METX119 Microbiology Summer 2018 (online)

Teaching Team:
Instructor: Prof. Karen Ottemann, Ph.D. ottemann@ucsc.edu
OH: Thursdays 4:00-5:30 PM PST

Teaching Assistants:
Sanjin Mehic smehic@ucsc.edu Office hours: Tuesday 8:00-9:00 AM PST and 5:00-6:00 PM PST
Joe Kiblen jkiblen@ucsc.edu Office house: Monday 9:00-10:00 AM PST and 7:00-8:00 PM PST

Important Deadlines for Summer Session I:
Drop: Monday, July 2 Withdraw: Friday, July 13
Neither Summer Session nor instructors drop students for non-attendance or non-payment. Students must drop themselves.
Dropping results in 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/fundamentals/academic-calendar.html

Course overview
This course examines the biology of microbes, with a strong 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 very 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;
   • Define 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, 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
   • Define ATP and NADH. What are they, and how do they function?
   • Define $\Delta G$.

(iii) Central Dogma including Replication, Transcription and Translation.
   • Describe what happens during DNA replication
   • Describe what happens during transcription
   • Describe what happens during translation

Office Hours:
Attendance at office hours is strongly encouraged but not required. It’s a great way to both cement the material and have questions answered. During the office hours, the TAs or Professor will be happy to go over study questions and parts of lecture that students want to cover.

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.

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 (1) during office hours; (3) via the Canvas Piazza Discussion. For the online 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 will need 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 3 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. The quizzes 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. You may not copy from another student.
4. The exams are not open book and can be taken via Proctor U online, or at an in person site on the UCSC campus. If you would like to take the exam at UCSC, please let the instructor know.
5. To pass this course, students must complete all of the quizzes, problem sets, midterm and final exams.

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

1. 15% completion of online quizzes (60 points). There will be 18 videos on the course website, and 6 quizzes. You must watch each video, open up the lecture notes, and complete each 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. *Note—the quizzes list points, but those are not accurate, and instead each is worth 12.
2. 25% for the three problem sets. These will be based on study questions (100 points total, 30-35 points each).
3. 25% midterm exam (100 points). This will be based on study questions.
4. 35% comprehensive final exam (140 points). This 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+
- 83-86%: B
- 80-82%: B-
- 74-79%: 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.

**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. If you have questions or concerns about exam accommodations, or any other disability-related matter, please contact the DRC office, located in Hahn 125 or at 831-459-2089 or drc@ucsc.edu.

**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.

To help make this issue more clear, here are some examples of what constitutes academic dishonesty and are not allowed: Copying material from another student; Using any materials, including notes, books, on line materials, when an exam is “closed book”; Allowing another student to copy or use your materials. 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.

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.

**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.
**Week-by-week Schedule.** All items are due at midnight, unless otherwise noted.

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<th>Completed during</th>
<th>Topics</th>
<th>Reading (in <em>Microbe</em> unless otherwise indicated)</th>
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<tr>
<td><strong>Module 1: What are microbes? An introduction to microbiology, to Bacterial and Archaeal physiology and to how these microbes grow</strong></td>
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<td>0 Week 1</td>
<td>Course overview and organization</td>
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| 1 Week 1 | A microbial planet: Introduction to Microbiology | • Chapter 1  
• Chapter 2 pages 25-29  
• *Microbe Hunters*, Chapter 1 on van Leeuwenhoek (https://laurieximenez.files.wordpress.com/2011/02/1a_microbehunters_pauldekruijf.pdf)  
| 2 Week 1 | Bacterial and Archaeal cell exterior | Chapter 2 |
| 3 Week 1 | Bacterial and Archaeal cell interior and growth | Chapter 3  
Chapter 4 |
| **Module 1 Quiz: Complete by Friday of Week 1 (June 29 2018)** |
| **Module 2: How bacteria acquire nutrients, gain energy, and build a new cell** |
| 4 Week 1 | Microbial metabolism and fueling | Chapter 5-6 |
| 5 Week 2 | Synthesis of building blocks | Chapter 7 |
| 6 Week 2 | Building macromolecules (DNA and RNA); building the cell envelope | Chapter 8-9 |
| 7 Week 2 | Inheritance and Information Flow | Chapter 10 |
| **Module 2 Quiz: Complete by Friday of Week 2 (July 6, 2018)** |
| **Module 3: How bacteria deal with environmental challenges** |
| 8 Week 2 | Phage biology and CRISPR | Chapter 10 and 17 |
| 9 Week 3 | Coordination and regulation of cell processes | Chapter 11 |
| 10 Week 3 | Succeeding in the environment: Large scale gene regulation and flagellar chemotaxis | Ch. 12. Ch. 2, pg. 47-5 |
| **Module 3 Quiz: Complete by Wednesday of Week 3 (July 11, 2018)** |
| **Week 3. July 13** | Midterm: Modules 1-3. Friday July 13. 2 hour exam period, complete between 6 AM and 10 PM PST. |
| **Module 4: Microbial Communities and Interactions** |
| 11 Week 3 | Microbial Communities and Interactions | Chapter 19 |
| 12 Week 4 | Biofilms | Chapter 20 |
| 13 Week 4 | Mammalian Microbial Interactions and Host Defense | Chapter 19 pp 545-549;  
Chapter 21 pp 613-615. Ch. 22 |
| **Module 4 Quiz: Complete by Thursday of Week 4 (July 19, 2018)** |
| **Module 5: Pathogens, disease, and applied microbiology** |
| 14 Week 4 | Microbial Pathogenesis. Studying Pathogens; Infections by *Staphylococcus aureus* | Chapter 22-23 |
| 15 Week 4 | Microbial Pathogenesis. Intracellular Pathogens, *Listeria* and *Mycobacteria* (plus a little bit about food poisoning) | Chapter 24  
http://www.cdc.gov/foodsafety/diseases/staphylococcal.html |
| **Problem Set 3: Covers Lectures 11-15 (Week 4 Material)  
Available July 19, 2018. Due July 23, 5 PM** |
| 16 Week 5 | Microbial Pathogenesis. Epidemic and Zoonotic Pathogens; *Vibrio cholerae* and *Yersinia* species | Chapters 26 and 27 |
| 17 Week 5 | Microbial Pathogenesis. *Helicobacter pylori* and vaccines | Chapter 23; *H. pylori*: JAMA and NEJM Articles in Canvas Files.  
The CDC: https://www.cdc.gov/vaccines/parents/ |
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<tr>
<td>18</td>
<td>Week 5</td>
<td>Practical Microbiology: Food, Industry, Sewage and Bioremediation</td>
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<td>July 27.</td>
<td>Module 5 Quiz: Complete by Thursday of Week 5 (July 26, 2018)</td>
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<td>Final Exam (comprehensive). July 27. 2 hour exam period, complete between 6 AM and 10 PM PST.</td>
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vaccine-decision/index.html
The Health and Human services web page: https://www.vaccines.gov/basics/index.html