Term Information

Effective Term	Spring 2016

General Information

Course Bulletin Listing/Subject Area	Earth Sciences
Fiscal Unit/Academic Org	School of Earth Sciences - D0656
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 Microbiology 5160

Cross-Listings

Cross-Listings	Cross-listed in Microbiology

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

- Curricular Map, Earth Sci B.S._Sept 2015.docx: Curricular map

  (Other Supporting Documentation. Owner: Krissek,Lawrence Alan)
- Geomicrobiology_new course_syllabus.docx: Revised syllabus with details on lecture # & lengt

  (Syllabus. Owner: Krissek,Lawrence Alan)

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 Krissek,Lawrence Alan on 09/10/2015 02:23 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Krissek,Lawrence Alan	09/10/2015 02:25 PM	Submitted for Approval
Approved	Krissek,Lawrence Alan	09/10/2015 02:26 PM	Unit Approval
Approved	Haddad,Deborah Moore	09/10/2015 04:17 PM	College Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	09/17/2015 11:54 AM	ASCCAO Approval
Submitted	Krissek,Lawrence Alan	09/17/2015 03:14 PM	Submitted for Approval
Approved	Krissek,Lawrence Alan	09/17/2015 03:14 PM	Unit Approval
Approved	Haddad,Deborah Moore	09/17/2015 04:57 PM	College Approval
Pending Approval	Nolen,Dawn Vankeerbergen,Bernadette Chantal Hanlin,Deborah Kay Jenkins,Mary Ellen Bigler Hogle,Danielle Nicole	09/17/2015 04:57 PM	ASCCAO Approval

Earth Sciences 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.

CURRICULAR MAP OF COURSES AVAILABLE IN EARTH SCIENCES B.S.
Revised Autumn 2015 to include proposed Earth Sci 5160

	Course Number	Course Title	Read/ evaluate Earth Sci literature	Present Earth Sci info	Apply Earth Sci data	Apply appropriate techniques/ methods	Identify Earth Sci problems, develop solutions	Apply other sciences
Preparation for the Major								
Earth Sciences	1121	The Dynamic Earth	B	B	B	B	B	B
Earth Sciences	1122	Earth through Time	B	B	B	B	B	B
Earth Sciences	2245	Introductory Data Analysis for Earth and Environmental Sciences		B	B	B	B	B
Major Program								
Earth Sciences	4194	Group Studies	I	I	I	I	I	I
Earth Sciences	4194H	Honors Group Studies	I	I	I	I	I	I
Earth Sciences	4310	Remote Sensing in the Earth Sciences	I	I	I	I	I	I
Earth Sciences	4421	Earth Materials	I	I	I	I	I	I

	Course Number	Course Title	Read/ evaluate Earth Sci literature	Present Earth Sci info	Apply Earth Sci data	Apply appropriate techniques/ methods	Identify Earth Sci problems, develop solutions	Apply other sciences
Earth Sciences	4423	Introductory Petrology	I	I	I	I	I	I
Earth Sciences	4425	Energy Resources and Sustainability	I	I	I	I	I	I
Earth Sciences	4450	Water, Ice, and Energy in the Earth System	I	I	I	I	I	I
Earth Sciences	4501	Paleontology	I	I	I	I	I	I
Earth Sciences	4502	Stratigraphy and Sedimentation	I	I	I	I	I	I
Earth Sciences	4530	Structural Geology	I	I	I	I	I	I
Earth Sciences	4560	Applied Geophysics	I	I	I	I	I	I
Earth Sciences	4880	Seminar in Geophysics	I	I	I	I	I	I
Earth Sciences	4998	Undergraduate Research in Earth Sciences	I - A	I - A	I - A	I - A	I - A	I - A
Earth Sciences	4998H	Honors Undergraduate Research in Earth Sciences	A	A	A	A	A	A

	Course Number	Course Title	Read/ evaluate Earth Sci literature	Present Earth Sci info	Apply Earth Sci data	Apply appropriate techniques/ methods	Identify Earth Sci problems, develop solutions	Apply other sciences
Earth Sciences	4999.01	Undergraduate Thesis in Earth Sciences	A	A	A	A	A	A
Earth Sciences	4999.01 H	Honors Undergraduate Thesis in Earth Sciences	A	A	A	A	A	A
Earth Sciences	4999.02	Undergraduate Research for Thesis in Earth Sciences	I - A	I - A	I - A	I - A	I - A	I - A
Earth Sciences	4999.02 H	Honors Undergraduate Research for Thesis in Earth Sciences	I - A	I - A	I - A	I - A	I - A	I - A
Earth Sciences	5160	Geomicro biology	I – A	I – A	I – A	I – A	I – A	I - A
Earth Sciences	5189.01	Field Geology I	I - A	I - A	I - A	I - A	I - A	I - A
Earth Sciences	5189.02	Field Geology II	I - A	I - A	I - A	I - A	I - A	I - A
Earth Sciences	5191	Internship in the Earth Sciences	I - A	I - A	I - A	I - A	I - A	I - A
Earth Sciences	5193.xx	Individual Studies	I - A	I - A	I - A	I - A	I - A	I - A

	Course Number	Course Title	Read/ evaluate Earth Sci literature	Present Earth Sci info	Apply Earth Sci data	Apply appropriate techniques/ methods	Identify Earth Sci problems, develop solutions	Apply other sciences
Earth Sciences	5194	Group Studies	I - A	I - A	I - A	I - A	I - A	I - A
Earth Sciences	5203	Geo-environment and Human Health	A	A	A	A	A	A
Earth Sciences	5206	Advanced Oceanography	A	A	A	A	A	A
Earth Sciences	5550	Geomorphology	I-A	I-A	I-A	I-A	I-A	I-A
Earth Sciences	5600	Siliciclastic Depositional Systems	A	A	A	A	A	A
Earth Sciences	5601.01	Sedimentary Petrology: Sandstones	A	A	A	A	A	A
Earth Sciences	5601.02	Sedimentary Petrology: Carbonate Rocks and Shales	A	A	A	A	A	A
Earth Sciences	5602.01	Carbonate Depositional Systems I	A	A	A	A	A	A
Earth Sciences	5602.02	Carbonate Depositional Systems II	A	A	A	A	A	A
Earth Sciences	5603	Stratigraphy	A	A	A	A	A	A
Earth Sciences	5604	Sequence Stratigraphy	A	A	A	A	A	A

	Course Number	Course Title	Read/ evaluate Earth Sci literature	Present Earth Sci info	Apply Earth Sci data	Apply appropriate techniques/ methods	Identify Earth Sci problems, develop solutions	Apply other sciences
Earth Sciences	5605	Paleoceano graphy	A	A	A	A	A	A
Earth Sciences	5613	Micropaleon tology	A	A	A	A	A	A
Earth Sciences	5614	Paleobiology	A	A	A	A	A	A
Earth Sciences	5615	Paleoecology	A	A	A	A	A	A
Earth Sciences	5617	Petrology of Earth and Planets	A	A	A	A	A	A
Earth Sciences	5618	Advanced Historical Geology	A	A	A	A	A	A
Earth Sciences	5621	Introduction to Geochemistry	A	A	A	A	A	A
Earth Sciences	5622	Stable Isotope Biogeo chemistry	A	A	A	A	A	A
Earth Sciences	5625	Igneous Petrology	A	A	A	A	A	A
Earth Sciences	5627	Global Biogeochemical Cycles	A	A	A	A	A	A
Earth Sciences	5628	Environmental Isotope Geochemistry	A	A	A	A	A	A

	Course Number	Course Title	Read/ evaluate Earth Sci literature	Present Earth Sci info	Apply Earth Sci data	Apply appropriate techniques/ methods	Identify Earth Sci problems, develop solutions	Apply other sciences
Earth Sciences	5629	Principles of Petrology	A	A	A	A	A	A
Earth Sciences	5636	Advanced Topics in Mineralogy and Crystallography	A	A	A	A	A	A
Earth Sciences	5641	Geostatistics	A	A	A	A	A	A
Earth Sciences	5642	Geomathe matical Analysis	A	A	A	A	A	A
Earth Sciences	5644	Tectonic Evolution of Continents	A	A	A	A	A	A
Earth Sciences	5645	Advanced Structural Geology	A	A	A	A	A	A
Earth Sciences	5646	Geodynamics	A	A	A	A	A	A
Earth Sciences	5650	Glaciology	A	A	A	A	A	A
Earth Sciences	5651	Hydrogeology	A	A	A	A	A	A
Earth Sciences	5655	Land Surface Hydrology	A	A	A	A	A	A
Earth Sciences	5660	Geology of Metallic Deposits	A	A	A	A	A	A

	Course Number	Course Title	Read/ evaluate Earth Sci literature	Present Earth Sci info	Apply Earth Sci data	Apply appropriate techniques/ methods	Identify Earth Sci problems, develop solutions	Apply other sciences
Earth Sciences	5661	Petroleum Geology	A	A	A	A	A	A
Earth Sciences	5663	Global Change and Sustainability in the Earth System	A	A	A	A	A	A
Earth Sciences	5670	General and Economic Geology of Selected Areas	A	A	A	A	A	A
Earth Sciences	5676	Elemental Chemical Analysis using Inductively Coupled Plasma Optical Emission and Mass Spectrometry	A	A	A	A	A	A
Earth Sciences	5680	Deep Earth Geophysics	A	A	A	A	A	A
Earth Sciences	5687	Energy Geophysics	A	A	A	A	A	A
Earth Sciences	5703	Principles of Biostratigraphy	A	A	A	A	A	A
Earth Sciences	5713	Taxonomy and Phylogeny in the Fossil Record	A	A	A	A	A	A

	Course Number	Course Title	Read/ evaluate Earth Sci literature	Present Earth Sci info	Apply Earth Sci data	Apply appropriate techniques/ methods	Identify Earth Sci problems, develop solutions	Apply other sciences
Earth Sciences	5714	Biometry	A	A	A	A	A	A
Earth Sciences	5717	Critical Issues in World Freshwater Resources	A	A	A	A	A	A
Earth Sciences	5718	Aquatic Geochemistry	A	A	A	A	A	A
Earth Sciences	5719	Environmental Organic Geochemistry	A	A	A	A	A	A
Earth Sciences	5746	Seminar in Rheological Properties of Solids	A	A	A	A	A	A
Earth Sciences	5751	Quantitative Reservoir Modeling	A	A	A	A	A	A
Earth Sciences	5752	Contaminants in Aqueous Systems	A	A	A	A	A	A
Earth Sciences	5754	Risk Assessment and Management in Earth Systems	A	A	A	A	A	A
Earth Sciences	5779	Seminar in Physical Properties of Minerals and Rocks	A	A	A	A	A	A
Earth Sciences	5780	Reflection Seismology	A	A	A	A	A	A

	Course Number	Course Title	Read/ evaluate Earth Sci literature	Present Earth Sci info	Apply Earth Sci data	Apply appropriate techniques/ methods	Identify Earth Sci problems, develop solutions	Apply other sciences
Earth Sciences	5781	Gravity Exploration	A	A	A	A	A	A
Earth Sciences	5782	Magnetic Exploration	A	A	A	A	A	A
Geod Sci	5781	Geodesy and Geodynamics	A	A	A	A	A	A
			Course Number	Course Title	Read/ evaluate Earth Sci literature	Present Earth Sci info	Apply Earth Sci data	Apply appropriate techniques/ methods
Electives from other departments (Geog, AtmosSC, EEOB, ENR, Chem, Math, etc.)								I-A

Program Learning Goals:

A) Students critically read and evaluate Earth Science literature

B) Students present Earth Science information in a clear and logical manner, both orally and in writing.

C) Students apply knowledge of Earth Science data to understand the dynamic physical, chemical, and biological processes of the Earth and its history.

D) Students apply knowledge of appropriate techniques, field methods, field mapping, and numerical methods to measure, portray, analyze, and interpret Earth Science data in specific subdisciplines.

E) Students identify Earth Science problems and develop solutions.

F) Students apply knowledge of modern applications from chemistry, physics, biology, mathematics, statistics, and computing to the solution of Earth Science problems.

Key: B = Beginning level; I = Intermediate level; A = Advanced level