



Course Syllabus

BIOL 2421 Microbiology for Science Majors (lecture + lab)

Catalog Description: Principles of microbiology, including metabolism, structure, function, genetics, and phylogeny of microbes. The course will also examine the interactions of microbes with each other, hosts, and the environment. Laboratory activities will reinforce principles of microbiology, including metabolism, structure, function, genetics, and phylogeny of microbes. The laboratory component will also examine the interactions of microbes with each other, hosts, and the environment. (ACGM Catalog)

Lecture hours = 3, Lab hours = 3

Prerequisites:

CHEM 1311 and 1111, or 1411 General Chemistry I (lecture and lab)

Plus one of the following biology sequences for majors:

BIOL 1306 and 1106, or 1406 Biology for Science Majors I (lecture and lab)

BIOL 1307 and 1107, or 1407 Biology for Science Majors II (lecture and lab)

or

BIOL 1311 and 1111, or 1411 General Botany (lecture and lab)

BIOL 1313 and 1113, or 1413 General Zoology (lecture and lab)

Semester Credit Hours: 4

Lecture Hours per Week: 3

Lab Hours per Week: 3

Extended Hours per Week: 0

Contact Hours per Semester: 96

State Approval Code: 26.0503.51 03

Class section meeting time:

Core Components and Related College Student Learning Outcomes

This course counts as part of the academic requirements of the Panola College Core Curriculum and an Associate of Arts or Associate of Science degree. Yes No: If no, skip to Instructional Goals.

The items below marked with an X reflect the state-mandated outcomes for this course **IF this is a CORE course:**

- Critical Thinking Skills – to include creative thinking, innovation, inquiry and analysis, evaluation and syntheses of information
 - CT1: Generate and communicate ideas by combining, changing, or reapplying existing information
 - CT2: Gather and assess information relevant to a question
 - CT3: Analyze, evaluate, and synthesize information
- Communication Skills – to include effective development, interpretation, and expression of ideas through written, oral, and visual communication
 - CS1: Develop, interpret, and express ideas through written communication

- CS2: Develop, interpret, and express ideas through oral communication
- CS3: Develop, interpret, and express ideas through visual communication
- Empirical and Quantitative Skills – to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions
 - EQS1: Manipulate and analyze numerical data and arrive at an informed conclusion
 - EQS2: Manipulate and analyze observable facts and arrive at an informed conclusion
- Teamwork – to include the ability to consider different points of view and to work effectively with others to support a shared purpose or goal
 - TW1: Integrate different viewpoints as a member of a team
 - TW2: Work with others to support and accomplish a shared goal
- Personal Responsibility – to include the ability to connect choices, actions, and consequences to ethical decision-making
 - PR1: Evaluate choices and actions and relate consequences to decision-making
- Social Responsibility – to include intercultural competence, knowledge of civic responsibility, and the ability to engage effectively in regional, national, and global communities
 - SR1: Demonstrate intercultural competence
 - SR2: Identify civic responsibility
 - SR3: Engage in regional, national, and global communities

Instructional Goals and Purposes:

The purpose of this course is to familiarize the student with the concepts, principles and theories of science as related to microbiology and to provide an opportunity to experience and appreciate the processes and methodology of science.

Learning Outcomes: [from the ACGM catalog]

Lecture:

After studying all materials and resources presented in the course, the student will be able to:

1. Provide examples of the impact of microorganisms on agriculture, environment, ecosystem, energy, and human health, including biofilms.
2. Identify unique structures, capabilities, and genetic information flow of microorganisms.
3. Compare the life cycles and structures of different types of viruses.
4. Discuss how microscopy has revealed the structure and function of microorganisms.
5. Give examples of the range of metabolic diversity exhibited by microorganisms, impact of metabolic characteristics on growth, and control of growth.
6. Describe evidence for the evolution of cells, organelles, and major metabolic pathways from early prokaryotes and how phylogenetic trees reflect evolutionary relationships.
7. Describe the causes and consequences of mutations on microbial evolution and the generation of diversity as well as human impacts on adaptation.
8. Classify interactions of microorganisms on human and non-human hosts as neutral, detrimental, or beneficial.

Laboratory:

After studying all materials and resources presented in the course, the student will be able to:

1. Apply scientific reasoning to investigate questions and utilize scientific tools such as microscopes and laboratory equipment to collect and analyze data.
2. Use critical thinking and scientific problem solving to make informed decisions in the laboratory.
3. Communicate effectively the results of scientific investigations.
4. Provide examples of the impact of microorganisms on agriculture, environment, ecosystem, energy, and human health, including biofilms.
5. Identify unique structures, capabilities, and genetic information flow of microorganisms.
6. Compare the life cycles and structures of different types of viruses.
7. Discuss how microscopy has revealed the structure and function of microorganisms.
8. Give examples of the range of metabolic diversity exhibited by microorganisms, impact of metabolic characteristics on growth, and control of growth.
9. Describe evidence for the evolution of cells, organelles, and major metabolic pathways from early prokaryotes and how phylogenetic trees reflect evolutionary relationships.
10. Describe the causes and consequences of mutations on microbial evolution and the generation of diversity as well as human impacts on adaptation.
11. Classify interactions of microorganisms on human and non-human hosts as neutral, detrimental, or beneficial.

Course Content:

A general description of lecture/discussion topics included in this course are listed in the Learning Outcomes section of this syllabus.

Students in all sections of this course will learn the following content:

Upon the successful completion of this course, the student should have an understanding of the following specific course objectives:

1. Identify major characteristics and classification strategies for prokaryotic and eukaryotic organisms and differentiate between prokaryotic and eukaryotic cell structure and function.
2. Identify the role of microbes in infection, disease and epidemiology.
3. Identify the causative agent of disease, pathogenicity abilities, symptoms, diagnosis, prevention and treatment of selected bacterial, fungal, protozoan and parasitic worm infections.
4. Discuss the general characteristics of viruses and identify the causative agent, mechanism of transmission, symptoms, prevention and treatment of selected viral diseases.
5. Identify the major components and principles associated with innate and adaptive (specific) immunity.
6. Identify the importance of immunization and identify/describe different serological tests used in identifying microbes.
7. Identify major metabolic pathways or processes associated with microorganisms.
8. Identify basic requirements for microbial nutrition and growth.
9. Discuss the principles associated with microbial genetics and identify contributions associated with genetic engineering.
10. Identify methods used to control microorganisms in the environment and the chemical control of microorganisms in the human body.
11. Identify the importance of microbes in applied microbiology and biotechnology.
12. Identify the importance of microbes in food microbiology, industrial microbiology and environmental microbiology.
13. Identify chemical concepts related to microbiology and identify the importance of the major organic macromolecules to microbial structure/utilization.

Upon the successful completion of this course, the student should have an understanding of the following specific **laboratory course objectives**:

1. Identify and demonstrate proper safety procedures concerning laboratory safety.
2. Apply scientific reasoning to investigate and analyze collected data.
3. Identify the parts and function of the microscope.
4. Understand proper use of the microscope, including technique for oil immersion.
5. Demonstrate the ability to properly prepare slides for microscopic examination.
6. Understand the role of proper aseptic technique and apply proper aseptic technique in the handling of microorganisms.
7. Identify the purpose and principles associated with negative, simple, Gram, capsule, acid-fast and endospore staining.
8. Discuss the importance of constructing wet mounts, streak plates and spread plates.
9. Estimate microbial numbers in a sample using serial dilution techniques.
10. Understand the effect of environmental factors on microbial growth as related to cell structure and metabolism (osmotic pressure, temperature, oxygen requirements and pH).
11. Identify the purpose and principles associated with different media types utilized in the laboratory.
12. Understand the purpose and principles associated with biochemical test media in determining metabolic differences between microbes.
13. Utilize resources such as Bergey's Manual to correctly identify an unknown bacterial strain.
14. Understand the role of chemical and physical control of microbes (antibiotics and disinfectants). Interpret antibiotic susceptibility using the Kirby Bauer test.
15. Define preservative. Identify preservatives found naturally or FDA approved in a variety of foods to inhibit microbial growth.

Methods of Instruction/Course Format/Delivery:

This course is offered in the traditional face-to-face classroom environment. Students in the traditional class will have access to this course using Canvas, a learning management system. Student learning outcomes, outlines/notes, power points, reviews and other study aids are provided within Canvas. A MasteringMicrobiology access code (provides access to the publisher's digital learning environment that helps to improve performance) is required to provide access to an eBook and homework (participation) assignments that help in the understanding of learning outcomes.

Students in the traditional class will meet regularly for lectures and labs and follow class attendance guidelines as indicated in the Panola College catalog. Face-to-face students will complete their exams in the classroom environment. Students should feel free to email any questions or concerns associated with this course to the instructor. Please be sure to check and appropriately respond to your emails in Canvas. Students should also feel free to communicate by phone or in person during scheduled office hours.

Students should use e-mail within Canvas to communicate with the instructor. Using Canvas email gives you access to the instructor and other classmates--you just select a name from the list. If there is an issue in contacting your instructor using email in Canvas, you may use their Panola College email address (located in the "Getting Started" module in Canvas). I will attempt to respond to all emails within 24 hours.

A course information sheet will be provided to include instructor information, course requirements, information on academic integrity, testing information, grading information, course materials, strategies for success and a tentative schedule. The course information sheet will be located in Canvas.

Major Assignments / Assessments:

The following items will be assigned and assessed during the semester and used to calculate the student's final grade.

Assignments

Lecture

1. A number of participation assignments are provided in MasteringMicrobiology (publisher's digital learning environment that helps to improve performance) and these assignments include a variety of question types to assist in the learning process.
2. Unit exams occur at various intervals during the semester and a Final examination occurs at the end of the semester. A variety of question types are used to assess learning outcomes.

Laboratory

1. Laboratory quizzes and laboratory exercises will provide an understanding of a number of microbiology concepts and activities (including microscope use, stain procedures, streak and spread plates, factors influencing microbial growth, culture transfers, antibiotic sensitivity, and bacterial/protozoan structure).
2. Determination of a microbiology unknown using a variety of morphological and biochemical tests. This activity will involve data collection, using a dichotomous key and critical thinking.
3. Researching a microbiology topic and writing an APA formatted paper. An oral presentation/power point is required and allows sharing with others in the class some of the more interesting findings from the research associated with the research topic.
4. A comprehensive laboratory exam will occur at the end of the semester. A variety of question types are used to assess laboratory learning outcomes.

Assessment(s):

Lecture

The lecture component of the microbiology course is 70% of your total grade.

1. Participation assignments are assessed in MasteringMicrobiology. These weekly assignments can be retaken/corrected (prior to the due date) to improve your grade. Cumulatively, these assignments represent 10% of the total grade in the course.
2. Unit exams are scantron-graded in face-to-face microbiology courses. Cumulatively, these exams represent 45% of the total grade in the course. Test information and specific exam content are provided within the course information sheet and within the Canvas modules provided at the start of the course. In a regular semester, each unit exam represents 9% of the total grade and (content-wise), the exams are divided as follows:

Exam #	Major Topic(s)
Unit #1	History, Chemistry, Prokaryotic Organisms, Applied and Environmental Microbiology
Unit #2	Eukaryotic Cell Structure/Organisms, Metabolism, Genetics, and Genetic Engineering
Unit #3	Controlling Microbial Growth, Antimicrobial Drugs, and Infection, Infectious Diseases and Epidemiology
Unit #4	Innate and Adaptive Immunity, Characterizing Viruses, Pathogenic RNA and DNA Viruses
Unit #5	Pathogenic Bacteria, Protozoa and Helminths, Fungi and Parasites

3. The Final Exam is a major assessment and includes a variety of multiple choice questions assessing the content from the entire course. The final exam is scantron-graded in face-to-face nutrition courses. The final examination is comprehensive and is worth 15% of your grade.

Laboratory

The laboratory component of the microbiology course is 30% of your total grade.

1. Laboratory quizzes and laboratory exercises utilize a broad variety of question types including multiple choice, fill in the blank, matching, short answer questions, and discussion type questions. Laboratory quizzes are announced and legitimate make-ups may be essay and should be completed **within a week** of the missed quiz. Laboratory exercises may include drawings, laboratory reports or any other methodologies

deemed important by the instructor. To earn credit for laboratory work the student must be both present and participating in the activity. Lab exercises are due the next scheduled lab meeting after a laboratory exercise has been completed. **Late work is not accepted.**

2. The microbiology unknown assignment is a major assessment in the microbiology lab and involves determining the identity of an unknown microorganism. The assessment grade sheet for the unknown evaluates streak plate technique, proper aseptic technique, subculturing, Gram staining, interpreting a number of biochemical tests, data collection, and constructing a dichotomous key. The dichotomous key allows the selection of the potential unknown organism which the student will submit to the instructor.
3. The microbiology research topic is assessed using a grading rubric that is provided along with detailed instructions within the course information sheet and Canvas.
4. A comprehensive laboratory exam will be administered at the end of the semester. A variety of question types are used to assess laboratory learning outcomes.

Course Grade:

The lecture component of the microbiology course is 70% of your total grade and the laboratory component of the microbiology course is 30% of your total grade.

The grading scale for this course is as follows:

- **Participation** activities will represent **10%** of your total grade and will be evaluated from homework assignments provided in Mastering Microbiology. **Due dates will be supplied with the homework assignments in MasteringMicrobiology and within your modules within Canvas; it is the student's responsibility to properly submit responses in a timely manner (Late responses will not be accepted!).**
- **Unit Exams** will represent **45%** of your total grade. Scheduled examination dates are provided within the course information sheet, within your modules in Canvas and on your calendar. **Examinations will be scantron-based and must be completed on the scheduled completion date.** Exam questions will be drawn from a variety of sources including your course outlines/notes/power points, review sheets, student learning outcomes, vocabulary terms and textbook/online (Connect) review questions. Missed examinations due to legitimate reasons should be rescheduled as soon as possible (ASAP). **The student will have one week to schedule/complete a missed Unit Exam.** The instructor reserves the right to change the exam format on any make-up exam. Each exam is worth 100 points and may consist of multiple choice, matching, short answer (completion), true and false and/or essay type questions.
- **Final Exam:** A final comprehensive examination will be given during final exams and will cover content from each of your assigned units during the course. The final examination is comprehensive and is worth **15%** of your total grade. **Finals should not be missed unless there is a serious situation; prompt contact with the instructor is vital or a grade of "0" will be assigned.**
- **Lab:** The laboratory component of the microbiology course is **30%** of your total grade.

- **Grade Determination**

Final course grades are determined by the following scale:

A=100-90 B=89-80 C=79-70 D=69-60 F=<59.5

Texts, Materials, and Supplies:

Bauman, Robert. Microbiology with Diseases by Taxonomy (5th Edition). 2017. Pearson, Upper Saddle River, New Jersey.

Harley, John. Laboratory Exercises in Microbiology (10th Edition). 2017. McGraw-Hill, New York, New York. (Panola College Custom Lab Manual)

Access Code for Pearson MasteringMicrobiology (digital teaching assignment/assessment tool used to increase engagement and learning).

One Blue/Green Book

Required Readings:

- Bauman, Robert. Microbiology with Diseases by Taxonomy (5th Edition)
- Harley, John. *Laboratory Exercises in Microbiology*. 10th Edition

Recommended Readings:

There are not any recommended readings for this course at this time.

Other:

- For current texts and materials, use the following link to access bookstore listings: <http://www.panolacollegestore.com>
- For testing services, use the following link: <http://www.panola.edu/elearning/testing.html>
- If any student in this class has special classroom or testing needs because of a physical learning or emotional condition, please contact the ADA Student Coordinator in Support Services located in the Administration Building or go to <http://www.panola.edu/student-success/disability-support-services/> for more information.
- Withdrawing from a course is the student's responsibility. Students who do not attend class and who do not withdraw will receive the grade earned for the course.
- Student Handbook, *The Pathfinder*: <http://www.panola.edu/student-success/documents/pathfinder.pdf>