



Department of Biology

School of STEM

BIO3015: Microbiology with Lab

Lecture (3 units) + Lab (1 unit)

Fall 2026

Meeting location: Evans 121 (lecture), Sator 105 (lab)

Meeting days/times: MWF: 12:15 – 1:10 pm (lecture)

R: 1:30 – 4:30 pm (lab section 1)

Final Exam: M: 10:30 am – 1:00 pm

Instructor title and name:	Dr. David Cummings, Professor of Biology
Email:	davidcummings@pointloma.edu
Office location and hours:	MW 2:00 – 4:00 pm OR by appointment Rohr Science 176

COURSE DESCRIPTION

An in-depth exploration of the world of microscopic organisms, including their diversity, physiology, biochemistry and ecology. Emphasis is on prokaryotes, but also some discussion of microscopic eukaryotes and viruses. Lecture and lab. Offered every year.

Prerequisite(s): BIO2010 and BIO3045.

COURSE LEARNING OUTCOMES

The primary objective of this course is to familiarize the Biology student with the world of microorganisms with an emphasis on the domain *Bacteria*. We will begin with fundamental concepts of microbiology (architecture, growth, and metabolism) followed by focused discussions of medical microbiology and immunology.

Specific course learning outcomes (CLOs): By the end of this course, students will be able to

1. describe the physical architecture and physiology of *Bacteria*;
2. explain the ways in which *Bacteria* cause disease and resist antibiotics;
3. paraphrase the mechanisms involved in the innate and adaptive immune systems;
4. design, execute, and evaluate experiments in the microbiology laboratory.

REQUIRED BOOK AND MOBILE APP

- (1) *Brock Biology of Microorganisms*, 16th ed. [E-Text](#) (not including Mastering) is required.
- (2) *Sanford Guide to Antimicrobial Therapy* app (not the booklet).

ASSESSMENT AND GRADING

A total of 675 points are possible in the class: 555 points in lecture and another 120 points in lab. Points from lecture and lab will be combined into a single score and one letter grade will be assigned to both at the end of the semester. Your final grade will be non-negotiable unless an error was made in grading.

Mid-term exams (300 points) – There will be three mid-term exams in this course, each worth 100 points. Each exam will consist of various question types (multiple choice, fill-in-the-blank, short answer) to assess your retention of basic facts and concepts as well as your ability to apply them to new situations. If you have a legitimate conflict with an exam date/time, you must let the instructor know prior to the week of the exam to make arrangements for a makeup exam. Exam dates are firm - please make your plans accordingly. Missed exams cannot be made up without prior instructor approval and only for a legitimate reason.

Final exam (150 points) – The final exam will consist of two parts: a 100-point comprehensive, open-book, take-home test, and a 50-point closed-book test covering just the newest material (the immune response). The comprehensive test will be due before the final exam, and the closed-book test will be taken during the scheduled final exam time. If you have more than two final exams scheduled on the same day as ours, you may be eligible to re-schedule, but you must inform the instructor no later than December 1.

Practice problem sets (105 points) – You will be given time in class and on your own to complete seven sets of carefully curated practice problems worth 15 points each.

Laboratory experience (120 points) – The BIO3015 lab consists of a bona fide research experience. Students will learn fundamental microbiology lab techniques in this context. See the description at the end of this syllabus for details.

Point breakdown

Mid-term exams (3)	300 points (44%)
Take-home final exam (1)	100 points (15%)
In-class final exam (1)	50 points (7%)
Practice problem sets (7)	105 points (16%)
Laboratory experience	120 points (18%)
TOTAL	675 possible points

Grade Scale Based on Percentages

A	B	C	D	F
A 92-100	B+ 88-89	C+ 78-79	D+ 68-69	F 59 or lower
A- 90-91	B 82-87	C 72-77	D 62-67	
	B- 80-81	C- 70-71	D- 60-61	

LECTURE TOPICS AND SCHEDULE

Date	Topic	Reading	Videos	Practice sets due
M 8/31	Introduction to microorganisms	1.2-1.3	Epi 10, 17	
W 9/2	Structure of bacteria	2.1-2.4, 2.6-2.9, 2.11	Epi 11-15, 17	
F 9/4	Structure of eukaryotic microbes Fungi, protozoa, helminths	2.13-2.15	Epi 6-9	
W 9/9	Introduction to viruses	5.1-5.2, 5.4	Epi 41-44	
F 9/11	Phages vs viruses of eukaryotes	5.5-5.7	Epi 45-47	Set 1
M 9/14	Chemical and physical requirements for growth	4.1-4.2, 4.11-4.16	Epi 23-25	
W 9/16	Binary fission and batch growth	4.6-4.7	Epi 26, 3015 epi 9	
F 9/18	Continuous culture	4.8		
M 9/21	Biofilms	4.9, 8.10, 20.4	Epi 16	
W 9/23	Exam 1 preview			
F 9/25	EXAM 1 (100 pts)			Set 2
M 9/28	Exam 1 review, intro to cell metabolism	3.1-3.2	Epi 018	
W 9/30	Free energy of catabolism	3.3-3.4		
F 10/2	Energy and enzymes	3.5		
M 10/5	Glycolysis and TCA cycle	3.6	Epi 19-20	
W 10/7	ETC and proton motive force	3.8-3.9	Epi 20	
F 10/9	Fermentation and anaerobic cell respiration	3.7, 3.10	Epi 21-22	Set 3
M 10/12	Introduction to bacterial genetics	6.1-6.2		
W 10/14	DNA replication in bacteria	6.3-6.4	Epi 31	
F 10/16	Gene expression in bacteria	6.5, 6.7-6.10	Epi 32-33	

M 10/19	HGT: recombination and transformation	13.9, 9.5-9.6	Epi 34	
W 10/21	HGT: Transduction and conjugation	9.7-9.8	Epi 34	
M 10/26	EXAM 2 (100 pts)			Set 4
W 10/28	Exam 2 review, Introduction to antibiotics and resistance	8.11		
F 10/30	Persistence and dormancy	8.12		
M 11/2	Antibiotic targets, Sanford Guide	28.5	Epi 35-37	
W 11/4	Antibiotic resistance mechanisms	28.7	Epi 38-40	
F 11/6	Sanford Guide			Set 5
M 11/9	Introduction to infectious diseases		Epi 53	
W 11/11	Virulence factors: adherence, colonization, invasion	25.1-25.3	Epi 54	
F 11/13	Virulence factors: enzymes	25.5	Epi 54	
M 11/16	Virulence factors: toxins	25.6-25.8	Epi 55	
W 11/18	Exam 3 preview		Epi 56	
F 11/20	EXAM 3 (100 pts)			Set 6
M 11/23	Exam 3 review, Introduction to the immune system	26.1	Immune System Overview	
M 11/30	Barriers to invasion	26.2	Epi 58-59	
W 12/2	Phagocytosis	26.5-26.7	Epi 60	
F 12/4	Inflammation, fever, anti-virals	26.8, 26.10	Epi 61-62	
M 12/7	Overview of adaptive immunity, Immunogens	27.1-27.2	Epi 63	
W 12/9	Humoral immunity, MHC	27.3 (up to and incl fig 27.7), 27.5	Epi 64, 67	
F 12/11	Cellular immunity	25.7-25.8	Epi 64-66	Set 7
M 12/14	EXAM 4 (150 pts)			

LAB LEARNING OUTCOMES

Routine and advanced microbiology lab methods will be taught in the context of a research experience, providing more opportunities for critical thinking.

Specific lab learning outcomes: By the end of the semester, students will be able to

- Manipulate bacteria using aseptic technique;
- Perform streak plates and spread plates;
- Use a compound light microscope to view bacteria in a wet mount and a Gram stain;
- Carry out antimicrobial susceptibility testing;
- Enrich and isolate specific bacteria from soil using selective enrichment media;
- Extract chromosomal and plasmid DNA and view by agarose gel electrophoresis;
- Carry out the polymerase chain reaction;
- Analyze a portion of the 16S rRNA gene using bioinformatic tools for taxonomic and phylogenetic information;
- Cultivate a biofilm and capture 3D images on a confocal microscope with the help of a TA or professor;
- Use image analysis software to quantify biofilm characteristics;
- Create a scientific poster in Power Point and present it in a poster session to non-experts.

ASSESSMENT AND GRADING

A total of 675 points are possible in Microbiology: 555 points in lecture and another 120 points in lab. Both lecture and lab grades will be combined into a single course grade that will be applied to both lecture and lab in your final transcript.

Weekly quizzes (40 pts) – Most weeks will begin with a brief 5-point quiz covering the assigned reading and videos. The lowest two quiz grades will be dropped.

Electronic lab notebook (40 pts) – Students will learn to keep a complete, accurate, and organized lab notebook. Entries are required within 24 hours of each lab session. Specific requirements will be provided separately.

Final poster (40 pts) – At the end of the semester, students will create a poster to present their research at a mini-conference. More details will be provided later.

LAB ASSIGNMENTS AND GRADES

Weekly quizzes	40
Electronic lab notebook	40
Final poster	40
TOTAL	120

LAB SCHEDULE

Dates	Lab Activities	Lab Quiz
R 9/3	Inoculate PIA with soil suspension Re-streak 3X before next week	LQ1
W 9/9	Inoculate 5 mL LB broth for glycerol stocks	
R 9/10	Glycerol stocks Presumptive identification	LQ2
R 9/17	Genomic DNA prep Four streak plates	LQ3
R 9/24	16S rRNA gene PCR Examine for pigments	LQ4
R 10/1	Gel electrophoresis PCR purification	LQ5
R 10/8	Molecular identification and phylogeny with ARB/SILVA	LQ6
W 10/14	Inoculate 5 mL broth for biofilms	
R 10/15	Inoculate 96-well plate for biofilm formation	LQ7
F 10/16	Rinse, stain, and mount biofilms (instructor)	
R 10/29	Confocal microscopy (all day)	LQ8
W 11/4	Streak onto MHA for AST	
R 11/5	Analyze biofilms with ImageJ/FIJI Set up AST	LQ9
W 11/11	Inoculate 5 mL LB broth for plasmid preps	
R 11/12	Interpret AST results Plasmid preps	LQ10
R 11/19	Work on posters	
R 12/3	Work on posters	
R 12/10	Poster session	

PLNU Mission

To Teach ~ To Shape ~ To Send

Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service is an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

Course Credit Hour Information

In the interest of providing sufficient time to accomplish the stated Course Learning Outcomes, this class meets the PLNU credit hour policy for a four-unit class delivered over 15 weeks. It is anticipated that students will spend a minimum of 37.5 participation hours per credit hour on their coursework. For this course, students will spend an estimated 150 total hours meeting the course learning outcomes. The time estimations are provided in the Canvas modules.

Final Examination Policy

Successful completion of this class requires taking the final examination on its scheduled day. The final examination schedule is posted on the [Class Schedules](#) site. If you find yourself scheduled for three (3) or more final examinations on the same day, you are authorized to contact each professor to arrange a different time for one of those exams. However, unless you have three (3) or more exams on the same day, no requests for alternative final examinations will be granted.

Incompletes and Late Assignments

All assignments are to be submitted/turned in by the indicated due date and time, including assignments posted in Canvas. Exceptions will only be granted in extremely unusual circumstances.

Spiritual Care

Please be aware PLNU strives to be a place where you grow as whole persons. To this end, we provide resources for our students to encounter God and grow in their Christian faith. If you have questions, a desire to meet with the chaplain, or prayer requests, you can contact your professor or the [Office of Student Life and Formation](#).

State Authorization

State authorization is a formal determination by a state that Point Loma Nazarene University is approved to conduct activities regulated by that state. In certain states outside California, Point Loma Nazarene University is not authorized to enroll online (distance education) students. If a student moves to another state after admission to the program and/or enrollment in an online course, continuation within the program and/or course will depend on whether Point Loma Nazarene University is authorized to offer distance education courses in that state. It is the student's responsibility to notify the institution of any change in his or her physical location. Refer to the map on [State Authorization](#) to view which states allow online (distance education) outside of California.

PLNU Copyright Policy

Point Loma Nazarene University, as a non-profit educational institution, is entitled by law to use materials protected by the US Copyright Act for classroom education. Any use of those materials outside the class may violate the law.

PLNU Recording Notification

In order to enhance the learning experience, please be advised that this course may be recorded by the professor for educational purposes, and access to these recordings will be limited to enrolled students and authorized personnel.

Note that all recordings are subject to copyright protection. Any unauthorized distribution or publication of these recordings without written approval from the University (refer to the Dean) is strictly prohibited.

PLNU Academic Honesty Policy

Students should demonstrate academic honesty by doing original work and by giving appropriate credit to the ideas of others. Academic dishonesty is the act of presenting information, ideas, and/or concepts as one's own when in reality they are the results of another person's creativity and effort. A faculty member who believes a situation involving academic dishonesty has been detected may assign a failing grade for that assignment or examination, or, depending on the seriousness of the offense, for the course. Faculty should follow and students may appeal using the procedure in the university Catalog. See Academic Policies for definitions of kinds of academic dishonesty and for further policy information.

Artificial Intelligence (AI) Policy

Use of Artificial Intelligence (AI) tools (*e.g.*, ChatGPT, iA Writer, Marmot, Botowski) is only permitted in situations where it helps the student to learn (*e.g.*, a study buddy). AI is not permitted to complete any of the assignments in this course on behalf of the student. Under no circumstances is it acceptable to turn in work done by an AI as if it was your own.

PLNU Academic Accommodations Policy

PLNU is committed to providing equal opportunity for participation in all its programs, services, and activities in accordance with the Americans with Disabilities Act (ADA). Students with disabilities may request course-related accommodations by contacting the Educational Access Center (EAC), located in the Bond Academic Center (EAC@pointloma.edu or 619-849-2533). Once a student's eligibility for an accommodation has been determined, the EAC will work with the student to create an Accommodation Plan (AP) that outlines allowed accommodations. Professors are able to view a student's approved accommodations through Accommodate.

PLNU highly recommends that students speak with their professors during the first two weeks of each semester/term about the implementation of their AP in that particular course.

Accommodations are not retroactive so clarifying with the professor at the outset is one of the best ways to promote positive academic outcomes.

Students who need accommodations for a disability should contact the EAC as early as possible (*i.e.*, ideally before the beginning of the semester) to assure appropriate accommodations can be provided. It is the student's responsibility to make the first contact with the EAC. Students

cannot assume that because they had accommodations in the past, their eligibility at PLNU is automatic. All determinations at PLNU must go through the EAC process. This is to protect the privacy of students with disabilities who may not want to disclose this information and are not asking for any accommodations.

Language and Belonging

Point Loma Nazarene University faculty are committed to helping create a safe and hospitable learning environment for all students. As Christian scholars we are keenly aware of the power of language and believe in treating others with dignity. As such, it is important that our language be equitable, inclusive, and prejudice free. Inclusive/Bias-free language is the standard outlined by all major academic style guides, including MLA, APA, and Chicago, and it is the expected norm in university-level work. Good writing and speaking do not use unsubstantiated or irrelevant generalizations about personal qualities such as age, disability, economic class, ethnicity, marital status, parentage, political or religious beliefs, race, gender, sex, or sexual orientation. Inclusive language also avoids using stereotypes or terminology that demeans persons or groups based on age, disability, class, ethnicity, gender, race, language, or national origin. Respectful use of language is particularly important when referring to those outside of the religious and lifestyle commitments of those in the PLNU community. By working toward precision and clarity of language, we mark ourselves as serious and respectful scholars, and we model the Christ-like quality of hospitality.

If you (or someone you know) have experienced other forms of discrimination, you can find more information on reporting and resources at www.pointloma.edu/nondiscrimination.

Sexual Misconduct and Discrimination

In support of a safe learning environment, if you (or someone you know) have experienced any form of sexual discrimination or misconduct, including sexual assault, dating or domestic violence, or stalking, know that accommodations and resources are available through the Title IX Office at pointloma.edu/Title-IX. Please be aware that under Title IX of the Education Amendments of 1972, faculty and staff are required to disclose information about such misconduct to the Title IX Office.

If you wish to speak to a confidential employee who does not have this reporting responsibility, you can contact Counseling Services at counselingservices@pointloma.edu or find a list of campus pastors at pointloma.edu/Title-IX.

If you (or someone you know) have experienced other forms of discrimination or bias, you can find more information on reporting and resources at www.pointloma.edu/bias

PLNU Attendance and Participation Policy

Regular and punctual attendance at all class sessions is considered essential to optimum academic achievement. If the student is absent for more than 10 percent of class sessions, the faculty member will issue a written warning of de-enrollment. If the absences exceed 20 percent, the student may be de-enrolled without notice until the university drop date or, after that date, receive an “F” grade.

LomaBooks Instructions for Students

This course is part of our course material delivery program, **LomaBooks**. The bookstore will provide each student with a convenient package containing all required physical materials; all digitally delivered materials will be integrated into Canvas.

You should have received an email from the bookstore confirming the list of materials that will be provided for each of your courses and asking you to select how you would like to receive any printed components (in-store pick up or home delivery). If you have not done so already, please confirm your fulfillment preference so the bookstore can prepare your materials.

For more information about **LomaBooks**, please go [HERE](#).

PLNU Academic Behavior Policy

Both faculty and students at PLNU have the right to expect a safe and ordered environment for learning. Students are expected to take the initiative to learn and conduct themselves in a mature and civil manner in the classroom environment. Any student behavior that is disruptive or threatening is a serious affront to PLNU as a learning community. Students who fail to adhere to these behavioral standards may be subject to disciplinary action, including removal from the class or further university sanctions. For a full definition of disruptive behavior, response procedures, and the appeal process, please consult the [Academic Behavior Policy](#) in the [University Catalog](#).