Environmental Microbiology - CE 40350/60350, GH 60350

Fall 2013

Monday/Wednesday 12:30-1:45P (3 credit hours—lecture); DeBartolo 116

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	Monday	Wednesday
August 28	---	① Study of Microbiology & Small Cell Basics Reading: Chapters 1 & 2
September 2, 4	② Chemistry Fundamentals Reading: Supplemental (old Chapter 3) *Bacterium of the Day #0*	③ Cell Structure and Function Reading: Chapter 3 *Bacterium of the Day #1*
September 9, 11	④ Genetics (part 1) Reading: Chapter 6.1-6.10, 7.1 *Bacterium of the Day #2*	⑤ Genetics (part 2) Reading: Chapter 6.12-6.21, 7.2-7.3 *Bacterium of the Day #3*
September 16, 18	⑥ Molecular Techniques: Application and Identification Reading: Ch. 11.1-11.6 and 16 **Schedule Mini-Group Meetings** *Bacterium of the Day #4*	⑦ Microbial Growth and Kinetics Reading: Chapter 5+supplemental *Bacterium of the Day #5*
September 23, 25	⑧ Fundamentals of Metabolism Reading: Chapter 4.1-4.7 +supplemental information *Bacterium of the Day #6*	**Exam 1** **(covers lectures 1-7)**
September 30, October 2	⑨ Catabolism and Anabolism Reading: Chapter 4.8-4.16 14.17-14.18 *Bacterium of the Day #7&8*	⑩ Phototrophic and Autotrophic Metabolism Reading: Chapter 13.1-13.7 *Bacterium of the Day #9&10*
October 7, 9	⑪ Fermentations and Propionic Acid Bacteria Isolation Reading: Chapter 14.1-14.5 **Paper outline due** (include at least 8 journal references) *Bacterium of the Day #11&12*	⑫ Autotrophic Metabolism and Acetogenesis Reading: Chapter 13.12-13.13, 14. 9 *Bacterium of the Day #13&14*
October 14, 16	⑬ Nitrogen-cycle Bacteria Reading: Chapter 13.10-13.11, 13.14-13.15, 14.6-14.7, 17.3, 24.3 *Bacterium of the Day #15&16*	⑭ Methanogens and sulfur-cycle bacteria Reading: Chapter 13.8, 14.8, 14.10, 24.1, 24.2, 24.4 *Bacterium of the Day #17&1*

October 21, 23	--Fall Break--	--Fall Break--
October 28, 30	⑮ Guest Lecture: Dr. Matthew Champion: Bacteriophage Reading: 9.1-9.10 *No Bacterium of the Day*	⑯ "Other" bacteria and Archea Reading: Chapters 18-19 **Mini-Group Presentations** *No Bacterium of the Day*
November 4, 6	⑰ Proteobacteria and motility Reading: Chapter 3.13-3.15, 17.5-17.19 *Bacterium of the Day #2&3*	**Exam 2** **(covers lectures 8-16)**
November 11, 13	⑱ Chemolithotrophy and Metals Cycling Reading: 13.9, 14.12, 23.1, 23.2, 24.5-24.8 *Bacterium of the Day #4&5*	⑲ Degradation of Aromatic Rings and Carbon Intermediates Reading: Chapter 14.13, 14.14, 24.9 +supplemental info *Bacterium of the Day #6&7*
November 18, 20	⑳ Water & Wastewater and Degradation of Xenobiotics Reading: Chapter 24.10, 35 +supplemental information *Bacterium of the Day #8&9*	㉑ Bacteria and Humans—Part I: The Good and Bad Reading: Chapter 27 *Bacterium of the Day #10&11*
November 25, 27	㉒Bacteria and Humans—Part II: The Ugly Reading: Chapter 32.10, 33-34 **Paper draft due** *Bacterium of the Day #12&13*	--no class--
December 2, 4	㉓ Intercellular Communication and Gene Regulation Reading: Chapter 8.1-8.11, 17.12 *Bacterium of the Day #14&15*	㉔ Biofilms and Polysaccharide Synthesis Reading: Chapter 14.16, 23.3-23.5+supplemental information *Bacterium of the Day #16&17*
December 9, 11	**Paper due—Presentations Begin**	**Presentations Continue**
December 17	**Tuesday—December 17, 8:00-10:00 AM Final Exam (Comprehensive—but will emphasize lectures 17-24)**	

Course Prerequisites:

CHEM 10122 or equivalent.

Textbook:
Madigan M.T., J.M. Martinko, D.A. Stahl, and D.P. Clark. Brock Biology of Microorganisms Thirteenth Edition. Benjamin Cummings Publishers. Upper Saddle River, N.J. 2010. ISBN: 978-0321649638

Office Hours:
Monday 2:30-3:30, Wednesday 9:00-10:00, or by appointment

Course statement: Microorganisms are everywhere. These bacteria and archea survive in extreme environments that include the deepest ocean regions, hot springs (like Old Faithful), Antarctica, and Death Valley. These organisms span the gamut of utility as some bacteria are absolutely required to maintain our own health while other bacteria display pathogenicity where the smallest of doses can kill. Separate from these extremes, there are other bacteria and archea being utilized routinely in various industries to generate chemicals, antibiotics, food products, and clean water. This course will cover the diversity and specific characteristics of many microbiotic genera and the molecular interactions these organisms utilize to function and survive.

Class goals:
By conclusion of the course you will:

1. Know the basic componenents of DNA, amino acids, polysaccharides, and lipids and identify how these funadamental chemical building blocks are involved in processes required for all living organisms.
2. Know the requirements for bacterial and archeal cellular metabolism, be able to balance chemical equations that summarize such metabolism, and recall the different metabolic pathways presented during the course.
3. Differentiate the environmental conditions required to survive, thrive, or even dominate a niche using examples of the specific species discussed in class and apply this understanding to explain unique aspects to the survival of these specific species.

Supplemental Reading and Handouts:

Supplemental Reading for several lectures will be posted with Resources on Sakai. Powerpoint slides from class will typically be available at least one day prior to lecture on Sakai.

Academic Integrity:
You should expect the utmost ethical academic behavior from your peers. All students must familiarize themselves with the Honor Code on the University's website and pledge to observe its provisions in all written and oral work, including oral presentations, quizzes and exams, and drafts and final versions of essays. Copying, cheating, plagiarism, or other dishonest practices will not be tolerated. Such actions will result in a zero for the assignment/exam, and likely failure of the course. Please refer to the Undergraduate Student Academic Code of Honor Handbook or the Graduate and Professional Student Handbook as appropriate for the specific steps that will be initiated to address such matters.

Homework:
Homework will NOT be graded. Homework problems will be assigned regularly based upon material covered in lectures. Students are encouraged to work together in groups to solve these problems. Some homework problems (or near exact replicas) will be utilized as Exam questions—therefore there are several direct and indirect advantages to solving and understanding the solutions to these homework problems.

Examinations:
There will be three exams, which are currently scheduled for **September 25**, **November 6**, and the final during the official assigned time for this class on **December 17**. These exams are closed book but you are allowed to bring one 8.5"×11" sheet of paper that includes content of your choice—these will be handed in along with your exam. You are also allowed to bring a standard calculator. Cell phones or other devices that access wireless or cellular technology are NOT allowed. If you cannot attend an exam, notify me **prior** to the exam (and not just 15 minutes prior!) to determine the correct course of action.

Mini-Presentation Group Projects: You will work in pairs to cover a specific topic in Chapter 13, 14, 17, 18 or 19 to be assigned by the instructor. You will first be responsible to "decode" a string of biochemical sequence data and then research the function of this macromolecule, learn about the organism that makes this macromolecule and produce a mini-lecture on your assigned topic to present to the class accompanied by power point slides. As part of this presentation you will also write one HW question (to be approved by the instructor) on your topic.

Paper/Presentation:
You will write a research paper about an organism (or group of organisms) of your choosing and give an oral presentation to the class to highlight aspects of your paper and share what you have learned. Papers should be formatted to conform to the guidelines of a MiniReview for publication in the journal *Applied and Environmental Microbiology* (http://aem.asm.org/site/misc/journal-ita_org.xhtml#05). Multiple primary sources should be referenced (some texts may also be acceptable; however, electronic sources such as Google and Wikipedia are acceptable only as sources of images and illustrations). A minimum of eight references must be included with your outline. Presentations will be allotted a set time and should utilize a few PowerPoint slides. If you are interested to add a laboratory component to this project that would include culturing your organism and testing of research hypotheses, this may be an option—please discuss it with me as soon as possible.

Bacterium of the Day:
You will take turns throughout the term to present a "bacterium of the day". You should familiarize yourself with some key points of your organism (natural environment, culturability, carbon source(s) utilized, metabolic features, phylogeny, pathogenicity, and other distinguishing characteristics) and make a brief presentation (~5 minutes) aided by 1-3 slides or a 1-page handout. You will not be responsible to learn each others' organisms. There will be no repeating of any genus without permission of the instructor. Sign up at least one week prior to your slot through the course web site.

Computer Quizzes:
Short quizzes on the assigned reading will be administered through the course Sakai web site (click "Tests & Quizzes" on the left sidebar). You will need to complete each quiz prior to the start of class to receive credit. You are expected to complete the quiz on your own. As you may take these quizzes from anywhere with online access, there will be no exceptions or make-ups but the lowest quiz score will be excluded from your grade.

Grading:

In-class Exams (2): 34%
Final Exam: 20%
Participation/Bacterium of the Day: 12%
Computer Quizzes: 5%
Mini-Group Presentation: 9%
Final Paper and Presentation: 20%

Attendance:
The University of Notre Dame Academic Code states that class attendance is expected. Roll may be taken on occasion. More importantly, participation is a portion of your grade and these points cannot be earned in your absence. Lastly, the small size of this class allows for a very interactive environment where others often benefit from your individual contributions and questions.