Term Information

Effective Term	Spring 2016

General Information

Course Bulletin Listing/Subject Area	Microbiology
Fiscal Unit/Academic Org	Microbiology - D0350
College/Academic Group	Arts and Sciences
Level/Career	Graduate, Undergraduate
Course Number/Catalog	5160
Course Title	Geomicrobiology
Transcript Abbreviation	Geomicrobiology
Course Description	The role of microorganisms in shaping our environment through mineralogical and geochemical processes at both local and global scales, in the present day and over geologic time. periods.
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week, 7 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No
Course Components	Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites	Open to Rank 4 undergrads and graduate students in the School of Earth Sciences, the Department of Microbiology, the Department of Civil, Environmental, and Geodetic Engineering, and the School of Environment and Natural Resources.
Exclusions	Not open to students with credit for Earth Sciences 5160

Cross-Listings

Cross-Listings	Cross-listed in Earth Sciences

Subject/CIP Code

Subject/CIP Code	26.0502
Subsidy Level	Doctoral Course
Intended Rank	Senior, Masters, Doctoral

Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Understanding the physical properties of microorganisms as they relate to respiration, mineral nucleation, and transport of solutes.
- Understanding the principles of microbial ecology and current knowledge of microbial diversity.
- Understanding mechanisms via which microorganisms can exist in the absence of oxygen, and how these metabolisms can alter the local and global environment (e.g. sulfide generation, iron oxidation).
- Understanding microbially-catalyzed cycling of iron and sulfur in the present and the early-earth.
- Understanding how microbial metabolism can be harnessed for the in situ remediation of contaminant metals and organic compounds.
- Understanding how microorganisms can accelerate mineral precipitation, and also catalyze the weathering of certain substrates.
- Understanding the role of microorganisms in early Earth, including the generation of reduced chemical species, and the response to oxygenation of Earth's atmosphere.

Content Topic List

- Microbial distribution in the marine subsurface and in the terrestrial subsurface.
- Microbial strategies for survival under energy limitation and short- and long-range microbial electron transfer.
- The sulfur cycle.
- Iron reduction and its role on early earth.
- Bioremediation and biomineralization.
- Microbial weathering.
- Microbial mat development.
- Geobiology of the Archean and Proterozoic Eons.

Attachments

- Geomicrobiology_5160_syllabus.pdf: Syllabus
  (Syllabus. Owner: Daniels,Charles John)
- LG_Map_M5160.pdf: Curricular Maps
  (Other Supporting Documentation. Owner: Daniels,Charles John)
- Geomicrobiology_5160_syllabus_updated.pdf: Updated Syllabus
  (Syllabus. Owner: Daniels,Charles John)

Comments

- See 9-17-15 e-mail to C. Daniels and L. Krissek. *(by Vankeerbergen,Bernadette Chantal on 09/17/2015 11:54 AM)*
- Course was offered successfully as Earth Science 5194 in Autumn 2014, and will be offered as Earth Science 5194 again in Spring 2016. This request will transition the course to permanent status, cross-listed between Earth Sciences and Microbiology. *(by Daniels,Charles John on 09/11/2015 03:14 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Daniels,Charles John	09/11/2015 03:15 PM	Submitted for Approval
Approved	Daniels,Charles John	09/11/2015 03:17 PM	Unit Approval
Approved	Fink,Steven Scott	09/11/2015 04:44 PM	College Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	09/17/2015 11:54 AM	ASCCAO Approval
Submitted	Daniels,Charles John	09/18/2015 11:19 AM	Submitted for Approval
Approved	Daniels,Charles John	09/18/2015 11:19 AM	Unit Approval
Approved	Fink,Steven Scott	09/22/2015 01:58 PM	College Approval
Pending Approval	Nolen,Dawn Vankeerbergen,Bernadette Chantal Hanlin,Deborah Kay Jenkins,Mary Ellen Bigler Hogle,Danielle Nicole	09/22/2015 01:58 PM	ASCCAO Approval

Microbiology 5160 – Geomicrobiology (3 credit hours)
The Ohio State University
Lecture: MWF, 55 minutes/lecture, details TBA

Professor
Dr. Michael J. Wilkins, Ph.D.

Grading
(% of final grade)

Textbook (optional)
Introduction to Geomicrobiology
Kurt O. Konhauser
Published by Wiley-Blackwell
ISBN: 978-0-632-05454-1
Published 2006

Class presentations | 20%
Class participation | 30%
Midterm exam | 20%
Final exam | 30%

Other readings (papers, etc.) will be posted as pdfs on Carmen

Email
wilkins.231@osu.edu

Office hours
After each lecture, Mendenhall Lab 315

Rationale
This class is being offered to educate both high-level undergraduate and graduate students in interdisciplinary research topics that fall under the general area of 'geomicrobiology'. There is an increasing appreciation for the role that microorganisms play in mineralogical and geochemical processes, at both local and global scales. This class will be beneficial for students interested in how microbiology, geochemistry, and mineralogy intersect, and will utilize primary literature to emphasize this rapidly growing scientific field.

Course objectives
In this course students will learn the role of microorganisms in shaping our environment, both in the present day, and over geologic time periods. Course objectives will include:

1. Understanding the physical properties of microorganisms as they relate to respiration, mineral nucleation, and transport of solutes.

2. Understanding the principles of microbial ecology and current knowledge of microbial diversity.

3. Understanding mechanisms via which microorganisms can exist in the absence of oxygen, and how these metabolisms can alter the local and global environment (e.g. sulfide generation, iron oxidation).

4. A focus on microbially-catalyzed cycling of iron and sulfur in the present and the early-earth. This topic will include discussions on microbial iron- and sulfate-reduction, and microbial oxidation of reduced iron and sulfur species.

5. Understanding how microbial metabolism can be harnessed for the *in situ* remediation of contaminant metals and organic compounds.

6. Understanding how microorganisms can accelerate mineral precipitation, and also catalyze the weathering of certain substrates.

7. Understanding the role of microorganisms in early Earth, including the generation of reduced chemical species, and the response to oxygenation of Earth's atmosphere.

Class requirements
Class will be open to rank 4 undergrads and graduate students in the School of Earth Sciences, the Department of Microbiology, the Department of Civil, Environmental, and Geodetic Engineering, and the School of Environment and Natural Resources.

Restrictions on participation are in place due to the advanced interdisciplinary nature of topics for discussion.

Week number	Topic
1	Introduction to Geomicrobiology
2	Microbial distribution in the marine subsurface
3	Microbial life in the terrestrial subsurface
4	Microbial strategies for survival under energy limitation
5	Short- and long-range microbial electron transfer
6	The sulfur cycle
7	Iron reduction and its role on early earth. Midterm exam will be given this week
8	Respiration of other metals
9	Bioremediation
10	Biomineralization
11	Microbial weathering
12	Microbial mat development
13	Geobiology of the Archean Eon
14	Geobiology of the Proterozoic Eon Final exam will be given this week

*Every attempt has been made to ensure that the information in the syllabus is complete and accurate. However, mistakes such as typographical errors may occur on occasion. Professor Wilkins will address any errors on this syllabus during lecture. The schedule shown above is tentative and will likely change throughout the semester depending on how quickly or slowly we cover the material in class.

Final Grade
Your final grade will be based on a midterm, a final exam, class attendance, and presentations carried out by students over the course of the semester. See the syllabus above for % of each component. Course will be letter-graded using the standard OSU grading scale

A	93-100	A-	90-92			
B+	87-89	B	83-86	B-	80-82	
C+	77-79	C	73-76	C-	70-72	
D+	67-69	D	60-66			
E	0-59					

Attendance. Please let Dr. Wilkins know if you will be absent from a seminar.

Presentations. Over the course of the semester, each student will be expected to lead discussion for one or two papers of their choosing during a 30-minute period. Their ability to develop talking points and direct discussion will account for 20% of the final grade.

Exams

Examinations will consist of multiple choice, short answer, and longer essay questions. All exams will be taken in class. Exam questions will come from material presented in the lecture, and in primary literature discussed during class. Each student must complete the exam on her or his own. You are NOT permitted to receive assistance from anyone else during the exam. You are NOT permitted to take the exams as part of a group. You ARE permitted to use your own lecture notes and slides during the exam. Dr. Wilkins will provide more details about each exam in class.

There are **NO** make-up exams except for valid reasons (e.g., medical excuse). *If you are sick, you MUST have a note signed by your medical doctor (i.e. a licensed physician) and* **dated the same day as the exam**.
Otherwise, you will receive a zero on the exam. **Dr. Wilkins will determine if your excuse is valid. If you do NOT have a reasonable excuse for missing an exam then you will receive a ZERO for the exam.**

Approved make-up exams will consist of short-answer and essay questions. An approved make-up exam will NOT be administered online.

Academic Misconduct
It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct (http://studentaffairs.osu.edu/csc/).

Students with Disabilities
Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated, and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901.
http://www.ods.ohio-state.edu/

Other
Periodic announcements, primary literature, and some lecture slides will be posted on Carmen http://telr.osu.edu/carmen/.

If I need to communicate with the entire class then I will likely send a mass email to all students. I will use your **OSU email account** for this purpose. I realize that many of you have other email accounts through services such as Goggle, Yahoo, or Hotmail. You must remember to check your OSU email account or you may miss important announcements.

Mapping Microbiology 5160 Learning Goals to BS and Ph.D. Degree Program Learning Goals

Microbiology BS Degree
Program Learning Goals (B, beginning; I, Intermediate; A, Advanced)

1. Students acquire the ability to interrelate and apply the fundamental concepts of chemistry, physics and mathematics to the functions of living cells.

2. Students understand the chemical properties of biological molecules and how these molecules function in the molecular mechanisms underlying physiological processes in microbial cells.

3. Students understand evolutionary processes, the diversity of microorganisms, and how microorganisms impact their environment, including their roles in human health and disease.

4. Students acquire the ability to design experiments to test hypotheses, perform analyses, interpret and analyze data, and present scientific information in written and oral formats.

5. Students acquire the ability to appraise scientific data presented in the popular press for accuracy and scientific merit and understand issues and ethical conflicts associated with applications of biotechnology.

Microbiology 5160 Learning Goals (Mapped to BS Degree Program Learning Goals)

1. Understanding the physical properties of microorganisms as they relate to respiration, mineral nucleation, and transport of solutes. **(PLG 1&2 Advanced)**
2. Understanding the principles of microbial ecology and current knowledge of microbial diversity. **(PLG 3 Advanced)**
3. Understanding mechanisms via which microorganisms can exist in the absence of oxygen, and how these metabolisms can alter the local and global environment (e.g. sulfide generation, iron oxidation). **(PLG 1&2 Advanced)**
4. Understanding microbially-catalyzed cycling of iron and sulfur in the present and the early-earth. **(PLG 1&2 Advanced)**
5. Understanding how microbial metabolism can be harnessed for the in situ remediation of contaminant metals and organic compounds. **(PLG 1&2 Advanced)**
6. Understanding how microorganisms can accelerate mineral precipitation, and also catalyze the weathering of certain substrates. **(PLG 1&2 Advanced)**
7. Understanding the role of microorganisms in early Earth, including the generation of reduced chemical species, and the response to oxygenation of Earth's atmosphere. **(PLG 1&2 Advanced)**

- In addition to the specific topics noted above, students will read and analyze primary literature and present their analyses in directed discussions**. These represent Advanced-level activity under the PLGs 4 and 5.**

Mapping Microbiology 5160 Learning Goals to BS and Ph.D. Degree Program Learning Goals

Microbiology BS: Learning Goal Map

Required Prerequisites for the Major — Learning Goals

Semester Course Number		Course Title	Semester hrs	1	2	3	4	5
BIOL 1113		Biological Sciences: Energy Transfer and Development	4	B			B	
BIOL 1114		Biological Sciences: Form, Function, Diversity, and Ecology	4	B			B	
MATH Requirement 1	MATH 1151	Calculus 1 (5 Hrs)	5	B				
	or							
	MATH 1156	Calculus for Biol. Sciences (5 Hrs)						
MATH Requirement 2	MATH 1152	Calculus 2 (5 Hrs)	3 - 5	B				
	or							
	MATH 1157	Math. Modeling for Biol. Sciences (5 Hrs)						
	or							
	STATS 1450	Intro. to the Practice of Statistics (3 Hrs)						
	or							
	STATS 2480	Statistics for the Life Sciences (3 Hrs)						
CHEM 1210		General Chemistry 1	5	B				
CHEM 1220		General Chemistry 2	5	B				
CHEM 2510		Organic Chemistry 1	4	B	B			
CHEM 2520		Organic Chemistry 2	4	B	B			
CHEM 2540		Organic Chemistry Lab 1	2	B	B		B	
PHYS 1200		Mechanics, Thermal Physics, Waves	5	B			B	
PHYS 1201		E&M, Optics, Modern Physics	5	B			B	
		Total Hrs.	**46 - 48**					

Goal: B: Beginning; I, Intermediate; A, Advanced

Required Core for the Major — Learning Goals

Semester Course Number		Course Title	Semester hrs	1	2	3	4	5
MICRBIOL 4100		General Microbiology	5	I	I	I	I	I
MICRBIOL 4110		Pathogenesis and Immunobiology	3	A	A	A		
MICRBIOL 4120		Microbial Physiology and Diversity	3	A	A	A		
MICRBIOL 4130		Microbial Genetics	3	A	A	I		
MICRBIOL 4140		Molecular Microbiology Laboratory	3	I	I	I	A	A
BIOCHEM 4511		Biochemistry	4	I	A			I
		Total Hrs.	**21**					

Goal: B: Beginning; I, Intermediate; A, Advanced

Electives: Total Required 9 hrs
Group 1: 3-9 hrs — Learning Goals

Semester Course Number		Course Title	Semester hrs	1	2	3	4	5
MICRBIOL 4150		Immunobiology Laboratory	3	I	I	A	A	A
MICRBIOL 4193		Individual Studies	1-3					
MICRBIOL 4194		Group Studies	1-3					
MICRBIOL 4591S		DNA Finger Printing Workshops in Columbus PS	1				A	A
MICRBIOL 4797		Study at a Foreign Institution	1-19					
MICRBIOL 4798		Study Tour Domestic	1-19					
MICRBIOL 4998		Undergrad Research in Microbiology	1-5				A	A
MICRBIOL 4998H		Honors Research	1-5				A	A
MICRBIOL 4999		Undergrad Research in Microbiology-Thesis	1-5				A	A
MICRBIOL 4999H		Honors Research-Thesis	1-5				A	A
MICRBIOL 5122		Immunology	2			A		
MICRBIOL 5129		Cellular and Molecular Biology of Pathogenic Eukaryotes	3		A	A		
MICRBIOL 5147		Eukaryotic Pathogens	3		A	A	A	
MICRBIOL 5149		Introductory Virology	3		A	A		
MICRBIOL 5150		Microbial Ecology	3	A	A	A		
MICRBIOL 5155		Environmental Microbiology	3	A	A	A		
MICRBIOL 5160		Geomicrobiology	3	A	A	A	A	A
MICRBIOL 5161H		Bioinformatics and Molecular Microbiology	3	A	A	A		A
MICRBIOL 5169H		Microbial Evolution	3			A		
MICRBIOL 5170		Microbes and Evolution	3			A		
MICRBIOL 5536		Food Microbiology Lecture	3		A	I		A
MICRBIOL 5546		Food Microbiology Laboratory	3		A	I	A	A
		Total Hrs.	**3-9**					

*Indicated graduate-level course. Requires special permission to enroll.

Goal: B: Beginning; I, Intermediate; A, Advanced

Electives: Total Required 9 hrs
Group 2: 0-6 hrs — Learning Goals

Semester Course Number		Course Title	Semester Hrs.	1	2	3	4	5
MICRBIOL 3300		The Biology of Pollution	2	B				I
BIOCHEM 5621		Intro Biological Chemistry Laboratory	4	I			I	
MOLGEN 4500		General Genetics	3		I			
MOLGEN 4606		Molecular Genetics I	4		I			
MVIMG 5000		Evolution of Emerging Viruses	2			A		
PLPATH 5010		Phytobacteriology	2		I	A		
PLPATH 5020		Introduction to Plant Virology	2		I	A		
PLPATH 5040		Science of Fungi: Mycology Lecture	3	I	I	A		
ANSCI 6090*		Anaerobic Microbiology	3		A			
ENR 5263		Biology of Soil Ecosystems	3	I	A			
ENR 5266		Field Soil Investigations	3	I			A	
		Total Hrs.	**0-6**					
		Total Hrs. for the Major	**30**					

*Indicated graduate-level course. Requires special permission to enroll.

Goal: B: Beginning; I, Intermediate; A, Advanced

Mapping Microbiology 5160 Learning Goals to BS and Ph.D. Degree Program Learning Goals

Microbiology Ph.D. Degree Program Learning Goals

PhD graduates of Microbiology should be able to:

1. Demonstrate a broad base of knowledge in several areas, including microbial physiology, genetics, biochemistry, and pathogenesis.
2. Demonstrate in-depth knowledge in an area of interest.
3. Make an original and substantial contribution to the field, as indicated by at least one first-author publication.
4. Effectively communicate science through oral and written presentations to both scientific and general audiences.

Microbiology 5160 Learning Goals (Mapped to Ph.D. Degree Program Learning Goals)

Learning goals for Microbiology 5160 align with our graduate degree PLG 1,2 and 4. Although this is a 5000-level course, the course content represents a specialization and we envision that this course will meet intermediate and advanced level goals for Microbiology graduate students.