

METX119 Microbiology Summer 2021 (online)

Teaching Team:

Instructor: Prof. Karen Ottemann, Ph.D. ottemann@ucsc.edu
OH: Office Hours: Weds 12:30-1:30 PM and Friday 9-10 AM Pacific Time

Teaching Assistants:

Information coming...

Accessing the class

This course is hosted on [Canvas](#). You do not need to sign up for an account, login with your CruzID and Gold Password at canvas.ucsc.edu. See [Canvas Getting Started Student Guide](#)."

Important Deadlines for Summer Session I:

Drop: Monday, June 28

Request for "W": Friday, July 9

Summer is unique. **You will not be dropped for non-attendance or non-payment.** You must drop yourself. Dropping before the deadline results in a full-tuition reversal/refund. Withdraw posts a W for the grade and full tuition is charged (no refund).

For all dates and deadlines, including 'change of grade option' (P/NP) and grades due, here is the summer academic calendar: <https://summer.ucsc.edu/studentlife/index.html>

For questions about dropping, requesting a W grade for a course, or withdrawing from the summer quarter, email summer@ucsc.edu.

Course overview

This course examines the biology of microbes, with a focus on members of the Bacterial Domain. Bacteria, along with the other domain of prokaryotes called Archaea, make up the vast majority of biomass on the earth, and are capable of growing under any and all conditions. Some bacteria cause disease, but most of them help us and our environment. Throughout the course, we will learn how scientists design experiments to study these small creatures.

Learning objectives

After completing this course, students will be exposed to the many amazing aspects of bacterial biology. Students will obtain this information via lectures, the book and other literature reading, quizzes, problem sets, participating in office hours. Students will be exposed to experimental design and interpretation related to Bacterial and Archaeal biology. Upon completion of the course, students will be able to:

1. Provide a detailed description of bacterial cell structure and function. Enumerate the differences between bacteria that are gram positive and gram negative; and between Bacterial and Archaeal cells.
2. Describe bacterial metabolism. Be able to define the four modes of energy and carbon metabolism. Differentiate respiration from fermentation, and aerobic respiration from anaerobic. Differentiate autotrophic growth from heterotrophic growth.
3. Enumerate the pathways that bacteria use to produce cellular building blocks, to move molecules outside the cytoplasmic membrane, and to the outer membrane.
4. Describe how bacteria grow and divide, and specific adaptations that allow growth in extreme environments and within mammalian hosts.
5. Describe how bacteria organize their DNA and regulate gene expression
6. Explain how the normal microbiota aids host health in both mammalian and non-mammalian systems
7. Describe bacterial diseases--how the causative microbes are transmitted and cause disease--for several disease-causing bacteria, including *Vibrio cholerae*, *Helicobacter pylori*, *Staphylococcus aureus*, *Escherichia coli*, *Yersinia pestis*, *Yersinia pseudotuberculosis*, *Mycobacterium tuberculosis*, and *Listeria monocytogenes*.
8. Define the principles of bacterial phage infection and the CRISPR defense system, including how the system has been adapted for amazing applications

9. Explain how prokaryotes interact with diverse environments and how we use their abilities to produce medicines, other useful products, and clean up contaminated environments.

Prerequisites and Needed Knowledge:

A solid understanding of biochemistry as gained through a Biochemistry course (UCSC courses Bio 20A and Biol 100 or 100A) and Molecular biology (Bio20A or Bio101). You can find this information in any general Biochemistry text, and most Intro Biology texts. You will need to know the following:

- (i) Protein and nucleic acid composition/structure;
 - Be able to describe the basic properties of the building blocks of proteins, DNA and RNA. Describe what differentiates a polar amino acid from a hydrophobic one.
 - Describe the general processes by which a protein folds into a three dimensional conformation, including the forces that drive folding
 - Describe the general structure of DNA
 - Describe how enzymes work, including the terms substrates, products, and catalyze.
 - Be able to explain the relationship between proteins and enzymes.
- (ii) Glycolysis and the TCA cycle;
 - Describe the general functions of reactions of glycolysis and the TCA cycle
 - Explain what ATP and NADH are and how they function.
 - Be able to describe what ΔG is.
- (iii) Central Dogma including Replication, Transcription and Translation.
 - Describe what generally happens during DNA replication
 - Describe what generally happens during transcription
 - Describe what generally happens during translation

Office Hours:

Office hours are times when the Instructors and the TAs are available to answer questions and go over parts of the lectures that you want to cover. A good way to learn the material is to try the study questions on your own, and then come and discuss your answers during office hours. Attendance at office hours is strongly encouraged but not required.

Textbook and UCSC Library Access

Required Text: *Microbe*, 2nd Edition (Swanson, Reguera, Schaechter, and Neidhardt). American Society for Microbiology Press.

- Available from UCSC Bay Tree Books and online from ASM Press (<http://www.asmscience.org/content/book/10.1128/9781555819132>). You can use the discount code "Microbe20" for purchase at ASM Press.
- UCSC Library has copies on reserve, both hard copy and electronic.

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Another good textbook option that is free: *Todar's online textbook of microbiology* (<http://www.textbookofbacteriology.net/>)

Accessing Library Resources Remotely*

- To access library materials, login through the campus VPN available here: <https://its.ucsc.edu/vpn/installation.html>

You will need to download the campus VPN software, and then login with your cruzID and Gold password. Once logged in via the campus VPN, you can navigate to the library homepage for immediate access. No barcode or library account creation will be required. Local? If you're in the area, you are welcome to come to campus! You can use the library to study or do research. You can check out books and materials with your student ID. For more information on the libraries, hours, and services, visit library.ucsc.edu

Canvas and Lecture Notes:

All class information is found on the Canvas Course Web Page. Included are lectures and outline-form lecture notes that are partially filled in for each lecture. A note on Canvas: Like most websites, Canvas tracks your activity, including which pages you've visited, when, and for how long. All submissions (assignments, quizzes, discussion forums) are time stamped, which means that your instructor can see exactly when you turn your work in.

Course Content Questions:

If you have course content questions, you can get them answered by asking them during office hours or via the Canvas Piazza Discussion. For the on line chat, I love it if questions are answered by other students (a good way to make sure you know the answer). The teaching team will monitor the site and provide input as needed. We will also look for good questions that could be used on the midterm. Please note, we will not answer questions about class content in emails.

Administrative Questions

Administrative questions should be addressed to Professor Ottemann via email.

Course Expectations, Exams, and Problem Sets

1. Students should plan to spend 30 hours a week on this summer course. Each week there will be three-four 1.5 hour lectures, and ~ 1 quiz. Over the entire course, there will be 2 problem sets, one midterm, and one final. The exams will be multiple choice and short answer (e.g. fill in the blanks, matching, and short paragraphs).
2. **IMPORTANT:** The questions on the quizzes, problem sets, midterm and final will be based on the study questions that come with each lecture. You should make sure to really understand the study questions and be able to answer them without looking at your notes. If you do this before the quizzes, you will be in good shape. We do not provide answers, but all the material is covered in the lectures, so look there. The book has similar material, so you should also check there. You can use the Piazza Discussion and/or office hours to go over the questions and make sure you have the right answers.
3. All Quizzes, Exams and problem sets are open book, meaning you can use your notes and online resources to help you formulate answers that you write or enter. All answers must be in your own words, and you may not copy from another student.
4. The Midterm and Final Exams will be given as timed exams on Canvas but will be open book as described above.
 Midterm: Friday July 9 12:00 PM-2:00 PM Pacific Time
 Final: Thursday July 22 12:00 PM-2:00 PM Pacific Time
5. To pass this course, students must complete all quizzes, problem sets, and exams.

Final Grade

The class total is 400 points. The final grade will be calculated from the scores on the following:

1. Online quizzes worth 60 points (15%). There will be 18 videos on the course website, and 6 quizzes. You must watch each video and complete the module quiz to unlock the next module. If you get at least 50% of the quiz answers correct, you will earn the full points for the quizzes. The intro quiz is worth 0 points, while the other five are worth 12 points each.
2. Two problem sets worth 100 points (25%). These will be based on study questions and assigned reading.
3. Midterm exam worth 100 points (25%) This will be based on study questions.
4. Final exam worth 140 points (35%). This exam is comprehensive and will be based on study questions.

You must complete all material to pass the class. This includes all quizzes, problem sets, and exams.

Grades will be assigned as follows. The grades are not curved.

At or over 98%: A+
 93-97%: A
 90-92%: A-
 87-89%: B+

76-79%: C+
 66-75%: C
 62-65%: C-

83-86%: B

80-82%: B-

55-61%: D

Below 55%: F

Policy on completing materials and late materials

You must take and submit all quizzes, and complete all problem sets and exams. Late materials will receive an automatic decrease in points by 50% for each late day.

If you are unable to meet a deadline for a legitimate reason (illness, accompanied by medical doctor's note, or death in the immediate family), you must notify Professor Ottemann at least 24 hours in advance of the quiz, problem set or exam, and an appropriate extension in time will be discussed. You must take the final as scheduled, otherwise you will receive an incomplete in the course.

DRC Accommodations:

The Disability Resources Center reduces barriers to inclusion and full participation for students with disabilities by providing support to individually determine reasonable academic accommodations. Operations continue via remote appointments. If you have questions or concerns about exam accommodations or any other disability-related matter, email the DRC Schedulers at drc@ucsc.edu for an appointment.

Academic Dishonesty

Academic integrity is the cornerstone of a university education. Academic dishonesty diminishes the university as an institution and all members of the university community. It tarnishes the value of a UCSC degree. All members of the UCSC community have an explicit responsibility to foster an environment of trust, honesty, fairness, respect, and responsibility. All members of the university community are expected to present as their original work only that which is truly their own. All members of the community are expected to report observed instances of cheating, plagiarism, and other forms of academic dishonesty in order to ensure that the integrity of scholarship is valued and preserved at UCSC.

In the event a student is found in violation of the UCSC Academic Integrity policy, he or she may face both academic sanctions imposed by the instructor of record and disciplinary sanctions imposed either by the provost of his or her college or the Academic Tribunal convened to hear the case. Violations of the Academic Integrity policy can result in dismissal from the university and a permanent notation on a student's transcript.

For the full policy and disciplinary procedures on academic dishonesty, students and instructors should refer to the [Academic Integrity page](#) at the Division of Undergraduate Education.

To help make this issue clear, here are some examples of what constitutes academic dishonesty and are not allowed: Copying material from another student or source; Allowing another student to copy or use your materials; Providing answers to assignments that are not in your own words. **My policy is to give a grade of 0 on any material where a student violates academic integrity policies, and require the student to retake the exam or redo the quiz/problem set, to demonstrate mastery of the material.** The student additionally will be reported to the University committees as appropriate.

Title IX:

The university cherishes the free and open exchange of ideas and enlargement of knowledge. To maintain this freedom and openness requires objectivity, mutual trust, and confidence; it requires the absence of coercion, intimidation, or exploitation. The principal responsibility for maintaining these conditions must rest upon those members of the university community who exercise most authority and leadership: faculty, managers, and supervisors.

The university has therefore instituted a number of measures designed to protect its community from sex discrimination, sexual harassment, sexual violence, and other related prohibited conduct. [Information about the Title IX Office](#), the [online reporting link](#), applicable campus [resources](#), reporting responsibilities, the [UC Policy on Sexual Violence and Sexual Harassment](#) and the UC Santa Cruz Procedures for Reporting and Responding to Reports of Sexual Violence and Sexual Harassment can be found at titleix.ucsc.edu.

The Title IX/Sexual Harassment Office is located at 105 Kerr Hall. In addition to the [online reporting option](#), you can contact the Title IX Office by calling 831-459-2462.

Schedule. All problem sets and quizzes are due at 11:59 PM of the indicated day.

Important due dates:		
	DUE	
Problem set 1	July 2	Covers Lectures 1-6
Midterm	July 9	Covers Lectures 1-10). 12:00 PM-2:00 PM Pacific Time
Problem set 2	July 18	Covers lectures 9-14
Final	July 22	Covers all material. 12:00 PM-2:00 PM Pacific Time

	When	Suggested day	Topics	Reading (in <u>Microbe</u> unless otherwise indicated)
Module 1: What are microbes? An introduction to microbiology, to Bacterial and Archaeal physiology and to how these microbes grow				
0	Week 1	June 21	Course overview and organization	
1	Week 1	June 21	A microbial planet: Introduction to Microbiology	<ul style="list-style-type: none"> • Chapter 1 • Chapter 2 pages 25-29 • Microbe Hunters, Chapter 1 on van Leeuwenhoek (https://lauriximenez.files.wordpress.com/2011/02/1a_microbehunters_pauldekruij.pdf)
2	Week 1	June 22	Bacterial and Archaeal cell exterior	Chapter 2
3	Week 1	June 23	Bacterial and Archaeal cell interior and growth	Chapter 3 Chapter 4
		June 25	Module 1 Quiz: Complete before Friday of Week 1 (June 25)	
Module 2: How bacteria acquire nutrients, gain energy, and build a new cell				
4	Week 1	June 25	Microbial metabolism and fueling	Chapter 5-6
5	Week 2	June 28	Synthesis of building blocks	Chapter 7
6	Week 2	June 29	Building macromolecules (DNA and RNA); building the cell envelope	Chapter 8-9
7	Week 2	June 30	Inheritance and Information Flow	Chapter 10
		July 1	Module 2 Quiz: Complete before Thursday of Week 2 (July 1)	
		July 2	Problem Set 1 Due (Covers Lectures 1-6; Available June 26)	
Module 3: How bacteria deal with environmental challenges				
8	Week 2	July 1	Phage biology and CRISPR	Chapter 10 and 17
9	Week 3	July 6	Coordination and regulation of cell processes	Chapter 11
10	Week 3	July 7	Succeeding in the environment: Large scale gene regulation and flagellar chemotaxis	Ch. 12. Ch. 2, pg. 47-5
		July 8	Module 3 Quiz: Complete before Thursday of Week 3 (July 8)	
		July 9	Midterm: Lectures 1-10. 10. 2 hour exam. 12:00 PM-2:00 PM Pacific Time	
Module 4: Microbial Communities and Interactions				
11	Week 4	July 12	Microbial Communities and Interactions	Chapter 19
12	Week 4	July 13	Biofilms	Chapter 20
13	Week 4	July 14	Mammalian Microbial Interactions and Host Defense	Chapter 19 pp 545-549; Chapter 21 pp 613-615. Ch. 22
		July 15	Module 4 Quiz: Complete before Thursday of Week 4 (July 15)	

Module 5: Pathogens, disease, and applied microbiology				
14	Week 4	July 15	Microbial Pathogenesis. Studying Pathogens; Infections by <i>Staphylococcus aureus</i>	Chapter 22-23
		July 18	Problem Set 2 Due (Covers lectures 9-14; Available July 12 after completion of Module 3)	
15	Week 5	July 16	Microbial Pathogenesis. Intracellular Pathogens, <i>Listeria</i> and <i>Mycobacteria</i> (plus a little bit about food poisoning)	Chapter 24 http://www.cdc.gov/foodsafety/diseases/staphylococcal.html
16	Week 5	July 19	Microbial Pathogenesis. Epidemic and Zoonotic Pathogens; <i>Vibrio cholerae</i> and <i>Yersinia</i> species	Chapters 26 and 27
17	Week 5	July 20	Microbial Pathogenesis. <i>Helicobacter pylori</i> and vaccines	Chapter 23; <i>H. pylori</i> : JAMA and NEJM Articles in Canvas Files. The CDC: https://www.cdc.gov/vaccines/parents/vaccine-decision/index.html The Health and Human services web page: https://www.vaccines.gov/basics/index.html Vaccine Textbook: https://www.ncbi.nlm.nih.gov/books/NBK11768/
18	Week 5	July 21	Practical Microbiology: Food, Industry, Sewage and Bioremediation	Chapter 28
		July 21	Module 5 Quiz: Complete before Thursday of Week 5, July 21	
		July 22	Final Exam (comprehensive). 2 hour exam. 12:00 PM-2:00 PM Pacific Time	