

METX119                      Microbiology                      Summer 2024 (online/asynchronous)  
Session 1: June 24 - July 26, 2024

**Teaching Team:**

Instructor:                      Prof. Karen Ottemann, Ph.D.                      [ottemann@ucsc.edu](mailto:ottemann@ucsc.edu)

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**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](https://canvas.ucsc.edu). See [Canvas Getting Started Student Guide](#)."

All office hours are via Zoom. Check the course zoom tab to access.

**Important Deadlines for Summer Session I:**

- Add/Swap - Thursday, June 27
- Drop - Monday, July 1 (tuition reversed)
- No classes are held in observance of Independence Day July 4
- Request "W" Grade - Sunday, July 14 (no tuition reversal)
- Change Grade Option - Sunday, July 21
- Grades Due - Thursday, August 1

If you change your mind after enrolling, YOU must officially drop your course in your MyUCSC portal by the [deadline](#) to avoid receiving an F or NP (No Pass) and being responsible for tuition and fees. [Click here for step-by-step directions](#).

You will not be dropped for non-payment. Failure to drop your course will result in billing you full tuition and fees.

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](mailto: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. Detail 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 Molecular Biology and basic Biochemistry as gained through introductory courses in this area (UCSC courses Bio 20A, Biol 100, Biol101). 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  $\Delta G$  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

### **Help with the class content:**

- 1) The Canvas Discussion Board. Please post and answer questions there. The TA and instructor will monitor and help with answers as well.
- 2) Attend office hours. Office hours/drop in 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. Office hours can be joined via the Canvas Zoom tab; you may also schedule meetings if these times don't work.

Prof. Karen Ottemann Office hours: Tuesday 8 AM and Wednesday 1PM

TA Alex Solov Office Hours. Thursday 8 PM and Friday 10 AM

### **Textbook and UCSC Library Access**

Required Text: Microbe, 2<sup>nd</sup> 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.

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

### **Access online materials from off campus**

Your **CruzID Gold** login will provide access to the online collections available through the Library website.

For the most seamless access, start your research from [UC Library Search](#).

Visit our [Online Access guide](#) for more options including direct login to Online Access, the Nomad browser extension, and Google Scholar.

### **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.

### **Administrative Questions**

Administrative questions should be addressed to Professor Ottemann via canvas

### **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 class resources (videos and notes) to help you formulate answers that you write or enter. You may not use the web or AI tools such as ChatGPT. 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. You must be able to attend in these times. The midterm and final will be zoom proctored, meaning you will join on zoom with your web cam on, and then be given an access code.  
Midterm: Friday July 12 12:00 PM-2:00 PM Pacific Time  
Final: Friday July 26 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 410 points. The final grade will be calculated from the scores on the following:

1. Online quizzes worth 60 points. 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 50 points each (100 total). These will be based on class videos, study questions, and any assigned reading.
3. Midterm exam worth 125 points. This exam will be based on class videos and study questions.
4. Final exam worth 125 points. This exam is based on class videos and 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.

At or over 98%: A+

93-97%: A

90-92%: A-

87-89%: B+

83-86%: B

80-82%: B-

76-79%: C+

66-75%: C

62-65%: C-

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.

### **Accessibility:**

UC Santa Cruz is committed to creating an academic environment that supports its diverse student body. If you are a student with a disability who requires accommodations to achieve equal access in this course, please affiliate with the DRC. I encourage all students to benefit from learning more about DRC services to contact DRC by phone at 831-459-2089 or by email at [drc@ucsc.edu](mailto:drc@ucsc.edu). For students already affiliated, make sure that you have requested Academic Access Letters, where you intend to use accommodations. You can also request to meet privately with me during my office hours or by appointment, as soon as possible. I would like us to discuss how we can implement your accommodations in this course to ensure your access and full engagement in this course.

### **Academic Dishonesty**

All members of the UCSC community benefit from an environment of trust, honesty, fairness, respect, and responsibility. You are expected to present your own work and acknowledge the work of others in order to preserve the integrity of scholarship. Academic integrity includes:

- *Following exam rules*
- *Using only permitted materials during an exam*
- *Viewing exam materials only when permitted by your instructor*
- *Keeping what you know about an exam to yourself*
- *Incorporating proper citation of all sources of information*
- *Submitting your own original work*

Academic misconduct includes, but is not limited to, the following:

- *Disclosing exam content during or after you have taken an exam*
- *Accessing exam materials without permission*

- Copying/purchasing any material from another student, or from another source, that is submitted for grading as your own
- Allowing another student to copy from your work
- Plagiarism, including use of Internet material without proper citation
- Using cell phones or other electronics to obtain outside information during an exam without explicit permission from the instructor
- Submitting your own work in one class that was completed for another class (self-plagiarism) without prior permission from the instructor.

Violations of the Academic Integrity policy will be reported to the University committee/college. Violations 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 Misconduct page](#) at the [Division of Undergraduate Education](#). 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.

### **Artificial intelligence (AI)**

In this class you are allowed to use outside sources as a way to learn about material, e.g. youtube videos and AI. However, you cannot use AI generated technology (e.g. ChatGPT) to answer problem set, exam or quiz questions. If you use AI, such as ChatGPT, in other assignments, you must note how you have used it. AI uses previously published work so if you use it without acknowledgement, you are committing plagiarism. Cutting and pasting whole text from the application will be considered academic dishonesty. You may use the technology to improve text you have already written, or to generate ideas for your work but you must include how you have used the technology in your assignments.

**Class Schedule.**

All problem sets and quizzes are due at 11:59 PM of the indicated day. Exams are taken 12-2 PM PST.

**Important due dates:**

Problem set 1	July 3	
Midterm	July 12	12:00 PM-2:00 PM Pacific Time
Problem set 2	July 19	
Final	July 26	12:00 PM-2:00 PM Pacific Time

Lec. #	Week	Suggested day	Topics	Supportive reading (in <u>Microbe</u> unless otherwise indicated)
<b>Module 1: What are microbes? An introduction to microbiology, to Bacterial and Archaeal physiology and to how these microbes grow</b>				
0	Week 1	M June 24	Course overview and organization	
1	Week 1	M June 24	A microbial planet: Introduction to Microbiology	<ul style="list-style-type: none"> <li>• Chapter 1</li> <li>• Chapter 2 pages 25-29</li> <li>• <u>Microbe Hunters</u>, Chapter 1 on van Leeuwenhoek (<a href="https://lauriximenez.files.wordpress.com/2011/02/1a_microbehunters_pauldekruij.pdf">https://lauriximenez.files.wordpress.com/2011/02/1a_microbehunters_pauldekruij.pdf</a>)</li> </ul>
2	Week 1	Tu June 25	Bacterial and Archaeal cell exterior	Chapter 2
3	Week 1	W June 26	Bacterial and Archaeal cell interior and growth	Chapter 3 Chapter 4
	Week 1	Th June 27	<b>Module 1 Quiz: Complete before Thur. of Week 1</b>	
<b>Module 2: How bacteria acquire nutrients, gain energy, and build a new cell</b>				
4	Week 1	Th June 27	Microbial metabolism and fueling	Chapter 5-6
5	Week 1	F June 28	Synthesis of building blocks	Chapter 7
6	Week 2	M July 1	Building macromolecules (DNA and RNA); building the cell envelope	Chapter 8-9
	Week 2	Due W July 3	<b>Problem Set 1 Due (Covers Lectures 1-6; Available June 28).</b>	
7	Week 2	July 3-5	Inheritance and Information Flow	Chapter 10
	Week 2	F July 5	<b>Module 2 Quiz: Complete before Fri. of Week 2</b>	
<b>Module 3: How bacteria deal with environmental challenges</b>				
8	Week 2	M July 8	Phage biology and CRISPR	Chapter 10 and 17
9	Week 3	T July 9	Coordination and regulation of cell processes	Chapter 11
10	Week 3	W July 10	Succeeding in the environment: Large scale gene regulation and flagellar chemotaxis	Ch. 12. Ch. 2, pg. 47-5
	Week 3	Th July 11	<b>Module 3 Quiz (Lectures 8-10): Complete before Thursday of Week 3</b>	

		F July 12	<b>Midterm: Lectures 1-9. 2 hour exam that must be taken 12:00 PM-2:00 PM Pacific Time</b>	
<b>Module 4: Microbial Communities and Interactions</b>				
11	Week 4	M July 15	Microbial Communities and Interactions	Chapter 19
12	Week 4	T July 16	Biofilms	Chapter 20
13	Week 4	W July 17	Mammalian Microbial Interactions and Host Defense	Chapter 19 pp 545-549; Chapter 21 pp 613-615. Ch. 22
		Th July 18	<b>Module 4 Quiz: Complete before Thursday of Week 4</b>	
<b>Module 5: Pathogens, disease, and applied microbiology</b>				
14	Week 4	Th July 18	Microbial Pathogenesis. Studying Pathogens; Infections by <i>Staphylococcus aureus</i>	Chapter 22-23
		F July 19	<b>Problem Set 2 Due ( Covers lectures 9-14; Available July 12 after midterm)</b>	
15	Week 4	F July 19	Microbial Pathogenesis. Intracellular Pathogens, <i>Listeria</i> and <i>Mycobacteria</i> (plus a little bit about food poisoning)	Chapter 24 <a href="http://www.cdc.gov/foodsafety/diseases/staphylococcal.html">http://www.cdc.gov/foodsafety/diseases/staphylococcal.html</a>
16	Week 5	M July 22	Microbial Pathogenesis. Epidemic and Zoonotic Pathogens; <i>Vibrio cholerae</i> and <i>Yersinia</i> species	Chapters 26 and 27
17	Week 5	T July 23	Microbial Pathogenesis. <i>Helicobacter pylori</i> and vaccines	Chapter 23; <i>H. pylori</i> : JAMA and NEJM Articles in Canvas Files. The CDC: <a href="https://www.cdc.gov/vaccines/parents/vaccine-decision/index.html">https://www.cdc.gov/vaccines/parents/vaccine-decision/index.html</a> The Health and Human services web page: <a href="https://www.vaccines.gov/basics/index.html">https://www.vaccines.gov/basics/index.html</a> Vaccine Textbook: <a href="https://www.ncbi.nlm.nih.gov/books/NBK11768/">https://www.ncbi.nlm.nih.gov/books/NBK11768/</a>
18	Week 5	W July 24	Practical Microbiology: Food, Industry, Sewage and Bioremediation	Chapter 28
	Week 5	Th July 25	<b>Module 5 Quiz: Complete before Thursday of Week 5</b>	
		F July 26	<b>Final: Covers Lectures 9-18. 2 hour exam that must be taken 12:00 PM-2:00 PM Pacific Time</b>	