MB 520/420

Microbial Genomes, Biogeochemistry, and Diversity

Instructors: Stephen Giovannoni
Time: TR 10-11:20 AM
Room: Nash 206

MB520 Grad student sessions: Nash 404, Time TBA. These sessions can be taken as a one-credit course (MB 505) without attending the lectures. For a partial list of reading see the MB520 announcement.

Office Hours: Stephen Giovannoni: TR 3:00 - 4:00 PM, Nash Rm 248, or by appointment
Review sessions will be held before the exams (TBA)

Text: Special edition of Brock Biology of Microorganisms, Brock & Madigan
Required reading will be available for download from Canvas

Tentative Lecture Schedule and Reading List for MB420/540 Fall 2017

Week	Date	Topic	Notes
1	Th Sept. 21	What happened in the Carboniferous?	
2	Tu Sept. 26	Phylogeny and Evolution	
	Th Sept. 28	Mars, Curiosity, and Early Life	
3	Tu Oct. 3	Microbial Genomics	
	Th Oct. 5	Genomes in Action: Vitamin Traffic	
4	Tu Oct. 10	Metagenomics: The Dark Matter	
	Th Oct. 12	Microbial Population Genetics	
5	Tu Oct. 17	Culturing the Unknown	
	Th Oct. 19	The Smallest Cells and Synthetic Genomics	
6	Tu Oct. 24	Mining Microbial Diversity	
	Th Oct. 26	Evolution in the Biosphere I: Early Life, Anaerobic Metabolism & Chemolithotrophy	
7	Tu Oct. 31	Evolution in the Biosphere II: Photosynthesis and the Great Oxidation	
	Th Nov. 2	**Midterm Exam**	
8	Tu Nov. 7	The Modern Biosphere Carbon Cycle I: Ocean Hypoxia in the Proterozoic and Today	
	Th Nov. 9	The Modern Biosphere Carbon Cycle II: Ocean Fertilization and Plankton Ecology	Jimmy Saw Lecture
9	Tu Nov. 14	Cellular Diversity and Eukaryotic Origins	Luis Bolanos Lecture
	Th Nov. 16	Symbiosis	
10	Tu Nov. 21	Protistan Diversity	
	Th Nov. 23	Archaeal Diversity I: Euryarchaeota and the P-T Extinction	
11	Tu Nov. 28	*No Class (Thanksgiving Holiday*	
	Th Nov. 30	Archaeal Diversity II: ARMAN and DPANN	
		Final Exam: Tuesday Dec 5, 2 PM	

Course Description: Microbial diversity from the earliest life forms to the modern role of bacteria and archaea in biogeochemical cycles. The evolution of microbial proteins, genomes and metabolic pathways shaped global transitions in Earth ecology. On this backdrop students are introduced to key concepts in molecular evolution, bioinformatics, genomics and metagenomics. Particular emphasis is placed on marine systems, from photosynthesis in surface waters to life in the ocean crust. Some examples of topics covered include: the evolution of photosynthesis; a geo-historical perspective on the global carbon cycle and its relevance to modern issues such as the ocean fertilization controversy and hypoxia; the origins of

the major domains of life; a genomic perspective on the simplest cells; microbial life in the deep subsurface (the earth's crust). This course is designed for upper division undergraduates and beginning graduate students who have taken upper division biochemistry and molecular biology courses

Pre-requisites: BB450, BB451.

Course Policies: Grades will be based on a midterm (100 points) and a final exam (100 points). The final exam is semi-cumulative. The exams will cover the materials presented in lecture and the assigned reading material. The final exam will be inclusive. Grades will be assigned according to the percentage of the total possible points obtained: 95-100%, A; 91-94%, A-; 87-90%, B+; 83-86%, B; 79-82%, B-; 75-78%, C+, 71-74%, C; 67-70%, C-; 63-66%, D+; 59-62%, D; 55-58%, D-; less than 55%, fail. To take into account variation in the difficulty of exams, 100% will be defined as the average of the highest three scores obtained. Makeup exams will be available to those with documented medical excuses or other documented emergencies. All makeup exams will have written essay and interview components.

MB520: There will also be discussion sessions held at a separate time (TBA) for 520 students, at which discussions of key papers will be presented by the graduate students. Exams for MB520 include additional written questions. These questions may be attempted for extra credit by undergraduate students enrolled in MB420. Extra-credit obtained in this manner can be used to shift a grade upwards by 0.66 on a 0 - 4.0 scale, e.g. from B- to B+. Getting one extra credit question correct cancels out getting one wrong, in another words, 5 out of 10 points is no extra credit. So, only attempt the extra credit questions if you know your stuff, not to try your luck.

DAS Statement: Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

Please note: The Department of Microbiology follows the university rules on civility and honesty. These can be found at http://oregonstate.edu/admin/stucon/achon.htm. Behaviors disruptive to the learning environment will not be tolerated and will be referred to the Office of Student Conduct for disciplinary action. Cheating or plagiarism by students is subject to the disciplinary process outlined in the Student Conduct Regulations.

Learning Outcomes (420): 1) Develop skills for critically thinking about microbial evolution; assessed by student ability to interpret molecular evolution trees in a variety of scenarios. **2)** Acquire knowledge about the relationship between protein function evolution, microbial diversity and geochemical transformation over earth history; assessed by student ability to identify important biogeochemical transformations in Earth history and their microbial causes. **3)** Learn methods and principles of microbial genome sequencing for environmental, medical, and industrial microbiology; assessed by students demonstrating their abilities to interpret cell functions from genomic data. **4)** Acquire baseline knowledge about the different microbial groups recognized by microbial systematics, and their phenotypic, genetic and biochemical properties; assessed by solving problems that link microbial diversity to socially or environmentally important phenomena.

Learning Outcomes (520): In addition to the above learning outcomes, students taking MB520 are expected to display a comprehension of advanced concepts that are exemplified in scientific literature assigned as reading. Comprehension is displayed by written answers to problems that require an understanding of experimental results and theories and their application to new situations.