



Department of Biology

BIO3015-1 Microbiology

Lecture (3 units) + Lab (1 unit)

Fall 2023

Meeting days/times MWF 1:30 pm – 2:25 pm

Meeting location Taylor Hall 314

Final Exam: Monday 12/11, 1:30 – 4:00 pm

Instructor title and name:	Dr. Dave Cummings
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Office location and hours:	Rohr Science 176, Monday 3:30-5:30 pm or by appointment

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 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 system;
3. analyze the methods and results reported in the primary research literature in microbiology;
4. evaluate the validity of an author's main arguments in a primary research article in microbiology.

REQUIRED BOOKS 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). See separate instructions (by email) for a 40% student discount on the app.

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.

ASSESSMENT AND GRADING

A total of 730 points are possible in the class: 555 points in lecture and another 175 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.

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. Seven of these activities will be worth 15 points each.

Laboratory experience (175 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 (41.1%, 13.7% each)
Take-home final exam (1)	100 points (13.7%)
In-class final exam (1)	50 points (6.9%)
Practice problem sets (7)	105 points (14.4%)
Laboratory experience	175 points (24.0%)
TOTAL	730 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	

*NOTE: Grades from lecture and lab will be combined to generate a single final grade for the course, which will be recorded for both lecture and lab on transcripts.

*NOTE: Final percentages will be rounded to the nearest whole number and the letter grade assigned will be **non-negotiable**.

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 Spiritual 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 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 not permitted, and use of these tools will be treated as plagiarism.

PLNU Academic Accommodations Policy

PLNU is committed to providing equal opportunity for participation in all its programs, services, and activities. 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 619-849-2486). Once a student's eligibility for an accommodation has been determined, the EAC will issue an academic accommodation plan ("AP") to all faculty who teach courses in which the student is enrolled each semester.

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 and/or if they do not wish to utilize some or all of the elements of their AP in that course.

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.

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.

You may report an incident(s) using the [Bias Incident Reporting Form](#).

PLNU Attendance and Participation Policy

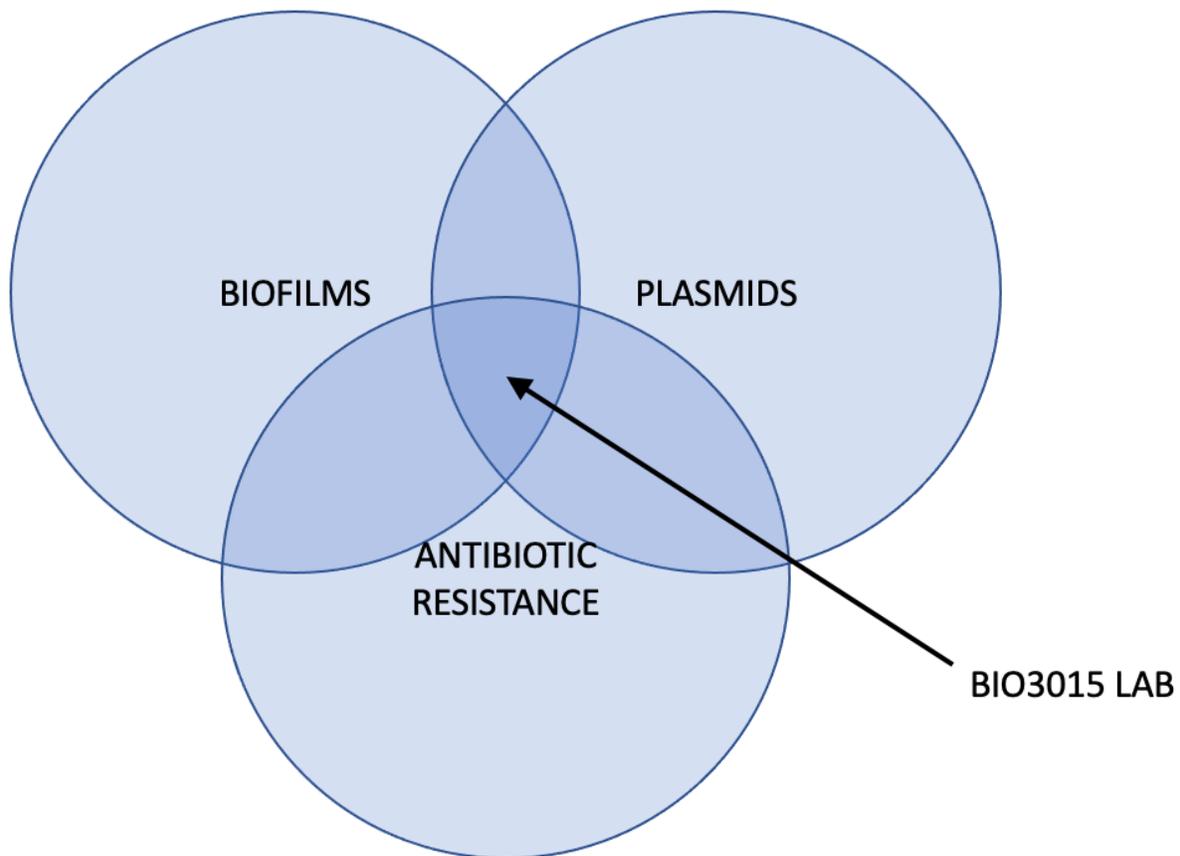
Regular and punctual attendance at all class sessions is considered essential to optimum academic achievement. If the student is absent for more than 10 percent of class sessions (>4/41 lectures, >1/12 labs), the faculty member will issue a written warning of de-enrollment. If the absences exceed 20 percent (>8/41 lectures, >2/12 labs), the student may be de-enrolled without notice until the university drop date or, after that date, receive an “F” grade.

LECTURE TOPICS AND SCHEDULE

Dates	Topics	Chapters and Videos	Practice Problem Sets
WK 1 & 2 M 8/28 – F 9/8	Microbial architecture <ul style="list-style-type: none">• Viruses• Fungi, protozoa, helminths• Bacteria and archaea	◇ Ch1, Ch2, Ch5 ◇ BIO3015 Episodes 001-008 ◇ BIO2020 Episodes 006-017	PPS1 due F 9/8
WK 3 & 4 M 9/11 – F 9/22	Bacterial growth <ul style="list-style-type: none">• Batch growth• Continuous culture• Environmental factors• Biofilms	◇ Ch4 ◇ BIO3015 Episodes 009-010 ◇ BIO2020 Episodes 023-026, 016 ◇ Center for Biofilm Engineering	PPS2 due F 9/22
F 9/22	Mid-term exam 1	◇ 100 points	
WK 5 & 6 M 9/25 – F 10/6	Energy metabolism <ul style="list-style-type: none">• Aerobic respiration• Anaerobic respiration• Fermentation	◇ Ch3 ◇ BIO2020 Episodes 018-022	PPS3 due F 10/6

Wk 7 & 8 M 10/9 – W 10/18	Horizontal gene transfer <ul style="list-style-type: none"> • Transformation • Transduction • Conjugation and plasmids • Insertion sequences and transposons • Integrons 	<ul style="list-style-type: none"> ◇ Ch6, Ch9 ◇ BIO2020 Episode 034 	PPS4 due W 10/18
M 10/23	Mid-term exam 2	<ul style="list-style-type: none"> ◇ 100 points ◇ Up to 20% cumulative 	
Wk 9 & 10 W 10/25 – F 11/3	Antibiotics and resistance <ul style="list-style-type: none"> • The Sanford Guide • Mechanisms of action • Mechanisms of resistance 	<ul style="list-style-type: none"> ◇ Ch28 ◇ BIO2020 Episodes 035-040 	PPS5 due F 11/3
Wk 11 & 12 M 11/6 – F 11/17	Infection and virulence factors <ul style="list-style-type: none"> • Structures • Proteins 	<ul style="list-style-type: none"> ◇ Ch25 ◇ BIO2020 Episodes 053-057 	PPS6 due F 11/17
M 11/20	Mid-term exam 3	<ul style="list-style-type: none"> ◇ 100 points ◇ Up to 20% cumulative 	
Wk 14 & 15 M 11/27 – F 12/8	The immune response <ul style="list-style-type: none"> • Innate immunity • Adaptive immunity 	<ul style="list-style-type: none"> ◇ Ch26, Ch27 ◇ BIO2020 Episodes 058-068 	PPS7 due F 12/8
M 12/11	Final exam (1:30-4 pm)	<ul style="list-style-type: none"> ◇ Take-home exam due (100 pts) ◇ Take in-person exam (50 pts) 	

LAB DETAILS



Description

The BIO3015 lab is not based on a lab manual with standard lab activities. Instead, it is research-based, and as such cannot be easily described in a lab manual. The focus will be the intersection among three of the most important topics in microbiology: biofilms, plasmids, and antibiotic resistance. You will learn many useful lab techniques in the context of culturing and imaging biofilms, mating bacteria with plasmids, and determining antibiotic resistance properties.

Lab techniques introduced (not necessarily mastered) in BIO3015L

- Apply aseptic technique to the cultivation of bacteria
- Use micropipettes and serological pipettes to handle liquids
- Culture bacteria in broth and on solid media
- Carry out streak plate and spread plate techniques
- Carry out dilution series for quantification of bacteria
- Cultivate biofilms of pure and mixed cultures
- Stain and visualize biofilms with confocal microscopy

- Mate bacteria to induce conjugation of plasmids in liquid co-culture
- Perform antimicrobial susceptibility testing with discs and Etests
- Design, execute, and interpret an experiment aimed at better understanding biofilms, antibiotic resistance, conjugation, or a combination
- Read and interpret the primary literature
- Maintain an electronic laboratory notebook
- Contribute to a team
- Create a scientific poster in Microsoft Power Point
- Present a scientific poster to a live and mixed audience at a campus-wide poster session

LAB TOPICS AND SCHEDULE

Date	Topic	Preparation
8/31	1. Basic microbiology lab skills <ul style="list-style-type: none"> • Aseptic technique • Micropipetting • Streak plate (selective and differential media) • Spread plate (viable plate count) 	<ul style="list-style-type: none"> ◇ Read lab safety document before lab. ◇ Watch videos posted on Canvas.
9/7	1. Interpret basic skills results. 2. Conjugation <ul style="list-style-type: none"> • 1-h liquid mating • Selection for transconjugants 3. Inoculate biofilms (groups 1 and 2)	<ul style="list-style-type: none"> ◇ Read Conjugation protocol.
9/14	1. Interpret conjugation results. 2. How to read a journal article <ul style="list-style-type: none"> • Rather et al. group worksheet (10 pts) 3. Image biofilms with CLSM (groups 1 and 2)	<ul style="list-style-type: none"> ◇ Read Rather et al. 2021.
9/21	NO MICROBIO LABS	

9/28	<ol style="list-style-type: none"> 1. Antibiotic susceptibility testing <ul style="list-style-type: none"> • Disc diffusion assay • Etests for MIC 2. Ghigo group worksheet (10 pts) 3. Inoculate biofilms (groups 3 and 4) 	<ul style="list-style-type: none"> ◇ Read Antibiotic Susceptibility Testing protocol. ◇ Watch videos posted on Canvas. ◇ Read Ghigo 2001.
10/5	<ol style="list-style-type: none"> 1. Interpret AST results. 2. Dalvise et al. individual worksheet (10 pts) 3. Image biofilms with CLSM (groups 3 and 4) 	<ul style="list-style-type: none"> ◇ Read Biofilm Growth protocol. ◇ Watch videos posted on Canvas. ◇ Read Dalvise et al. 2010.
10/12	<ol style="list-style-type: none"> 1. Intro to bioinformatics: annotate a plasmid sequence 2. Inoculate biofilms (groups 5 and 6) 	<ul style="list-style-type: none"> ◇ Read Plasmid Annotation protocol.
10/19	NO MICROBIO LABS	
10/26	<ol style="list-style-type: none"> 1. Design an experiment <ul style="list-style-type: none"> • Experimental Design group worksheet (10 pts) 2. Image biofilms with CLSM (groups 5 and 6) 	<ul style="list-style-type: none"> ◇ Read Biofilm Microscopy protocol. ◇ Watch videos posted on Canvas.
11/2	<ol style="list-style-type: none"> 1. Hausner and Wertz individual worksheet (10 pts) 2. Experiment week 1 	Read Hausner and Wertz 1999.
11/9	<ol style="list-style-type: none"> 1. Experiment week 2 	
11/16	<ol style="list-style-type: none"> 1. Experiment week 3 	

11/23	NO MICROBIO LABS	
11/30	1. Open-notes lab quiz (25 pts) 2. Work on posters	◇ Begin poster before 11/30
12/7	1. Poster session	◇ Print poster. Practice presentation.

Journal article worksheets (10 pts ea)	40 pts
Electronic lab notebook (5 pts per day)	50 pts
Experimental design worksheet	10 pts
Poster	50 pts
<u>Open-notes lab quiz</u>	<u>25 pts</u>
LAB TOTAL	175 pts