. Students are expected to come into the laboratory each class period prepared to work and should understand the procedures being performed each day. The GTA is simply there to reinforce certain topics, to answer questions, and to ensure the laboratory runs smoothly. Students are expected to be independent and to think about what they are doing and why they are doing it. Students will essentially earn a point or two each laboratory period by being prepared for lab (understanding the protocols), by following the GTA's directions, by being an asset to the class, by being respectful to others (including the GTA) and the lab environment, by not mindlessly wasting reagents and supplies, and by cleaning up the lab space, equipment and supplies at the conclusion of lab.

Proficiencies.

- Microscopy (5)
 - Identify parts of microscope and adjust them as needed
 - Focus on a sample at different magnifications
- Aseptic technique (5)
 - Streaking for isolation
 - Inoculating
- Pipetting (5)
- Gram stain (5)

Any student who feels he or she may need an accommodation based on the impact of a disability should contact the Office of Disability Services (ODS) at 865-974-6087 in 100 Dunford Hall to document his or her eligibility for services. ODS will work with students and faculty to coordinate accommodations for students with documented disabilities.

H. Lab Reports

When working in a research lab, it is important to keep precise notes on how you performed experiments. If the experiment worked, you want to know exactly how you performed it so that you can repeat it. On the other hand, if the experiment failed, you need to know the steps you performed so that you can make modifications to the protocol. Additionally, writing a lab report allows you to engage in the material, allowing you to better understand what you have done and why, and helps pinpoint weaknesses in your understanding.

A good description of scientific writing is that it fits as much relevant information into the fewest number of words required for the naïve reader to understand the topic thoroughly and to enable him/her to repeat the reported procedure. As you progress in your biological career, it should become clear that precise writing is necessary for success. This course is designed to prepare you for a career in the biological sciences, thus the reports will be evaluated accordingly.

General formatting for all reports should include double-spacing, font size 10-12, and paragraph format for all sections (no bullets) with one inch margins. No contractions, figures of speech, colloquialisms, or slang should be used. Be sure to use proper grammar, including proper punctuation, throughout the report. Most peer-reviewed journals require six essential sections. These are an abstract, an introduction, the materials and methods, the results, a discussion, and a list of references. All sections should be written in past tense. Passive sentence structure is traditionally used in scientific writing. Additionally, avoid using the term "I" throughout the report.

The GTAs will discuss scientific writing extensively and will provide samples of papers to use as models for writing the lab reports. The following is a basic rubric for writing and grading of lab reports. However, your

GTA may provide you with specific information that should be included in an individual report and may slightly change the point values ascribed to a section.

Abstract. The abstract should be an explanation of why the experiment was performed, the procedure, and what results are to be obtained from the experiment. This should be written in paragraph form and will assess your overall understanding of the experiment. (5 points)

Introduction. This section provides background information on the topic under investigation and identifies the rationale for performing the experiment. Do not copy information straight from the lab manual or from a handout. The information should be written in your own words and should include (at the very least) multiple references to authoritative textbooks and (ideally) peer-reviewed literature. The naïve reader should be able to understand the purpose for performing the experiment and how the data obtained from your experiment will contribute to the overall information available about the topic. This section does not cover any specific details of experimental procedure and does not involve speculation. (10 points)

Materials and Methods. This section provides a detailed explanation of the steps that were performed throughout the entire experiment and conveys the purpose of each step. Collection procedures, growth media formulations, incubation conditions, cell counting methods, statistical tests, general protocols, and all other information regarding the steps taken to collect the data are included in this section. References to the lab manual or a handout are acceptable, providing that all procedural steps were followed as described in the lab manual or handout. If changes were made in the experimental protocol, these must be noted. This section should include references to tables and figures displaying sample information. The naïve reader should be able to repeat your procedures step by step, so detail is of key importance. (5 points)

Results. This section reports all of the data collected during the experiment. Data should be presented in tabular or graphical format, and should also be described in paragraph form. Presenting a table or graph with no written words is not sufficient. Data analysis is not included in this section. Be sure to accurately and concisely label the results in the tables or graphs. A figure legend for each figure should also be provided. The naïve reader should be able to understand the data collected from your experiment. Ideally, his/her data should match those you are reporting in this section. (15 points)

Discussion. This is the section where most students lose points because they fail to be thorough in the discussion of results and the importance of these results. A discussion is not a compilation of information from the previous three sections. The discussion should include your specific interpretation of the data and the implications of these data. In discussing the implications of your results, a few questions to consider are: What was the goal of the experiment? How did the procedure aid in the achievement of the goal? Was this experiment successful in achieving the stated goal? If the results were unexpected, what were possible sources of error? What new information was obtained by doing this experiment? How will this information help the collective understanding of the main topics stated in the introduction? The naïve reader should be able to understand the results you expected, why you expected these results, whether or not your results matched the expected results, and the reason(s) for these discrepancies. Additionally, the naïve reader should appreciate how your results advanced the knowledge of the topic. (10 points)

References. Arrange the citations in alphabetical order by the first author of a paper or textbook and number consecutively. The names of all authors of a paper should be listed. All listed references must be cited in your report by providing a number in the body of the report. Journal names should be abbreviated according to *BIOSIS Serial Sources* (The Thompson Corporation, Philadelphia, PA, 2006) which is available in Hodges Library. (5 points)

Follow the formats listed below:

Print Journal Article

Caserta E, Haemig HAH, Manias DA, Tomsic J, Grundy FJ, Henkin TM, Dunny GM. 2012. *In vivo* and

in vitro analyses of regulation of the pheromone-responsive *prgQ* promoter by the PrgX pheromone receptor protein. J. Bacteriol. **194**:3386-3394.

Online Journal Article

Winnick S, Lucas DO, Hartman AL, Toll D. 2005. How do you improve compliance? Pediatrics **115**:e718-e724.

Article in Print Book

Forman MS, Valsamakis A. 2011. Specimen collection, transport, and processing: virology, p 1276-1288. In Versalovic J, Carroll KC, Jorgensen JH, Funke G, Landry ML, Warnock DW (ed), Manual of clinical microbiology, 10th ed, vol 2. ASM Press, Washington, DC.

Print Book

da Costa MS, Nobre MF, Rainey FA. 2001. Genus I. Thermus Brock and Freeze 1969, 295,AL, emend. Nobre, Trüper and da Costa 1996b, 605, p. 404-414. In Boone DR, Castenholz RW, Garrity GM (ed), Bergey's manual of systematic bacteriology, 2nd ed, vol 1. Springer, New York, NY.

Online Book

Gregory ST. 2 September 2009, posting date. Chapter 2.5.4, Structural basis for the decoding mechanism. In Böck A, et al (ed), EcoSal—*Escherichia coli* and *Salmonella*: cellular and molecular biology. ASM Press, Washington, DC. doi:10.1128/ecosal.2.5.4. {Note that each chapter has its own posting date.}

Often students are unclear as to whether to reference a topic. The best advice is to ask the following question: "Did I discover the topic listed in the report?" If you cannot answer yes to this question, you should include a reference. Additionally, if information from the lab manual is cited, then a reference to the lab manual should also be included.

There is no set length for a lab report. It should cover the important information completely but succinctly; not be a report that is a set number of pages in length. Instead of spending time incorporating excessive or unrelated information into the report, spend time ensuring that the information detailed in the above sections as well as requirements by the individual GTA are covered. The report should be written in your own words, should not be a shared activity between you and your lab partner, and should not be a rewrite of the notes provided by the GTA. However, in order to write the report in your own words, you must possess a complete understanding of the topic. Thus, writing a lab report will allow you to identify details in your understanding of the topic that need clarification (especially before an exam).

The dates the lab reports are to be turned in are listed below. **GTA's will not accept reports that are turned in later than the beginning of class time on the day the reports are due.** This deadline is firm and will not be extended due to computer issues, illness, or car problems. Do not wait until the night the report is due to begin working on the report.

Lab Report	Exercise Number	Report Due Date
Oral Biofilms	Online Exercise 2	February 23, 2018
Growth Curve	Exercise 24 and Online Exercise 3	March 21, 2018
Molecular & Biochemical Analysis of Unknown	Exercises 11, 15, 16, 21, 22, and 25-36 and Online Exercise 4	April 11, 2018

All submitted lab reports must be your own original work for the Spring 2018 semester. If you are retaking this course for any reason, you must write new lab reports that are not over 50% identical in the introduction, results, and discussions sections to any reports you turned in during previous semesters. This match will

be assessed via Unicheck Plagiarism Checker on Canvas. Any attempt to turn in a report that is greater than 50% identical in the introduction, results, and discussion sections to any other report (including your own) will result in a grade of zero for the report.

Once the grades for the lab reports are posted on Canvas a student will have one week to contact the GTA regarding any discrepancies or questions regarding grading. Once that time frame has passed, the lab report grade will remain as posted.

I. Academic Offenses

The following statements are excerpts taken from Hilltopics Student Code of Conduct (<http://hilltopics.utk.edu/student-code-of-conduct/>) regarding academic integrity and academic conduct. For further information, please visit this website.

Honor Statement

An essential feature of The University of Tennessee is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. *“As a student of the university, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity.”*

Prohibited Conduct

1. The Honor Statement prohibits cheating, plagiarism, and any other type of academic dishonesty.
2. Plagiarism is using the intellectual property or product of someone else without giving proper credit. The undocumented use of someone else’s words or ideas in any medium of communication (unless such information is recognized as common knowledge) is a serious offense, subject to disciplinary action that may include failure in a course and/or dismissal from the university. Specific examples of plagiarism include, but are not limited to:
 - (a) Using without proper documentation (quotation marks and a citation) written or spoken words, phrases, or sentences from any source;
 - (b) Summarizing without proper documentation (usually a citation) ideas from another source (unless such information is recognized as common knowledge);
 - (c) Borrowing facts, statistics, graphs, pictorial representations, or phrases without acknowledging the source (unless such information is recognized as common knowledge);
 - (d) Collaborating on a graded assignment without the instructor’s approval; and
 - (e) Submitting work, either in whole or in part, created by a professional service and used without attribution (e.g., paper, speech, bibliography, or photograph).

Standards of Conduct

A student or student organization may be disciplined for the following types of misconduct:

“Cheating, plagiarism, or any other act of academic dishonesty, including, but not limited to, and act in violation of the Honor Statement.”

Be sure that you are doing your own work on all assignments and exams. Cheating, the **appearance** of cheating, or plagiarism will not be tolerated in this course. The **minimum** penalty for such an offense is a grade of zero on the assignment, quiz, or exam; at the instructor’s or teaching assistant’s discretion, further action against the offender may be pursued. Egregious cases will be turned over to the Office of Student Judicial Affairs and the student will receive an F in the course.

Spring 2018 Laboratory Schedule

<u>Date</u>	<u>Topic</u>	<u>Reading in Lab Manual</u>
W Jan. 10	Microscopy	1
F Jan. 12	Eukaryotic Microorganisms and Aseptic Technique	2, 3, 4, 5
W Jan. 17	Effect of Physical Factors on Microbial Growth	6, 7, 8, 9
F Jan. 19	Last Day to Final Register, Add, Change Grading Options or Drop Without a "W"	
F Jan. 19	Isolation of Microbes and The Microbes Around Us	10, 11
W Jan. 24	Analysis of a Scientific Paper	
F Jan. 26	Microbes in Soil, Water, and Food	12, 13, 14
W Jan. 31	Simple and Differential Staining Methods I	15, 16
F Feb. 2	Simple and Differential Staining Methods II	17, 18, 19, 20
W Feb. 7	Exam I (Exercises 1-20 and Scientific Paper)	
F Feb. 9	Biofilms and Exploring Oral Biofilms	Online Exercises 1-2
W Feb. 14	Biofilms and Exploring Oral Biofilms	Online Exercises 1-2
F Feb. 16	Control of Microbial Growth	21, 22, 23
W Feb. 21	Prokaryotic Growth	24
F Feb. 23	Eukaryotic Growth	Online Exercises 3
W Feb. 28	Prokaryotic and Eukaryotic Growth	24, Online Exercise 3
F Mar. 2	16S rRNA Analysis	Online Exercise 4
W Mar. 7	16S rRNA Analysis	Online Exercise 4
F Mar. 9	Exam II (Exercises 21-24 and Online Exercises 1-4)	
W Mar. 14	Spring Break (no classes)	
F Mar. 16	Spring Break (no classes)	
W Mar. 21	16S rRNA Analysis and Transcriptomics	Online Exercise 4
F Mar. 23	Microbial Biochemistry I	25, 26, 27, 28, 29, 30
W Mar. 28	Microbial Biochemistry II	31, 32, 33, 34, 35, 36
F Mar. 30	Spring Recess (no classes)	
T Apr. 3	Last Day to Drop with a "W"	
W Apr. 4	Immunology I and Virology/Medical Microbiology I	Online Exercise 5, 37
F Apr. 6	Immunology II and Virology/Medical Microbiology II	Online Exercise 5, 37
W Apr. 11	Immunology III and Virology/Medical Microbiology III	Online Exercise 5, 37
F Apr. 13	Immunology IV and Virology/Medical Microbiology IV	Online Exercise 5, 37
W Apr. 18	Virology/Medical Microbiology V and Presentations I	37
F Apr. 20	Presentations II	
W Apr. 25	Presentations III	
F Apr. 27	Presentations IV	

Final Exam (Exercises 25-37, Online Exercises 4 and 5, and Presentations)

11:15 am – 2:15 pm Sections 10:15 am – 12:15 pm on Thursday, May 3, 2018
 2:30 – 5:30 pm Sections 2:45 – 4:45 pm on Wednesday, May 2, 2018

Final Exam Policy. Final exams must be given during the final exam period at the scheduled time, although alternative uses of the scheduled exam period may be designated by the instructor.

Students are not required to take more than two written exams on any day. The instructor(s) of the last non-departmental exam(s) on that day must reschedule the student's exam during the exam period. It is the obligation of students with such conflicts to make appropriate arrangements with the instructor at least two weeks prior to the end of classes.

Changes to the syllabus. The instructor has the right to revise/alter any part of the syllabus. If any changes occur, students will be notified immediately via Canvas, group email and in-class announcements.