



Microbiology Major Requirements (Winter 2019)

Program in Biology Student Services

📍: 1140 Undergrad. Science Bldg. (USB)

🌐: <http://www.lsa.umich.edu/biology>

✉: lsa-biology-advising@umich.edu

☎: 734-763-7984

Why study Biology?

Biology as a discipline is connected to many aspects of our everyday lives. From development and disease, to the food we eat, to the environment around us, studying biology brings us a deeper understanding of the world around us and allows us to benefit society through medicine, agriculture and environmental stewardship. Biology is a rapidly advancing area as we learn more every day about biological concepts ranging from our cells to our planet. Mastering biology opens up diverse careers in health science (medicine, dentistry, public health), biotechnology and pharmaceutical sciences, biological research, environmental policy, conservation and wildlife biology, ecological monitoring, and farming.

Who should major in Microbiology?

Microbiology includes the study of viruses, algae, bacteria, protozoa, and fungi. Immunobiology is also included within the science of microbiology. A major in microbiology prepares students for graduate study in microbiology, biochemistry, agricultural science, and food science, as well as for study in other areas of biology which emphasize cellular structures and their functions. A bachelor's degree in microbiology may qualify students for entry-level positions in medical, industrial, or governmental laboratories.

Students intending to go to medical school should compare degree requirements to the med school requirements found here: <https://lsa.umich.edu/advising/plan-your-path/pre-health>. It is strongly recommended that pre-med and other pre-health students meet with an LSA pre-health advisor.

Exclusions: Students who elect a major in Microbiology may not elect the following majors: Biology; Biology, Health, and Society; General Biology; Cellular and Molecular Biology (CMB); CMB:BME; Cellular & Molecular Biomedical Science (CMBS); Ecology and Evolutionary Biology; Ecology, Evolution, and Biodiversity; Molecular, Cellular, and Developmental Biology (MCDB); Plant Biology; Neuroscience; Biochemistry; or Biomolecular Science. They also may not elect an academic minor in Biology; Ecology and Evolutionary Biology; Plant Biology; Chemistry; or Biochemistry.

How do I declare?

Students interested in any major in the biological sciences are encouraged to meet with an advisor to discuss their academic plans as soon as possible! Students need not have completed all of the major prerequisites to declare, but should have completed the introductory biology sequence with a 2.0 or better and be in good academic standing. Make an advising appointment online through the Biology website: www.lsa.umich.edu/biology.

What courses should I take first?

The introductory biology sequence consists of: BIOLOGY 171, BIOLOGY 172 or 174, and BIOLOGY 173. Students should take 171 or 172/174 first and then follow with the second lecture course and 173. **(Note that the introductory biology sequence courses cannot be taken pass/fail.)**

- Students with an appropriate AP/IB score receive credit for BIOLOGY 195, which is the equivalent of BIOLOGY 171 & 172/174, but does NOT grant credit for 173.
- Transfer students who receive credit for BIOLOGY 191 should take BIOLOGY 192 and BIOLOGY 173 to complete the introductory biology sequence.

<p>BIOLOGY 171 ...focuses on ecology, biodiversity, and genetics and evolutionary processes. Students engage with biological hypotheses dealing with prominent current issues such as human evolutionary origins, emerging diseases, conservation biology, and global change.</p>	<p>BIOLOGY 172 or 174 (prerequisite: prior or concurrent credit for CHEM 130) ...focuses on how cells, organs, and organisms work. (174 covers the same material as 172 but is geared toward students who prefer a more problem-solving approach to understand biology, rather than a more traditional lecture-based course.)</p>
<p>BIOLOGY 173 (prerequisite = BIOLOGY 171, 172, 174, 191, or 195) ...is the accompanying lab component to the introductory sequence. The course provides an integrated introduction to experimental biology. Topics focus on biochemistry, molecular genetics, evolution, and ecology.</p>	

How do I get involved in research?

Independent research is a wonderful opportunity to take an active role in studying what you enjoy! Students participate in a lab, field, or modeling project in which they themselves have a say in the design, implementation, and interpretation of experiments. It is expected that the student will meet regularly with his or her mentor as well as gain exposure to the scientific literature of the field. Please visit the Undergraduate Research web pages for the specific requirements for independent research and advice on how to choose a research area and mentor: <http://www.lsa.umich.edu/biology/studentresearch>.

What are the requirements for Honors?

The Program in Biology administers an Honors Program to train students to conduct independent research in the biological sciences. Participating in the honors program allows students to develop their research skills, deepen their understanding of the field, and form productive relationships with faculty and other students. The achievement is noted on the diploma and official transcript.

In addition to completing all the requirements for the major, an honors degree requires:

- (1) an overall **and** major GPA of at least 3.4,
- (2) participation in at least two terms of independent research, and
- (3) the completion of a significant piece of independent research that is
 - (a) reported in an honors thesis and
 - (b) presented in a public forum.

Note that undergraduate research students typically register for an independent research course (as appropriate for their major) during each term of research. Formal course registration is encouraged, but not required. For more information, including the Honors Program application, consult the [Program in Biology Honors Information page](#).

How do I find out about internships, study abroad, or summer programs?

Information about study abroad, faculty-led intercultural internships, faculty-led courses and field experiences, and Spring/Summer language study is available through the Center for Global and Intercultural Study (www.lsa.umich.edu/cgis). The Opportunity Hub (<https://lsa.umich.edu/opportunityhub>) also provides information on fellowships, internships and other student opportunities.

Can I transfer courses from another institution?

The Program in Biology will review classes taken at other institutions to determine equivalency to University of Michigan Biology courses. (**Note that 300- and 400-level courses will not be evaluated for equivalent credit.**) If an external class is determined to be equivalent to a U-M course, it can be posted to your transcript as the U-M Biology course (with a "T") when you successfully complete the course *and* the transfer steps listed on the Biology website: www.lsa.umich.edu/biology/transfercredit. Approved equivalent courses may count toward major requirements, but transfer students are encouraged to meet with a major advisor to develop a major plan. **At least 20 of the 32 credits required for the Microbiology major must be taken in-residence.**

[Note: You are welcome to request review of a course *before you take it*. You will need to provide a detailed syllabus, and must obtain one from the instructor in advance.]

How can I get involved with student organizations?

There are several student organizations pertinent to biology-related majors. More detailed information is available on the Program in Biology website: www.lsa.umich.edu/biology.

- **Biology Student Alliance (BSA):** a student org. open to all Program in Biology & Neuro. majors as well as pre-med or other science-oriented students interested in biology research and outreach, and in collaborating and socializing with other biology-interested students. Email bsa-eboard@umich.edu for more information.
- **Botany Undergrads Doing Stuff (BUDS):** an extremely informal group of people dedicated to botany. Contact Faculty Advisors Robyn Burnham or Laura Olsen if interested.
- **Michigan Ecology and Evolutionary Biology Society (MEEBS):** The Michigan Ecology and Evolutionary Biology Society (MEEBS) is an informal club designed to create a community for EEB-interested students from any major. Contact faculty advisor [Catherine Badgley](#) or check out the MEEBS [Facebook page](#) for more information.
- **Neuroscience Students Association (NSA):** an organization for students with an interest in neuroscience. Email nsaleadteam@umich.edu for more information.

MICROBIOLOGY MAJOR REQUIREMENTS

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Core:

1. Microbiology: BIO 207
2. Genetics: BIO 305
3. Biochemistry: Choose from: MCDB 310, BIOLCHEM 415, or CHEM 351

Advanced Laboratories:

Choose one course from each category:

1. MCDB 429 or EEB 447 / EEB 401 (“Environmental Microbiology” Section ONLY)
2. Choose a 2nd course from: Independent research* [MCDB 400, EEB 400, INTMED 400, MICRBIOL 399, or EPID 399]; MCDB 306, EPID 504, EPID 545, BIOLCHEM 416, or [MCDB 429 or EEB 447 / EEB 401 (“Environmental Microbiology” Section ONLY), if not used above].

**Independent research must be taken for a minimum of 3 credits in one term. A maximum of 3 credits of independent research may count toward the major program.*

Group 1. Microbiology Advanced Electives (4 courses, minimum of 12 credits)

Choose 4 courses to reach at least 12 credits from the approved list (below).

EARTH 413 Geomicrobiology (3)	MCDB 415 Microbial Genetics (3)
EEB 416/MCDB 416 Introduction to Bioinformatics (4)	MCDB 436 Immunology (3) (<i>only one of MCDB 436 or MICROBIOL 440 will count toward the major</i>)
EEB 447 (3) (or EEB 401 [“Environmental Microbiology” Section ONLY]) <i>*if not used to fulfill an Advanced Lab*</i>	MCDB 489 Genes and Genomes (3)
EEB 446 Microbial Ecology (3)	MICRBIOL 405 Introduction to Infectious Disease (3)
EEB 468 Biology of Fungi (4)	MICRBIOL 415 Virology (3)
EPID 460 Introduction to Bacterial Pathogenesis (3)	MICRBIOL 430 Microbial Symbiosis
MCDB 408 Genomic Biology (3)	MICRBIOL 440 Immunology (3) (<i>only one of MICRBIOL 440 or MCDB 436 will count toward the major</i>)
MCDB 409 / MICRBIOL 409 / INTMED 409 Experimental and Investigational Bacteriology (4) - ULWR	MICRBIOL 460 / INTMED 460 Eukaryotic Microbiology (3)

Group 2. Additional Electives

Select additional courses from Group 1 above OR the list below to bring the total credits in the major to a minimum of 32 credits. Additional courses from the Advanced Laboratories list may be taken here if not used to fulfill the Advanced Lab requirement above.

BIOLOGY 225 Human & Animal Physiology (3)	EPID 507 Microbial Control: Sterilization, Disinfection and Manipulation (3)
BIOLOGY 272 Fundamentals of Cell Biology (4)	EPID 525 Clinical and Diagnostic Microbiology (3)
CHEM 230 Physical Chemistry (3)	EPID 543 Epidemiology of Viral Diseases (3)
EARTH/EEB 313 Geobiology (4)	MATH - Any MATH course with MATH 116 as a prereq., <i>if not used as a QA prereq. for the major</i>
EEB 390, EEB 391, or EEB 392 Evolution (3-5)	MCDB 401 Advanced Topics
EEB 401 Advanced Topics	MCDB 427 Molecular Biology (4)
EEB 476 Ecosystem Ecology (3)	MCDB 428 Cellular Biology (4)
EEB 482 or EEB 483 Freshwater Ecosystems: Limnology (4-5)	MCDB 411 or CHEM 452 Advanced Biochemistry (3-4)
EPID 505 Polymicrobial Communities in Human Health and Disease (3)	STATS - Any STATS course at the 400-level or above, <i>if not used as a QA prereq. for the major</i>

MICROBIOLOGY PREREQUISITES:

Introductory Biology Prerequisites:

- Choose Sequence A, B, or C:
- A: BIO 171, BIO 172 or 174, & BIO 173
- B: BIO 195 (AP/IB) & BIO 173
- C. BIO 191 (transfer credit), BIO 192, & BIO 173

Students may declare the major after completing the intro bio sequence with a C average

TERM: COURSE: CR: GRADE:

	TERM:	COURSE:	CR:	GRADE:
<input type="checkbox"/> Choose Sequence A, B, or C:				
A: BIO 171, BIO 172 or 174, & BIO 173				
B: BIO 195 (AP/IB) & BIO 173				
C. BIO 191 (transfer credit), BIO 192, & BIO 173				

Chemistry Prerequisites:

- CHEM 210 & 211

- CHEM 215 & 216

	TERM:	COURSE:	CR:	GRADE:
<input type="checkbox"/> CHEM 210 & 211				
<input type="checkbox"/> CHEM 215 & 216				

Quantitative Analysis Prerequisites:

- Choose two courses from the following:
 - Calculus I (MATH 115, 120 (AP), 175, 185, or 295)
 - Calculus II (MATH 116, 121 (AP), 156, 176, 186, or 296)
 - Statistics (STATS 180 [AP], 250 or 280); STATS 400-level or above (min. 3 credits)
 - Computer Programming (EECS 183, 203, or 280)
 - BIOLOGY 202; BIOPHYS/PHYSICS 290
 - Other course with a MATH 115 prereq. approved by a major advisor

[Note: Any course used to fulfill this requirement cannot also be used as a major elective; i.e., a course cannot "double-count."]

	TERM:	COURSE:	CR:	GRADE:
<input type="checkbox"/> Choose two courses from the following:				
• Calculus I (MATH 115, 120 (AP), 175, 185, or 295)				
• Calculus II (MATH 116, 121 (AP), 156, 176, 186, or 296)				
• Statistics (STATS 180 [AP], 250 or 280); STATS 400-level or above (min. 3 credits)				
• Computer Programming (EECS 183, 203, or 280)				
• BIOLOGY 202; BIOPHYS/PHYSICS 290				
• Other course with a MATH 115 prereq. approved by a major advisor				

Physics Prerequisites:

- PHYSICS I (lecture + lab): One of the following combinations: PHYSICS 125 & 127; 135 & 136; 140 & 141; or 160 & 161. [PHYSICS 139 (AP) will also fulfill this requirement.]

- PHYSICS II (lecture + lab): One of the following combinations: PHYSICS 126 & 128; 235 & 236; 240 & 241; or 260 & 261. [PHYSICS 239 (AP) will also fulfill this requirement.]

	TERM:	COURSE:	CR:	GRADE:
<input type="checkbox"/> PHYSICS I (lecture + lab): One of the following combinations: PHYSICS 125 & 127; 135 & 136; 140 & 141; or 160 & 161. [PHYSICS 139 (AP) will also fulfill this requirement.]				
<input type="checkbox"/> PHYSICS II (lecture + lab): One of the following combinations: PHYSICS 126 & 128; 235 & 236; 240 & 241; or 260 & 261. [PHYSICS 239 (AP) will also fulfill this requirement.]				

MICROBIOLOGY MAJOR:

Core Courses:

- Microbiology: BIO 207

- Genetics: BIO 305

- Biochemistry: Choose from: MCDB 310, BIOLCHEM 415, or CHEM 351

	TERM:	COURSE:	CR:	GRADE:
<input type="checkbox"/> Microbiology: BIO 207				
<input type="checkbox"/> Genetics: BIO 305				
<input type="checkbox"/> Biochemistry: Choose from: MCDB 310, BIOLCHEM 415, or CHEM 351				

Advanced Labs:

- Lab 1: MCDB 429 or EEB 447 / EEB 401: "Environmental Microbiology" Section ONLY

- Lab 2: Choose from: 3 cr. of Independent research [MCDB 400, EEB 400, INTMED 400, MICRBIOL 399, or EPID 399]; MCDB 306, EPID 504, EPID 545, BIOLCHEM 416, or [MCDB 429 or EEB 447 / EEB 401 ("Environmental Microbiology" Section ONLY), if not used above]

	TERM:	COURSE:	CR:	GRADE:
<input type="checkbox"/> Lab 1: MCDB 429 or EEB 447 / EEB 401: "Environmental Microbiology" Section ONLY				
<input type="checkbox"/> Lab 2: Choose from: 3 cr. of Independent research [MCDB 400, EEB 400, INTMED 400, MICRBIOL 399, or EPID 399]; MCDB 306, EPID 504, EPID 545, BIOLCHEM 416, or [MCDB 429 or EEB 447 / EEB 401 ("Environmental Microbiology" Section ONLY), if not used above]				

Major Elective Requirements:

- Group 1: Advanced Electives – Choose at least four courses to reach at least 12 credits from the approved list

- Group 2: Additional Electives -- Choose course(s) from the approved list, if needed to reach 32 credits in the major

	TERM:	COURSE:	CR:	GRADE:
<input type="checkbox"/> Group 1: Advanced Electives – Choose at least four courses to reach at least 12 credits from the approved list				
<input type="checkbox"/> Group 2: Additional Electives -- Choose course(s) from the approved list, if needed to reach 32 credits in the major				

Total Credits and GPA Requirement for Microbiology:

- Minimum 32 cr. in Major

- Minimum 2.0 GPA in Major: GPA is calculated from all mandatory prerequisites, all courses used for major requirements (including cognates), and all courses in BIOLOGY, EEB, MCDB, EPID, INTMED, and MICRBIOL.

<input type="checkbox"/> Minimum 32 cr. in Major
<input type="checkbox"/> Minimum 2.0 GPA in Major: GPA is calculated from all mandatory prerequisites, all courses used for major requirements (including cognates), and all courses in BIOLOGY, EEB, MCDB, EPID, INTMED, and MICRBIOL.

CONSTRAINTS:

- Prerequisites, introductory science courses, and non-specific (departmental) transfer courses are EXCLUDED from the 32 cr. required for the major.
- A maximum of three credits of independent research (EEB 400, MCDB 400, INTMED 400, EPID 399, or MICRBIOL 399) may count toward the major.
- Only one of MCDB 436 and MICRBIOL 440 will count toward the major.

<ul style="list-style-type: none"> • Prerequisites, introductory science courses, and non-specific (departmental) transfer courses are EXCLUDED from the 32 cr. required for the major. • <u>A maximum of three credits of independent research</u> (EEB 400, MCDB 400, INTMED 400, EPID 399, or MICRBIOL 399) may count toward the major. • Only one of MCDB 436 and MICRBIOL 440 will count toward the major.
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