Microbiology Major Requirements

Why study Biology?
"Pursuing a career in biology can be immensely rewarding and exciting. Studying biology teaches us to ask questions, make observations, evaluate evidence, and solve problems. Biologists learn how living things work, how they interact with one another, and how they evolve. They may study cells under a microscope, insects in a rainforest, viruses that affect human beings, plants in a greenhouse, or lions in the African grasslands. Their work increases our understanding about the natural world in which we live and helps us address issues of personal well-being and worldwide concern, such as environmental depletion, threats to human health, and maintaining viable and abundant food supplies."

[from: http://www.aibs.org/careers]

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 function. A bachelor's degree in microbiology may qualify students for entry-level positions in medical, industrial, or governmental laboratories.

Students intending to go to graduate school should have at least two terms of research experience. These can appear as graded courses, UROP participation, or be independent of the graded curriculum. Most graduate school-bound students will have 1-2 graded research courses (2-4 credits/each) on record. Students intending to go to medical school should compare degree requirements to the med school requirements found here: http://www.lsa.umich.edu/advising/academicplanning/prehealth. 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; General Biology; Cell and Molecular Biology; CMB:BME; Ecology and Evolutionary Biology; 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 biology introductory 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 biological science introductory sequence consists of: BIOLOGY 171, BIOLOGY 172 or 174, and BIOLOGY 173. (Students with an appropriate AP score receive credit for BIOLOGY 195, which is the equivalent of BIO 171 & 172/174, but does NOT grant credit for 173.) Students should take 171 or 172/174 first and then follow with the second lecture course and 173.

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<th>BIOLOGY 171</th>
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<td>...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.</td>
<td>(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.)</td>
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<td>(prerequisite = BIOLOGY 171, 172, 174, 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.</td>
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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 Microbiology. In addition to completing all the requirements for the major, an honors degree requires a major GPA of at least 3.4, and the completion of a significant piece of independent research that is reported in an honors thesis and presented in a public forum. Refer to http://www.lsa.umich.edu/biology/academics/honorsprogram for detailed requirements.

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. Please refer to www.lsa.umich.edu/cgis for detailed information about options.

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, EEB, and MCDB courses. 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, EEB, or MCDB 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.

[Note: You are welcome to request review of a course before you take it. You will need to provide a detailed syllabus, so you 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):** intended for Biology, CMB, Microbiology, Plant Biology, Neuroscience, and Biochemistry majors, as well as pre-med or science oriented students interested in learning more about MCDB-related topics. Email BSA-Board@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.
- **Neuroscience Students Association (NSA):** an organization for students with an interest in neuroscience. Email nsaleadteam@umich.edu for more information.
- **Society of Biology Students (SBS):** an informal group for students interested in Biology in general. Website: http://www.sitemaker.umich.edu/sbs/home or contact the Faculty Advisor, Robyn Burnham at rburnam@umich.edu for information.
- **Student Society for Stem Cell Research (SSSCR), University of Michigan – Ann Arbor Chapter:** an international network dedicated to the advancement of scientific research for cures. Website: www.umich.edu/~umssscr/index.html. Email ssscrexec@umich.edu.
UPPER-LEVEL ELECTIVE REQUIREMENT FOR MICROBIOLOGY

- 19 credits of Upper-Level Electives are required.
- A minimum of 11 credits must be selected from Groups 1 and 2, and must include:
  - at least two courses from Group 1, and
  - at least one course from Group 2.
- The remaining 8 credits may be selected from Groups 1, 2, or 3.

GROUPS 1 AND 2: SPECIFIED ELECTIVES (Select a minimum of 11 credits.)

1: Microbial Genetics, Physiology, Cellular Biology, Diversity, and Ecology—Select at least two courses.
EEB 315 Ecology and Evolution of Infectious Diseases (3)
EEB 401 Advanced Topics (only sections applicable to Microbiology)
EEB 446 Microbial Ecology (3)
EEB 468 Biology of Fungi (4)
EEB 470 Microbial Diversity (3)
MCDB 401 Advanced Topics (only sections applicable to Microbiology)
MCDB 408 Genomic Biology (3)
MCDB 415 Microbial Genetics (3)
MCDB 444 Bacterial Cell Biology (3)
MCDB 489 Genes and Genomes (3)
MICRBIOL 320 / INTMED 320 Bacterial Growth and Function (4) *(also fulfills ULWR if taken Fall 2015 or later)*
MICRBIOL 430 Microbial Symbiosis
MICRBIOL 460 / INTMED 460 Eukaryotic Microbiology (3)

2: Microbial Pathogenesis, General Virology, and Immunology—Select at least one course.
EPID 460 Introduction to Bacterial Pathogenesis (3)
MICRBIOL 405 Introduction to Infectious Disease (3)
MICRBIOL 415 Virology (3)
MCDB 436 or MICRBIOL 440 Immunology (3) *(only one of these will count toward the major)*

GROUP 3: ADDITIONAL ELECTIVES

Advanced Biochemistry, Molecular Biology, Cellular Biology
MCDB 411 or CHEM 452 Advanced Biochemistry (3-4)
MCDB 427 Molecular Biology (4)
MCDB 428 Cellular Biology (4)
Advanced Mathematics
Any MATH course with a MATH 116 prerequisite

Earth
EARTH 413 Geomicrobiology

Ecology
EEB 390 Evolution (3)
EEB 416/MCDB 416 Introduction to Bioinformatics (4)
EEB 476 Ecosystem Ecology (3)
EEB 483 Freshwater Ecology (4)

Epidemiology
EPID 504 Polymicrobial Communities Laboratory (3)
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)

Microbiology And Immunobiology
Any MICRBIOL course at the 500-level or higher *(with approval of an advisor)*

Statistics
Any STATS course at the 400-level or above

Research
- Students are encouraged to participate in independent research with an appropriate faculty member. To use this option, **two terms** of independent research are required; however, **ONLY the 2nd term will count toward the major.**
- Students may select from: EPID 299 and EPID 399; MICRBIOL 299 and 399; two terms of INTMED 499; EEB 300 and 400; or MCDB 300 and 400. See your advisor to discuss the best course sequence option.
- Each course must be taken for a **minimum of 2 credits** each time.
- **Only 3 credits total of independent research may count toward the major program.**

Other Courses with permission of a microbiology advisor.
# MICROBIOLOGY MAJOR REQUIREMENTS

## MICROBIOLOGY PREREQUISITES:

### Introductory Biology Sequence:

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- Choose Sequence A or B:
  - A: BIO 171, 172 or 174, & 173
  - B: BIO 195 (AP) & 173

### Chemistry Sequence:

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- CHEM 210 & 211
- CHEM 215 & 216

### Quantitative Analysis Sequence:

- CALCULUS I: MATH 115, 120 (AP), or 185
- One course from: MATH 116, 121 (AP), 156, or 186; STATS 250; STATS 400-level or above (min. 3 credits); BIOLOGY 202; BIOPHYS/PHYSICS 290; EECS 203 or 280; EARTH 468; or other course with a MATH 115 prereq. chosen in consultation with 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."]

### Physics Sequence:

- PHYSICS I (lecture + lab): PHYSICS 125, 135, 140 or 160 *and* the accompanying lab - PHYSICS 127, 136, 141, or 161. [PHYSICS 139 (AP) will satisfy this requirement.]
- PHYSICS II (lecture + lab): PHYSICS 126, 235, 240 or 260 *and* the accompanying lab - PHYSICS 128, 236, 241, or 261. [PHYSICS 239 (AP) will satisfy this requirement.]

## MICROBIOLOGY MAJOR:

### Core Courses

- Microbiology: BIO 207
- Genetics: BIO 305
- Biochemistry: Choose from: MCDB 310, BIOLCHEM 415, or CHEM 351
- Advanced Laboratory: MCDB 306 or 429, or BIOLCHEM 416

### Upper-Level Elective Requirement

(A minimum of 19 credits is required.)

### Specified Electives (A minimum of 11 credits is required.)

- Group 1 – choose at least two courses from Group 1 (Microbial Genetics, Physiology, Cellular Biology, Diversity, and Ecology) – see attached list.
- Group 2 – choose at least one course from Group 2 (Microbial Pathogenesis, General Virology, and Immunology) – see attached list.

### Additional Electives

- Group 3 – choose from Groups 1, 2, or 3 – see attached list.

## Total Units and GPA Requirement for Microbiology

- Minimum 32 cr. in Major
  - Note: A maximum of 3 credits of independent research may count toward the 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 MCDB, EEB, BIOLOGY, EPID, INTMED, and MICRBIOL.