Microbiology Major Requirements

Program in Biology Student Services
: 2200 Biological Sciences Bldg. (BSB) : http://www.lsa.umich.edu/biology
: lsa-biology-advising@umich.edu : 734-763-7984 (front desk)

Who should major in Microbiology?
Microbiology is a major shared by the following departments: Molecular, Cellular, and Developmental Biology; Ecology and Evolutionary Biology, Microbiology and Immunology, Internal Medicine, and Epidemiology. 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. 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; Biotechnology & Bioenvironmental Sciences (BBS); Biology, Health, and Society (BHS); Cellular & Molecular Biomedical Science (CMBS); 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; 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 must have completed the introductory biology sequence, one term in residence with a major/minor GPA of 2.0 or better, and be in good academic standing in order to declare. Make an advising appointment online through the Program in 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. Students with an appropriate AP/IB score receive credit for BIOLOGY 196, which is the equivalent of BIOLOGY 173.
- Transfer students who receive credit for BIOLOGY 191 should take BIOLOGY 192 (offered in Fall terms only) and BIOLOGY 173 to complete the introductory biology sequence.

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.	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.)
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.	

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.

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?

- **Microbiology Club:** Our organization strives to introduce students to different topics within microbiology and explore the many opportunities within the field. We help connect students with professionals in the field of microbiology by hosting speakers. We aim to promote science outreach to the community, by organizing field trips to different universities and grade schools to spread the passion for science and biology. Email: olacomm@umich.edu for more information
- **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.
- **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.

MICROBIOLOGY MAJOR REQUIREMENTS

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
2. Choose a 2nd course from: Independent research* [MCDB 400, EEB 400, MICRBIOL 399, MICRBIOL 400 or EPID 399]; MCDB 306, EPID 504, EPID 545, BIOPHYS 450, or [MCDB 429 or EEB 447, 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)
EEB 315 Ecology & Evolution of Infectious Diseases (3)
EEB/CMPLXSYS 325 Memes, Measles, and Misinformation (3)
EEB 416/MCDB 416 Introduction to Bioinformatics (4)
EEB 447 (3) (or EEB 401 ["Environmental Microbiology" Section ONLY]) **if not used to fulfill an Advanced Lab**
EEB 446 Microbial Ecology (3)
EEB 468 Biology of Fungi (4)
EPID 460 Introduction to Bacterial Pathogenesis (3)
MCDB 408 Genomic Biology (3)
IHS 340 Germs Wars, Asthma & the Rise of the Food Allergy Epidemic (3) **ULWR**
MCDB 415 Microbial Genetics (3)
MCDB 436 Immunology (3) *(only <u>one</u> of MCDB 436 or MICROBIOL 440 will count toward the major)*
MCDB 444 Microbial Biotechnology & Synthetic Biology (3)
MCDB 464 Cellular Diversity in the Immune and Nervous System (3)
MCDB 472 Building a Synthetic Cell (3)
MCDB 489 Genes and Genomes (3)
MICRBIOL 405 Introduction to Infectious Disease (3)
MICRBIOL 415 Virology (3)
MICRBIOL 430 Microbial Symbiosis
MICRBIOL 440 Immunology (3) *(only <u>one</u> of MICRBIOL 440 or MCDB 436 will count toward the major)*
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 31 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)
BIOLOGY 272 Fundamentals of Cell Biology (4)
CHEM 230 Physical Chemistry (3)
EARTH/EEB 313 Geobiology (4)
EEB 390, EEB 391, or EEB 392 Evolution (3-5)
EEB 401 Advanced Topics
EEB 476 Ecosystem Ecology (3)
EEB 482 or EEB 483 Freshwater Ecosystems: Limnology (4-5)
EPID 505 Polymicrobial Communities in Human Health and Disease (3)
EPID 507 Microbial Control: Sterilization, Disinfection and Manipulation (3)
EPID 525 Clinical and Diagnostic Microbiology (3)
EPID 543 Epidemiology of Viral Diseases (3)
MATH - Any MATH course with MATH 116 as a prereq., *if not used as a QA prereq. for the major*
MCDB 401 Advanced Topics
MCDB 427 Molecular Biology (4)
MCDB 428 Cellular Biology (4)
MCDB 411 or CHEM 452 Advanced Biochemistry (3-4)
MICRBIOL 450 Global Impact of Microbes: Fieldwork (3)
STATS - Any STATS course at the 400-level or above, *if not used as a QA prereq. for the major*

MICROBIOLOGY MAJOR REQUIREMENTS

MICROBIOLOGY PREREQUISITES & CO-REQUISITES:

Introductory Biology Prerequisites:	**TERM:**	**COURSE:**	**CR:**	**GRADE:**
□ Choose Sequence A, B, or C:				
A: BIO 171, BIO 172 or 174, & BIO 173				
B: BIO 195 (AP/IB) & BIO 173 or BIO 196 (AP)				
C. BIO 191 (transfer credit), BIO 192, & BIO 173				
Students may declare the major after completing the intro bio sequence with a C average				

Chemistry Prerequisites:

□ CHEM 210 & 211				
□ CHEM 215 & 216				

Quantitative Analysis Prequisites:

Choose four courses from the following options:				
□ MATH 115, 120 (AP), 185, 275, or 295				
□ MATH 116, 121 (AP), 156, 186, 276, or 296				
□ PHYSICS I: PHYSICS 125, 135, 139 (AP), 140, 150, or 160				
□ PHYSICS II: PHYSICS 126, 235, 239 (AP), 240, 250 or 260				
□ Computer Programming: EECS 180 (AP), 183, 203, and/or 280				
□ Statistics: STATS 180 (AP) or 250; DATASCI 101; STATS 280; STATS 400-level or above (min. 3 credits)				
□ BIOLOGY 202; BIOLOGY/BIOPHYS/COMPFOR 131; BIOLOGY/BIOPHYS/COMPFOR 231				
□ BIOPHYS/PHYSICS 290				
[Note: Any course used to fulfill this requirement cannot also be used as a major elective; i.e., a course cannot "double-count."]				

MICROBIOLOGY MAJOR:

Core Courses:

□ Microbiology: BIO 207				
□ Genetics: BIO 305				
□ Biochemistry: Choose from: MCDB 310, BIOLCHEM 415, or CHEM 351				

Advanced Labs:

□ Lab 1: MCDB 429 or EEB 447				
□ Lab 2: Choose from: 3 cr. of Independent research [MCDB 400, EEB 400, MICRBIOL 399, MICRBIOL 400, or EPID 399]; MCDB 306, EPID 504, EPID 545, BIOPHYS 450, or [MCDB 429 or EEB 447, 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 31 credits in the major				

Total Credits and GPA Requirement for Microbiology:

□ Minimum 31 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, and MICRBIOL.

CONSTRAINTS:

- Prerequisites, introductory science courses, and non-specific (departmental) transfer courses are EXCLUDED from the 31 cr. required for the major.
- A maximum of three credits of independent research (EEB 400, MCDB 400, EPID 399, or MICRBIOL 399 or 400) may count toward the major.
- Only one of MCDB 436 and MICRBIOL 440 will count toward the major.