Term Information

Effective Term	Spring 2026

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	4800
Course Title	Advances in Microbial Biotechnology
Transcript Abbreviation	Adv Micro Biotech
Course Description	Lecture course covering topics in applied microbial biotechnology, biocatalysis, and chemical biology. The origins of modern biotechnology, impact of microbial chemicals, and significant developments in biotechnology will be discussed.
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week, 12 Week, 8 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	MICRBIO 4100; or BIOCHEM 4511 or 5613; or PHR 3200
Exclusions	
Electronically Enforced	Yes

Cross-Listings

Cross-Listings	

Subject/CIP Code

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

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

- Students will:
  - knowledgeably describe historical origins of and understand methods in and impact of microbial biotechnology
  - understand the application of microbial enzymes and use of microbes in the production of valuable chemicals

Content Topic List

- - Origins of modern biotechnology
  - Industrial enzymes
  - Biocatalysis
  - Natural products
  - Applied genomics
  - Genetic engineering
  - Vaccines and antibody production
  - Commodity chemical production
  - PROTACs

Sought Concurrence

Yes

Attachments

- M4800_Cover letter.pdf: Cover letter

  (Cover Letter. Owner: Ruiz,Natividad)
- MICRBIOL 4800_Syllabus_2025_04_30.pdf: Syllabus

  (Syllabus. Owner: Ruiz,Natividad)
- Mapping2LG_4800.pdf: Learning goals mapping

  (Other Supporting Documentation. Owner: Ruiz,Natividad)
- M4800_concurrence_request_form.pdf: Concurrence forms

  (Concurrence. Owner: Ruiz,Natividad)

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Ruiz,Natividad	05/02/2025 09:45 AM	Submitted for Approval
Approved	Ruiz,Natividad	05/02/2025 09:45 AM	Unit Approval
Pending Approval	Vankeerbergen,Bernadette Chantal	05/02/2025 09:45 AM	College Approval

THE OHIO STATE UNIVERSITY

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May 2, 2025

Dear Colleagues,

The Department of Microbiology would like to propose a new course, **MICRBIO 4800: Advances in Microbial Biotechnology**. This 3.0-credit microbiology elective lecture course will cover topics in applied microbial biotechnology, biocatalysis, and chemical biology. Significant developments in biotechnology will be reviewed by faculty-led lectures, discussions of primary literature, and student presentations of research assignments.

We anticipate that this course will be of great interest mainly to students majoring in Microbiology, Biology, and Pharmacy. In addition, the College of Arts & Sciences is developing a Biotechnology major for which MICRBIO 4800 will be a required class. Notably, Central Ohio is becoming a nationally recognized biotechnology center where academic, medical, and governmental institutions, as well as private companies (e.g. Amgen, Andelyn, Forge Biologics, and brewing industry) will be looking to hire well-trained personnel with biotechnology and/or industrial microbiology expertise. Last year, we had a very successful launch of MICRBIO 4145 (Introduction to Industrial Microbiology and Bioprocessing Laboratory), and we believe that MICRBIO 4800 and the accompanying submission for the MICRBIO 5891 (Progress in Biotechnology) seminar course will also be of great interest to students and contribute to preparing them for careers in these fields.

I have attached a syllabus and a list of the course learning objectives mapped to the Microbiology BS Program Learning Goals. We propose it to be a Group 1 elective course for our major.

I requested concurrence from CLSE since Biology offers BIOLOGY 3501.04, Integrative Skills in Biology: Biotechnology. I have attached the supportive concurrence form.

Thank you for your consideration.

Natividad Ruiz

Professor of Microbiology
Vice Chair for Teaching & Undergraduate Affairs

Microbiology 4800
Advances in Microbial Biotechnology

Course Syllabus

The Ohio State University | [Term YEAR] | 3 Units | Lecture
[Location] | TuTh [11:10-12:30 pm]

Description

Microbiology is the cornerstone of biotechnology. Significant innovations throughout medicine, agriculture, industry, and consumer products have been founded on basic discoveries on the genetic and metabolic diversity of microorganisms. These advancements are continuing source of new solutions to address modern challenges of human health, the environment, and sustainability. Here, we cover mechanistic advancements in microbiology and the modern technologies derived from their study.

This course is organized into four distinct modules. First, we focus on the origins of modern biotechnology, focusing on the revolutionary advances in of molecular biology, recombinant DNA, and genetic engineering. Second, we examine the application of proteins, enzymes, and advances in applied catalysis. Third, we explore the impact of microbial chemicals, including their role in producing bioproducts, chemotherapeutics, and shaping new innovations in chemical biology. Lastly, the most recent and significant developments in microbial biotechnology will be discussed in the final section through student research presentations on select topics.

Course Director

Kou-San Ju, PhD
Department of Microbiology, College of Arts & Sciences
Division of Medicinal Chemistry & Pharmacognosy, College of Pharmacy
290 Aronoff Laboratory
Email: ju.109 -at- osu.edu
Office hours: TBA

Prerequisites:

Completion of any one of the following courses with a grade of C- or higher:

Microbiology 4100; or Biochemistry 4511 or 5613; or Pharmacy 3200

Format

The course is 100% in-person and will take place in the classroom at scheduled times. The first part of the course is in the form of faculty led lectures and discussions. The latter part of the course will be student presentations based on research assignments. Research papers for in-class discussions will be announced at the beginning of each week. Students will also be assigned as discussion leaders and help present these papers to the class. All students are expected to study the readings in preparation for lecture and actively participate in discussions.

Readings and Materials

There is no required textbook. The class will be based soley on material presented in class, lectures, and literature discussions. However, the following is recommended for those who wish to have an general resource on microbial biotechnology.

Microbial Biotechnology: Fundamentals of Applied Microbiology, 2nd edition
By Alexander Glazer and Hiroshi Nikaido
WH Freeman and Company (New York)

Material for this course will derive from scientific literature. Primary sources (including papers) will be provided as PDF documents through Carmen. Abbreviated class notes will also be provided via Carmen. You are expected to access this site and review these materials in order to prepare for class.

Assignments and Grading

25%	Exam 1	In-class
25%	Exam 2	In-class
15%	Research Presentation	In-class
15%	Research Paper	Due [TBA]
20%	Exam 3	During finals week

The OSU standard grading scale based on % of total points will be used to determine grades:

A ≥ 93 %	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 < 60	

Exams

Exams will be based on lecture presentations and discussions. All examinations are as scheduled on the lecture schedule. Missed exams will be scored zero. Make-up exams will only be allowed for students with approved excused absences (severe illness; quarantine; death of family member; OSU athletic commitment; professional interview than cannot be rescheduled; religious observation; military service commitment). In all cases, documentation is required. Instructor must be notified in writing at least 14 days in advance for excused scheduled absences (OSU athletic commitment; professional interview than cannot be rescheduled; religious observation; military service commitment). Make-up exams (rescheduling) will not be permitted for reasons such as oversleeping; forgetting about the exam; vacation; being un-prepared to take the exam; having exams on the same day for another class.

To be eligible for a make-up exam, you must:

1. Email the instructor ***prior*** to the scheduled time of the exam.
2. Provide a valid excuse with written, original documentation for your absence prior to taking the make-up exam. You may be requested to e-mail a digital copy of your excuse, but valid, original documentation is still required.

If you qualify, the make-up is to be completed within 72-hours period following the time of the exam or the end of your excused leave. The make-up may be different from the original exam. Missed exams will be scored zero. Any documentation suspected to be fraudulent will be reported to the Committee on Academic Misconduct (see below).

Research Paper

A detailed description of this assignment will be provided in a subsequent handout no later than the sixth week of class. After selecting, from a pre-approved list, a single topic in microbial biotechnology, students are required to meet with the instructor (during office hours, no later than the eight of class) to discuss the chosen area and potential directions of investigation. Topics are first-come first-served. Student will individually research the most current and significant developments on the subject and examples of its commercialization. Each student will then write a 12-15-page research paper (double-spaced) on his or her assigned topic. The paper should be conceived and written individually, in their own words. Figures and references do not count towards the page limit.

Proper citations are expected to prevent plagiarism (academic misconduct) -- examples will be provided in the rubric. Students are encouraged to speak with the instructor if there are questions regarding the use of citations. Reports will be scanned through Turnitin Feedback Studio to detect academic plagiarism. The use of generative AI is also prohibited. Research papers suspected to violate these polices will be referred to the Committee on Academic Misconduct (see below).

Papers will be evaluated based on the analysis of the subject material (both depth and completeness of cited sources), thesis presentation, clarity of organization, and the quality of writing. Rubric, with expectations of content and formatting, will be provided no later than the sixth week of class. Information for both presentations and reports should derive from the primary literature (research articles and reviews). Research papers will be submitted both electronically (Word document, via Carmen) and in printed form to the instructor. All papers are due at the start of class on [date], the first day of student presentations. Late will be penalized 20% each day. Non-submissions will be scored zero points.

Research Presentation

Students will also share the findings of their research by giving an in-class presentation. Presentations will be evaluated based on organization, subject knowledge, visual appeal, preparedness, and presentation style. A digital copy your presentation is due two days prior to when you present (PowerPoint slides via Carmen). These will be converted into handouts for class.

Attendance and Participation

Students are expected to arrive on time fully prepared at every class section, play an active role in discussions on lecture topics, and contribute positively to the class through comments that advance the level and depth of dialog. This includes preparation, presentation, and discussion of assigned research papers in class. Because class slides posted in Carmen do not contain much text, you should attend every lecture and supplement them with your own notes.

Classroom Etiquette

Electronic devices should be silenced during lectures and exams. Computers and tablets can be used during lectures as long as they do not distract other students. Cellular phones should be stored away. Recording lectures (audio and/or video) is prohibited without the express consent of the instructor. The use of unauthorized electronic devices during exams is prohibited and will be reported to the Committee on Academic Misconduct (see below).

Course Communications and Email Policy

Students are responsible for all announcements made in class, posted on the course website (Carmen), or communicated by email. Questions about class material should not be submitted by e-mail and they will not be answered. Instead, please ask questions during class or come to office hours -- I will be happy to answer them! There will be time set aside at the beginning and end of every class for questions.

Credit Hours and Course Expectations

This is a 3-credit hour course. According to Ohio State Policy, students should around 3 hours per week spent on direct instruction (lectures) in addition to 6 hours on homework (reading and reviewing material, assignment preparation) to receive a grade of (C) average.

Learning Outcomes

Students that successfully complete this course will:

- Knowledgeably describe historical origins of microbial biotechnology
- Understand commonly employed methods in microbial biotechnology
- Knowledgeably describe the origin, methods, and impact of genetic engineering and applications of genomics in biotechnology
- Understand the antibody function, engineering and applications
- Understand the application of microbial enzymes, and principles of biocatalysis and protein engineering
- Understand the application of microbes in the production of commodity chemicals
- Understand the role of microbial natural products, their discovery, and applications
- Understand the major discoveries and impacts of microbes in chemical biology
- Critically evaluate research papers, accurately interpret raw and processed data sets
- Identify key findings of research papers and explain them clearly to an audience of peers

- Identify strong arguments supported by conclusive data; identify weak arguments supported by inconclusive data
- Argue the merits and/or weaknesses of published work from a knowledgeable perspective

LECTURE SCHEDULE

This is a tentative schedule and is subject to change. The time allotted for student presentations and the schedule of lecture topics will be adjusted depending on the number of students enrolled in the class.

Date	Day	Week	Topic	Module
1/13 1/15	Tu Thr	1	Origins of Modern Biotechnology	Genetic engineering
1/20 1/22	Tu Thr	2	Recombinant DNA Technologies	
1/27 1/29	Tu Thr	3	Genetic Engineering	
2/3 2/5	Tu Thr	4	Applied Genomics	
2/10 2/12	Tu Thr	5	**Exam 1** Vaccines and Antibodies	Proteins, Enzymes, and Catalysis
2/17 2/19	Tu Thr	6	Industrial Enzymes	
2/24 2/26	Tu Thr	7	Biocatalysis	
3/3	Tu	8	**Exam 2**	
3/5	Thr		Natural Products - Overview	Big Impacts from Small Molecules
3/10 3/12	Tu Thr	9	Commodity Chemicals	
3/16-3/20	Mn-Fr	10	**Spring Break - No Class**	
3/24 3/26	Tu Thr	11	Antibiotics and Herbicides	
3/31 4/2	Tu Thr	12	PROTACs Chemical Proteomics	
4/7 4/9	Tu Thr	13	Student Presentations	Special Topics
4/14 4/16	Tu Thr	14	Student Presentations	
4/21 4/23	Tu Thr	15	Student Presentations	
TBD	**TBD**		Final Exam	

ADDITIONAL INFORMATION

Instructor feedback and response time

I am providing the following list to give you an idea of my intended availability throughout the course. (Remember that you can call **614-688-HELP** at any time if you have a technical problem.)

- **Grading and feedback:** You can generally expect feedback within **7 days**.
- **Email:** I will generally respond to emails within 48 hours on days when class is in session at the University. Emails are reserved for general questions regarding logistical aspects of the class. Questions on course content and grading should be asked in-person before, during, or after class, or during office hours. All emails should have an accurate and descriptive subject line ("Question about M4800 exam schedule"), begin with a salutation ("e.g., "Prof. Ju"), and conform to standard English with proper punctuation and capitalization.

Discussion and Communication Guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style**: While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics.
- **Tone and civility**: We will maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm does not always come across online.
- **Citations**: When we have academic discussions, please cite your sources to back up what you say. For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.

Plagiarism and Academic Misconduct

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's Code of Student Conduct (http://studentaffairs.osu.edu/csc/), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and *this* syllabus may constitute "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/).

The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. *Ignorance of the University's Code of Student Conduct is never considered an "excuse" for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.* For more information see: http://studentlife.osu.edu/csc/.

If we suspect that a student has committed academic misconduct in this course, we are obligated by University Rules to report suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

Generative Artificial Intelligence (GenAI)

Revisions to the Code of Student Conduct went into effect on Jan, 1, 2024, after a review by the Council on Student Affairs. Among the revisions is an updated definition of academic misconduct that clarifies that the unauthorized use of generative artificial intelligence (AI) systems or similar technologies to complete academic activities is prohibited conduct. Commonly used GenAI tools include including ChatGPT, Sudowrite and others. **For this course, the use of GenAI tools on submitted and graded material is prohibited.** With this, we understand that GenAI tools have a future in education and the workplace. Because of this I want to suggest places where GenAI may be of use in the course, and the known limitations of using GenAI. GenAI can be useful to students to help summarize and clarify long and difficult texts or topics, especially topics that have been well studied and written about extensively. GenAI may also be useful to generate practice questions while studying for an exam. In both of these, please be aware or the many known limitations of GenAI: it can generate incomplete, inaccurate, or false information, GenAI is prone to hallucination where it connects things that have not real connection, citations generated by GenAI might be inaccurate or completely made-up, GenAI will plagiarize text without proper attribution as required by the Code of Student Conduct, answers are prone to biases. When using GenAI, it is important to recognize these known limitations and intervene with your own reading and interpretation.

ACCESSIBILITY ACCOMMODATIONS FOR 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; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Your Mental Health

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 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.

Statement on Title IX

All students and employees at Ohio State have the right to work and learn in an environment free from

harassment and discrimination based on sex or gender, and the university can arrange interim measures, provide support resources, and explain investigation options, including referral to confidential resources. **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 https://civilrights.osu.edu/title-ix or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu.

Weather or Other Short-Term Closing

Should in-person classes be cancelled, I will notify you as to which alternative methods of teaching will be offered to ensure continuity of instruction for this class. Communication will be email, CarmenCanvas, or other mode of communication.

Religious Accommodations

Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student's religious or spiritual belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam, altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement and the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the Office of Institutional Equity. For questions or to report discrimination or harassment based on religion, individuals should contact the Civil Rights Compliance Office. (Policy: Religious Holidays, Holy Days and Observances).

Copyright Protection

The materials used in connection with this course are 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.

Concurrence Form

The Ohio State University
College of Arts and Sciences Concurrence Form

The purpose of this form is to provide a simple system of obtaining departmental reactions to course requests. **An e-mail may be substituted for this form.**

An academic unit initiating a request should complete Section A of this form and send a copy of the form, course request, and syllabus to each of the academic units that might have related interests in the course. Units should be allowed two weeks to respond to requests for concurrence.

Academic units receiving this form should respond to Section B and return the form to the initiating unit. Overlap of course content and other problems should be resolved by the academic units before this form and all other accompanying documentation may be forwarded to the College of Arts and Sciences and the Office of Academic Affairs.

A. Proposal to review

Microbiology	4800	Advances in Microbial Biotechnology
Initiating Academic Unit	Course Number	Course Title

New	05/01/2025
Type of Proposal (New, Change, Withdrawal, or other)	Date request sent

CLSE	05/15/2025
Academic Unit Asked to Review	Date response needed

B. Response from the Academic Unit reviewing
Response: include a reaction to the proposal, including a statement of support or non-support (continued on the back of this form or a separate sheet, if necessary).

The CLSE does not current offer any comparable coursework, nor do we have immediate plans to do so in the future. As such, we happily offer our concurrence for this course.

Signatures

	Name	Position	Unit	Date
1.	Adam Andrews	Assistant Director	CLSE	5/1/2025
2.				
3.				

Revised 5/27/14

Required Prerequisites for the Major

Semester Course Number		Course Title	Semester hrs	Learning Goals 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	
		Total Hrs.	**41 - 43**					

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

Required Core for the Major

Semester Course Number		Course Title	Semester hrs	Learning Goals 1	2	3	4	5
MICRBIO 4100		General Microbiology	5	I	I	I	I	I
MICRBIO 4110		Pathogenesis and Immunobiology	3	A	A	A		
MICRBIO 4120		Microbial Physiology and Diversity	3	A	A	A		
MICRBIO 4130		Microbial Genetics	3	A	A	I		
MICRBIO 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

Semester Course Number		Course Title	Semester hrs	Learning Goals 1	2	3	4	5
MICRBIO 2000		Introduction to MicrOHbIOlogy Research	1.5				B	B
MICRBIO 2100		Wild Yeast: Isolation to Fermentation	3		B	B	B	B
MICRBIO 3704		HIV: From Microbiology to Macrohistory	4			I	I	I
MICRBIO 4145		Introduction to Industrial Microbiology and Bioprocessing Laboratory	3	I	I	I	A	A
MICRBIO 4150		Immunobiology Laboratory	3	I	I	A	A	A
MICRBIO 4193		Individual Studies	1-3					
MICRBIO 4194		Group Studies	1-3					
MICRBIO 4591S		DNA Finger Printing Workshops in Columbus PS	1				A	A
MICRBIO 4797		Study at a Foreign Institution	1-19					
MICRBIO 4798		Study Tour Domestic	1-19					
MICRBIO 4800		Advances in Biotechnology	3	A	A	A	A	I
MICRBIO 4998		Undergrad Research in Microbiology	1-5				A	A
MICRBIO 4998H		Honors Research	1-5				A	A
MICRBIO 4999		Undergrad Research in Microbiology-Thesis	1-5				A	A

MICRBIO 4999H		Honors Research-Thesis	1-5				A	A
MICRBIO 5122		Immunology	3			A		
MICRBIO 5129		Cellular and Molecular Biology of Pathogenic Eukaryotes	3		A	A		
MICRBIO 5130		Biology by Numbers	3	A			A	A
MICRBIO 5147		Eukaryotic Pathogens	3		A	A	A	
MICRBIO 5149		Introductory Virology	3		A	A		
MICRBIO 5155		Environmental Microbiology	3	A	A	A		
MICRBIO 5161		Bioinformatics and Molecular Microbiology	3	A	A	A		A
MICRBIO 5270		Antibiotics and Microbial Natural Products	3		A	A	A	A
MICRBIO 5536		Food Microbiology Lecture	3		A	I		A
MICRBIO 5546		Food Microbiology Laboratory	3		A	I	A	A
MICRBIO 6020*		Microbial Physiology and Biochemistry	3	A	A	A	A	
MICRBIO 6080*		Advanced Microbial Genetics	3		A		A	
MICRBIO 6155*		Microbial Ecology & Evolution	3			A	A	A
MICRBIO 7010*		Cellular and Molecular Immunology	3			A	A	
MICRBIO 7023*		Molecular Immunology: Lecture	3			A	A	
MICRBIO 7050*		Fermentation Biotechnology	3	A			A	A
MICRBIO 7060*		Advanced Topics in Molecular Microbiology	2		A		A	
MICRBIO 7536*		Advanced Food Microbiology	3		A	I	A	A
MICRBIO 7724*		Molecular Pathogenesis	3		A	A	A	
MICRBIO 7889*		Host-Pathogen Interactions: Research Seminar	1			A	A	
MICRBIO 7899*		Microbiology Colloquium	1					
MICRBIO 8149*		Microbiome Informatics	3	A*	A*	A*		
		Total Hrs.	**3-9**					

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
MICRBIO 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	
		Total Hrs.	**0-6**					
		Total Hrs. for the Major	**30**					

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

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

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 4800 Learning Goals (Mapped to Program Learning Goals)

1. Knowledgeably describe historical origins of microbial biotechnology **(PLG 2 & 3 Advanced; PLG 5 Intermediate)**

2. Understand commonly employed methods in microbial biotechnology **(PLG 1, 2 & 3 Advanced**)

3. Knowledgeably describe the origin, methods, and impact of genetic engineering and applications of genomics in biotechnology **(PLG 2, 3 Advanced; PLG 5 Intermediate)**

4. Understand the antibody function, engineering and applications **(PLG 1, 2 & 3 Advanced)**

5. Understand the application of microbial enzymes, and principles of biocatalysis and protein engineering **(PLG 1, 2 & 3 Advanced)**

6. Understand the application of microbes in the production of commodity chemicals **(PLG 1, 2 & 3 Advanced)**

7. Understand the role of microbial natural products, their discovery, and **applications (PLG 2 & 3 Advanced)**

8. Understand the major discoveries and impacts of microbes in chemical biology **(PLG 2 & 3 Advanced)**

9. Critically evaluate research papers, accurately interpret raw and processed data sets (**PLG 4 Advanced)**

10. Identify key findings of research papers and explain them clearly to an audience of peers **(PLG 4 Advanced)**

11. Identify strong arguments supported by conclusive data; identify weak arguments supported by inconclusive data **(PLG 4 Advanced)**

12. Argue the merits and/or weaknesses of published work from a knowledgeable perspective **(PLG 4 Advanced)**