

BIOL473: Environmental Microbiology

Winter 2013 • Tuesday & Thursday 11:45-13:00 in CC305

Instructor

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Course Description: We live in a microbial world. There are billions of times more microbes on Earth than stars in the universe and microbial metabolisms are critical to the maintenance of life on our planet. The objective of this course is to provide an overview of microbial diversity and ecophysiology with special emphasis on how the activities and interactions of micro-organisms influence biological systems ranging from humans to the planet as a whole. Special emphasis will be placed on aquatic ecosystems and the microbiology of the ocean. The course structure will consist mainly of lectures. However, students will be required to summarize the findings of a research article by both oral presentation as well as by written assignments (detailed below). Students are expected to have a strong background understanding of molecular biology, biochemistry, genetics, and the general structure and function of cells and their components.

Course Topics

01. *Significance and History of Environmental Microbiology*
02. *Microbial Diversity and Systematics*
03. *The Environment and Microbial Habitats*
04. *Metabolic Diversity and Ecophysiology*
05. *Origins of Life and Formation of the Biosphere*
06. *Global Processes - The Carbon Cycle*
07. *Nutrient Cycles - Nitrogen, Sulfur, and Phosphorous*
08. *Microbe-Microbe Interactions and Ecological Principles*
09. *Symbiotic Associations with Plants and Animals*
10. *Applied Environmental Microbiology*

Suggested Textbook: Barton and Northup. Microbial Ecology (2011). The textbook is not required but strongly suggested, The course will follow the text book, but is also developed from the primary scientific literature. Lecture material (*i.e.* power point slides) will be made available at the Moodle site prior to the beginning of each lecture.

Office Hours: Office hours with Dr. Walsh are held in GE 330.17 on Fridays at 10:00-12:00. Alternatively, please schedule an appointment if you wish to discuss the course outside of these hours.

Student Evaluation

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|-----|----------------------|-----|---|
| 20% | Midterm exam | 15% | Written assignments (and class participation) |
| 15% | Student presentation | 50% | Final exam (cumulative) |

| Class | Date | Topic | Chapter in Barton and Northup |
|-------|-----------|---|-------------------------------|
| 01 | Jan 08 | Course introduction | Ch. 1 |
| 02 | Jan 10 | Origin and early evolution of the biosphere | |
| 03 | Jan 15 | Diversity of Bacteria and Archaea (species concepts) | Ch. 2 |
| 04 | Jan 17 | | |
| 05 | Jan 22 | Cell physiology and bioenergetics | Ch. 3 |
| 06 | Jan 24 | | |
| 07 | Jan 29 | Microbial habitats and lifestyles (aquatic/terrestrial) | Ch. 4 |
| 08 | Jan 31 | | |
| 09 | Feb 05 | Methods in environmental microbiology (metagenomics) | Ch. 5 |
| 10 | Feb 07 | | |
| 11 | Feb 12 | Microbial communities and interactions | Ch. 6 & 9 |
| 12 | Feb 14 | | |
| | Feb 18-24 | Midterm Break | |
| 13 | Feb 26 | | |
| 14 | Feb 28 | Midterm Exam | |
| 15 | Mar 05 | Microbial Biogeochemistry | Ch. 10 |
| 16 | Mar 07 | | |
| 17 | Mar 12 | Microbe-Animal/Plant Interactions | Ch. 7-8 |
| 18 | Mar 14 | | |
| 19 | Mar 19 | Decomposition of Natural Compounds/Bioremediation | Ch. 12-13 |
| 20 | Mar 21 | | |
| 21 | Mar 26 | Student symposium I: The human microbiome | |
| 22 | Mar 28 | | |
| 23 | Apr 02 | Student symposium II: Nitrogen cycling in the ocean | |
| 24 | Apr 04 | | |
| 25 | Apr 09 | Course Review | |
| 26 | Apr 11 | | |

Plagiarism: The most common offense under the Academic Code of Conduct is plagiarism, which the Code defines as “**the presentation of the work of another person as one’s own or without proper acknowledgement.**” This could be material copied word for word from books, journals, internet sites, professor’s course notes, etc. It could be material that is paraphrased but closely resembles the original source. It could be the work of a fellow student, for example, an answer on a quiz, data for a lab report, a paper or assignment completed by another student. It might be a paper purchased through one of the many available sources. Plagiarism does not refer to words alone - it can also refer to copying images, graphs, tables, and ideas. “Presentation” is not limited to written work. It also includes oral presentations, computer assignments and artistic works. Finally, if you translate the work of another person into French or English and do not cite the source, this is also plagiarism. In Simple Words: ***Do not copy, paraphrase or translate anything from anywhere without saying where you obtained it!***

Oral presentations (473 students)

Near the end of the semester, we will have two student symposiums on special topics in environmental microbiology. This year, those topics will be 1) **the human gut microbiome** and 2) **the oceanic nitrogen cycle**. Working in pairs, students will present the findings of a recent research article on one of the two topics. The research articles are posted at the Moodle site and listed below. In addition to 10 research articles for each topic, there is also a review article that will be helpful in preparing for the presentation. Students are asked to look through the research articles, select one of interest, and then sign up for the presentation on the sheet posted outside Dr. Walsh's office in GE330.17. **Please sign up no later than 25-Jan-2012**. Sign up early to ensure you get the article that most interests you!

The presenters: Students will work in pairs to present the findings of a recent research article. Presentations on the human microbiome will take place on Mar 26th and 28th. Presentations on the nitrogen cycle will take place on Apr 2nd and 4th. Student presentations will be 10 minutes in length, followed by a 5 minute question/discussion period.

Preparing the presentation: Students are strongly encouraged to visit Dr. Walsh's office for help and input as they prepare their presentations. The content of the oral presentation should be as follows:

01. *Introduction of the topic:* Concisely present the background information that frames the current research article and the question/problem being examined. Most of this information will be referenced in the introduction of your paper. **Read some of these key references to increase your familiarity with the topic** and use NCBI pubmed to explore the topic more thoroughly. Be sure to describe the goal/objective of the research.
02. *The methodology:* Provide an adequate description of the methods such that the results can be properly understood and interpreted. Given the time constraint, you do not need to present a detailed description, only a general overview.
03. *The results:* This is the most important part of the research and your presentation. Clearly and logically present a summary of the major findings of the research article. **If nothing else, get the results right!** Pay special attention to the order in which the results are presented in the article as they are most likely presented in a logical manner, the latter building on the former.
04. *The discussion and conclusions:* This is typically the most interesting part of the research article (and your presentation), because it is where the results are interpreted and their impact on our state of knowledge is presented. Be sure to point out the major strength and weakness of the study. Also, many of the selected research articles were published a few years ago, therefore certain questions raised in the discussion of your paper may have already been addressed in the literature. Don't be afraid to investigate the impact of your research article by looking for additional articles where it has been referenced. Science is a continuum!

The audience and written summaries (498U/685A students): All students are expected to have read the research articles prior to the presentations (**this material will be tested on the final exam**). In addition, each student will be assigned **a total of 4 papers** for which they will be required to summarize and critique in written format. Papers for written summaries will be assigned once students have signed up for their oral presentations. The written summaries are expected to be between 400-600 words in length. The content of the written summaries should be the same as for the oral presentations (see above). The summaries are due before the oral presentation of the research article. **Late assignments will be docked by 50%.**