

## Term Information

Effective Term Autumn 2019

## General Information

Course Bulletin Listing/Subject Area Microbiology  
Fiscal Unit/Academic Org Microbiology - D0350  
College/Academic Group Arts and Sciences  
Level/Career Undergraduate  
Course Number/Catalog 2000  
Course Title Introduction to Microbiology Research  
Transcript Abbreviation IntroMicroResearch  
Course Description This course introduces undergraduate students to the process of microbiology research and familiarizes students with ongoing Microbiology Research at The Ohio State University.  
Semester Credit Hours/Units Fixed: 1.5

## Offering Information

Length Of Course 14 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 Biology 1113(H) or equivalent  
Exclusions None  
Electronically Enforced Yes

## Cross-Listings

Cross-Listings none

## Subject/CIP Code

Subject/CIP Code 26.0502  
Subsidy Level Baccalaureate Course  
Intended Rank Freshman, Sophomore, Junior

## 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

- Demonstrate an ability to formulate hypotheses and design experiments based on the scientific method.
- Discuss how to approach the problem of identifying and formulating a viable research project.
- Analyze and interpret results from a variety of microbiological methods and apply these methods to analogous situations.
- Effectively communicate fundamental concepts of microbiology in written and oral format.

### Content Topic List

- Hypothesis formulation and testing
- Experimental design
- Experimental methods used in microbiology research
- Scientific communication
- How to read a scientific Paper
- Fundamental microbiology at OSU
- Microbial pathogenesis Research at OSU
- Environmental microbiology research at OSU
- Virology/Computational Biology/Mycology/Parasitology/Bacteriology at OSU

### Sought Concurrence

No

## Attachments

- Syllabus\_M2000\_submit.pdf: Syllabus  
*(Syllabus. Owner: Kwiek,Jesse John)*
- M2000\_Coverletter\_21\_Dec\_2018.pdf: Cover Letter- original  
*(Cover Letter. Owner: Kwiek,Jesse John)*
- Mapping2LG\_2000.pdf: Course objective mapped to PLG  
*(Other Supporting Documentation. Owner: Kwiek,Jesse John)*

## Comments

- Clever title! *(by Haddad,Deborah Moore on 12/21/2018 04:38 PM)*

## Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Kwiek,Jesse John	12/21/2018 03:57 PM	Submitted for Approval
Approved	Kwiek,Jesse John	12/21/2018 03:59 PM	Unit Approval
Approved	Haddad,Deborah Moore	12/21/2018 04:38 PM	College Approval
Pending Approval	Nolen,Dawn Vankeerbergen,Bernadette Chantal Oldroyd,Shelby Quinn Hanlin,Deborah Kay Jenkins,Mary Ellen Bigler	12/21/2018 04:38 PM	ASCCAO Approval



21 December 2018

**RE: New Course Proposal: Microbiology 2000**

Dear Colleagues,

We propose a new course, **Microbiology 2000: Introduction to Microbiology Research**, a 1.5 credit microbiology elective that introduces undergraduate students to the process of scientific (microbiology) research and familiarizes them with ongoing microbiology research at The Ohio State University. In addition to the benefits realized from achievement of the academic learning goals, which are adapted from the American Society for Microbiology curriculum guidelines, we expect that this course will prepare students to identify and contact Microbiology faculty to inquire about undergraduate research opportunities (e.g. Microbiology 4998[H]). To facilitate your evaluation of this proposal, I have attached a syllabus and a list of the course learning objectives mapped to the Microbiology BS Program Learning Goals.

I thank you for your consideration.

Regards,

Jesse J. Kwiek  
Associate Professor  
Vice Chair for Teaching & Undergraduate Affairs  
Department of Microbiology  
Ohio State University  
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484 West 12th Avenue  
Columbus, OH 43210  
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## Microbiology 2000: Introduction to Microbiology Research

Autumn 2019

<b>Instructors:</b>	Juan Alfonzo, Ph.D. Professor Dept. of Microbiology	Jesse Kwiek, Ph.D. Associate Professor Dept. of Microbiology	Natacha Ruiz, Ph.D. Associate Professor Dept. of Microbiology
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<b>Phone:</b>	614.292.0141	614.292.3256	614.292.4326
<b>Office hours:</b>	By appointment	By appointment	By appointment

**Class meetings:** Tuesday, 2:20p - 3:40p, **Class location:** TBD

**Required Texts:** Articles posted on Carmen

**Course Description:** This course introduces undergraduate students to the process of microbiology research and familiarizes students with ongoing Microbiology Research at The Ohio State University.

**Prerequisite:** Biology 1113(H) or equivalent.

**Learning Objectives** (adapted, in part, from the American Society of Microbiology)

1. Apply the process of science
  - a. Demonstrate an ability to formulate hypotheses and design experiments based on the scientific method. *This objective will be achieved when students read/evaluate/critique historical accounts and papers from OSU microbiologists.*
  - b. Discuss how to approach the problem of identifying and formulating a viable research project. *This objective will be achieved through discussions about ongoing Microbiology Research.*
  - c. Analyze and interpret results from a variety of microbiological methods and apply these methods to analogous situations. *This objective will be achieved when students talk about research methods used by Department faculty.*
2. Communicate and collaborate with others
  - a. Effectively communicate fundamental concepts of microbiology in written and oral format. *This will be achieved through a group project, in which a pair of students will identify a micro faculty member whose science interests them. Students will write a summary of the faculty member's research and present their findings to the class. Alternatively, a pair of students will identify a microbiology story in the popular press and present it to the class.*

**Grading:** Final course grades will be calculated as follows:

Participation/contributions to in-class discussions	70%
Group Presentation	15%
Research Summary	15%

**Grading Scale:** 93-100 = A; 90-92 = A-; 87-89 = B+; 83-86 = B; 80-82 = B-; 77-79 = C+; 73-76 = C; 70-72 = C-; 67-69 = D+; 60-66 = D; 0-59 = F.

**Course Requirements and Policies**

**Enrollment:** All students must be officially enrolled in the course by the end of the second full week of the semester. No requests to add the course will be approved by the department chairs after that time. Enrolling officially and on time is solely the responsibility of the student.

**Attendance and Participation:** Students are expected to attend all meetings of the course. Preparation for class and in-class participation and contributions are important to student learning and are weighed heavily in the final grade. The rubric on preparation, participation, and contribution is listed below. The highest participation grades will go to those who help build the discussions through their own contributions and their questions to peers. The most valuable contributions often begin with the words “I don’t understand.” To do well, complete the reading assignments, come to class, and participate. Above all, ask questions when you do not understand or need more information. The course is designed for you to succeed.

Note that students who are not in class are unable to participate and students with spotty or poor attendance will have lower participation grades. In the event that you must miss class, you are responsible for the contents of the lecture and/or discussion. Students who must miss class for religious observances must notify the instructor of their absence in advance.

**Participation Rubric.** *Adapted from The Teaching Professor, March 2005.*

	<b>Exceeds Expectations</b>	<b>Meets Expectations</b>	<b>Approaching Expectations</b>	<b>Does NOT Meet Expectations</b>
<b>Preparation</b>	Arrives on time fully prepared at every class session	Arrives mostly, if not fully, prepared (ongoing)	Inconsistent preparation	Rarely or never prepared
<b>Participation</b>	Plays an active role in discussions (ongoing)	Participates constructively in discussions (ongoing)	When prepared, participates constructively in discussions	Comments vague if given; frequently demonstrates lack of interest
<b>Contribution to Class</b>	Comments advance level and depth of dialogue (consistently)	Makes relevant comments based on assigned material (ongoing)	When prepared, relevant comments are based on assignments	Demonstrates a noticeable lack of interest

YOU WILL POSITIVELY AFFECT YOUR PARTICIPATION GRADE BY:

1. Becoming more active and/or making more effective comments that raise overall level of discussion.
2. Asking thoughtful questions that will enhance discussion and engage peers.
3. Listening carefully to, supporting, and engaging your peers in discussion.

YOU WILL NEGATIVELY AFFECT YOUR PARTICIPATION GRADE BY:

1. Not attending class (unexcused), or **arriving to class late**.
2. Using electronic devices (*e.g.* cell phone, iPad, computer, etc.) for personal, non-class related reasons.
3. Dominating class discussions, thereby restricting others’ participation.
4. Making offensive, and/or disrespectful comments during discussions.

**Cellphones and Laptops.** We encourage you to be device free during class time. Ideally cellphones and laptops should be switched off and put away. Texting, typing, and surfing the internet during class creates an atmosphere of distraction and undermines the basic purpose of education: to listen, learn, think and discuss the topic at hand. Numerous studies have demonstrated that multi-tasking is detrimental to classroom learning (See, for example Faria Sana, Tina Weston, and Nicholas Cepeda, “[Laptop Multitasking Hinders Classroom Learning for Both Users and Nearby Peers](#),” Computers and Education, 62:2013, 24-31). Their study makes clear that “*multitasking on a laptop poses a significant distraction to both users and fellow students and can be detrimental to comprehension of lecture content.*” **If you would like to take notes on your computer, please turn off your WI-FI for the duration of the class and close all other windows.** In case of on-going use of cellphones or laptops that is distracting to other students or the instructors, students will be notified and asked

to either move to the back of the classroom and/or stop using the device. The instructors reserve the right to impose a more comprehensive policy should these provide on-going distractions.

**Research Summary:** Students will write a 2-page research summary, based on either a microbiology story in the popular press or on research conducted by a Microbiology Faculty member. All direct quotes and any outside material used as a source should be cited. Direct quotes must be noted with quotation marks and their source should be cited. You must also cite outside sources you use in your writing. We will provide you with detailed instructions for properly citing, but if you have questions about how to do this, please ask. Written assignments must be submitted through Carmen (not via email), and they will be scanned through Turnitin Feedback Studio to assess plagiarism and group work. Prior to document submission, we encourage you to scan your work with [iThenticate](#) in order to identify and correct any citation omissions.

**Group Presentation:** Students will work in groups of two to prepare a 15-minute presentation, which will be evaluated according to the following rubric:

	<b>Exceeds Expectations</b>	<b>Meets Expectations</b>	<b>Approaching Expectations</b>	<b>Does NOT Meet Expectations</b>
<b>Organization</b>	Information presented in logical, interesting sequence that audience can follow	Information presented in reasonably logical sequence that audience generally can follow	Audience has difficulty following presentation because the material is not presented logically	Audience cannot follow presentation; sequence of information is confusing or contradictory
<b>Subject Knowledge</b>	Presenter(s) demonstrates full knowledge of topic (more than required), shows nuance and detailed understanding; answers questions very well	Presenter(s) at ease with topic and provides a solid basis for understanding the topic with some sophistication; solid answers to questions	Presenter(s) uncomfortable with information; presentation includes partial or incomplete information; incomplete answers to questions	Presenter(s) does not have grasp of information; knowledge superficial or lacking; unable to respond appropriately to questions
<b>Visual Appeal/Creativity</b>	Slides were engaging, relevant, and always complemented spoken presentation	Slides were engaging, mostly relevant, but didn't always complement spoken presentation	Slides somewhat engaging <sup>4</sup> but rarely relevant or complementary to spoken presentation	Slides were not relevant to spoken presentation or difficult to understand/interpret

**Late work:** All students are responsible for knowing and adhering to the deadlines for course assignments. Late work will be penalized. The only exception to this will be when you have explicit, advance permission from the one of the professors. If you anticipate a problem in completing your work on time, you must contact the instructors. If you do not hear back, you should assume that your work is due on the original date.

**Plagiarism and academic misconduct:** It is the responsibility of the Committee on Academic Misconduct (COAM) 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. Plagiarism is presenting another person's words, ideas, or sequence of arguments as your own without attribution. We will discuss what constitutes plagiarism and how to cite sources properly in this course. If at any point, however, you have a question about this, please ask. If you are tempted to plagiarize or find yourself using material from the Internet or any other source and trying to pass it off as your own, stop working on the assignment and contact the instructors. It is better to submit work late than to violate the Code of Student Conduct. It is the instructors' responsibility to report all instances of alleged academic misconduct to

the committee (Faculty Rule 3335-5-487), and the professor and discussion section leaders take this responsibility seriously. For additional information, see the Code of Student Conduct (<http://studentaffairs.osu.edu/csc/>). Examples of academic misconduct most applicable to this course include the following: Plagiarism; Knowingly providing or receiving information during an exam; Falsifying documentation to excuse a missed exam or class; Lying about a death in the family to excuse a missed exam or class; Asking instructors to alter your grade as a special personal favor.

**Students with disabilities:** The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: [slds@osu.edu](mailto:slds@osu.edu); 614-292-3307; [slds.osu.edu](http://slds.osu.edu); 098 Baker Hall, 113 W. 12th Avenue.

**As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation.** These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting [ccs.osu.edu](http://ccs.osu.edu) or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273-TALK or at [suicidepreventionlifeline.org](http://suicidepreventionlifeline.org).

**Title IX** makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at <http://titleix.osu.edu> or by contacting the Ohio State Title IX Coordinator, Kellie Brennan, at [titleix@osu.edu](mailto:titleix@osu.edu).

**The Ohio State University affirms the importance and value of diversity in the student body.** Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

**Email:** Electronic mail is a valuable tool. The instructors will, from time to time, send emails to the class. We are also happy to respond to your email messages that conform to the appropriate standards. In academic and professional settings, all emails should have a descriptive subject line ("Question about Microbiology course assignment"), begin with a respectful salutation ("Prof. Ruiz" or "Prof. Alfonzo"), and conform to standard



English with proper punctuation and capitalization. Because this is a team-taught course, please copy both professors on messages related to the class. For an excellent overview of how students can most effectively use email with their professors, please see "How to e-mail a professor" <http://mledy.blogspot.com/2005/01/how-to-e-mail-professor.html>

**Copyright Protection:** The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

### Course Schedule

Week	Date	Faculty Lead	Topic	Guest Speaker	Reading
1	20-Aug-19	JA, JK, NR	What is microbiology?	None	None
2	27-Aug-19	JA, JK, NR	Hypothesis formulation and testing	None	Microbe Hunters, ch 4.
3	3-Sep-19	JA, JK, NR	Experimental design	None	Platt: "Strong Inference." Flexner: "The usefulness of Useless Knowledge."
4	10-Sep-19	JA, JK, NR	Experimental methods used in microbiology research	None	Excerpts from "A Crack in Creation: Gene Editing and the Unthinkable Power to Control Evolution."
5	17-Sep-19	JA, JK, NR	Scientific communication	Speaker from OSU Research Communications, Media & PR	Select OSU Press Releases
6	24-Sep-19	JA, JK, NR	How to read a scientific Paper	None	Article from Microbiologist
7	1-Oct-19	NR	Fundamental microbiology at OSU	OSU Micro Faculty	Article from OSU Microbiologist
8	8-Oct-19	JK	Microbial pathogenesis Research at OSU	OSU Micro Faculty	Article from OSU Microbiologist
9	15-Oct-19	JK	Environmental microbiology research at OSU	OSU Micro Faculty	Article from OSU Microbiologist
10	22-Oct-19	JK	Virology/Computational Biology	OSU Micro Faculty	Article from OSU Microbiologist
11	29-Oct-19	JA	Mycology	OSU Micro Faculty	Article from OSU Microbiologist
12	5-Nov-19	JA	Parasitology	OSU Micro Faculty	Article from OSU Microbiologist
13	12-Nov-19	NR	Bacteriology	OSU Micro Faculty	Article from OSU Microbiologist
14	19-Nov-19	JA, JK, NR	Group presentations (1)	None	None
15	26-Nov-19	JA, JK, NR	Group presentations (2)	None	None
16	3-Dec-19	JA, JK, NR	Student/Faculty panel discussion	Various Microbiologists	None



## 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 Req. #1	MATH 1151	Calculus 1 (5 Hrs)	5	B				
	or							
	MATH 1156	Calculus for Biol. Sciences (5 Hrs)						
MATH Req. #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	
<b>Total Hrs.</b>			<b>46 - 48</b>					

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
<b>Total Hrs.</b>			<b>21</b>					

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 2000		Introduction to Microbiology Research	1.5				B	B
MICRBIOL 3704		HIV: From Microbiology to Macrohistory	3			I	I	I
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	3				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 5161	Bioinformatics and Molecular Microbiology	3			A	A	A
MICRBIOL 5170	Microbes and Evolution	3				A	
MICRBIOL 5270	Antibiotics and Microbial Natural Products	3			A	A	A
MICRBIOL 5536	Food Microbiology Lecture	3			A	I	A
MICRBIOL 5546	Food Microbiology Laboratory	3			A	I	A
MICRBIOL 6020*	Microbial Physiology and Biochemistry	3			A	A	A
MICRBIOL 6080*	Advanced Microbial Genetics	3			A		A
MICRBIOL 6155*	Microbial Ecology & Evolution	3				A	A
MICRBIOL 7010*	Cellular and Molecular Immunology	3				A	A
MICRBIOL 7020*	Physiology Meets Pathogenesis	2			A	A	A
MICRBIOL 7023*	Molecular Immunology: Lecture	3				A	A
MICRBIOL 7050*	Fermentation Biotechnology	3			A		A
MICRBIOL 7060*	Advanced Topics in Molecular Microbiology	2			A		A
MICRBIOL 7536*	Advanced Food Microbiology	3			A	I	A
MICRBIOL 7724*	Molecular Pathogenesis	3			A	A	A
MICRBIOL 7889*	Host-Pathogen Interactions: Research Seminar	1				A	A
MICRBIOL 7899*	Microbiology Colloquium	1					
MICRBIOL 8149*	Microbiome Informatics	3			A*	A*	A*
	<b>Total Hrs.</b>	<b>3-9</b>					

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

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

**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 3798.05	Impact of HIV: Tanzania (study abroad)	4			I	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
	<b>Total Hrs.</b>	<b>0-6</b>					
	<b>Total Hrs. for the Major</b>	<b>30</b>					

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

**Program Learning Goals (B, beginning; I, Intermediate; A, Advanced)**

- Students acquire the ability to interrelate and apply the fundamental concepts of chemistry, physics and mathematics to the functions of living cells.
- Students understand the chemical properties of biological molecules and how these molecules function in the molecular mechanisms underlying physiological processes in microbial cells.
- Students understand evolutionary processes, the diversity of microorganisms, and how microorganisms impact their environment, including their roles in human health and disease.
- 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.
- 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.

**Micrbiology 2000 learning Goals (Mapped to Program Learning Goals)**

- Apply the process of science
  - Demonstrate an ability to formulate hypotheses and design experiments based on the scientific method. This objective will be achieved when students read/evaluate/critique historical accounts and papers from OSU microbiologists. **(PLG 4B)**
  - Discuss how to approach the problem of identifying and formulating a viable research project. This objective will be achieved through discussions about ongoing Microbiology Research. **(PLG 4B)**
  - Analyze and interpret results from a variety of microbiological methods and apply these methods to analogous situations. This objective will be achieved when students talk about research methods used by Department faculty. **(PLG 4B)**
- Communicate and collaborate with others
  - Effectively communicate fundamental concepts of microbiology in written and oral format. This will be achieved through a group project, in which a pair of students will identify a micro faculty member whose science interests them. Students will write a summary of the faculty member's research and present their findings to the class. Alternatively, a pair of students will identify a microbiology story in the popular press and present it to the class. **(PLG 5B)**