Microbiology Major Requirements (effective Winter 2017)

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 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: 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; Ecology, Evolution, and Biodiversity; 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. (Note that the introductory biology sequence courses cannot be taken pass/fail.)

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<tr>
<th>BIOLOGY 171</th>
<th>BIOLOGY 172 or 174</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</td>
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<td>(prerequisite = BIOLOGY 171, 172, 174, or 195)</td>
<td>focuses on how cells, organs, and organisms work.</td>
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<td>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>
<td>(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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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. a major GPA of at least 3.4, and
2. the completion of a significant piece of independent research that is
3. reported in an honors thesis and
4. presented in a public forum.

For more information, consult the Program in Biology Honors Program information page or a Program in Biology advisor.

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 sscrexec@umich.edu.
UPPER-LEVEL ELECTIVE REQUIREMENT FOR MICROBIOLOGY

- 19 credits of Upper-Level Electives are required.
- A minimum of 4 courses, 12 credits, must be selected from Group 1.
- Additional courses to bring Upper-Level Electives to 19 credits may be chosen from Groups 1 or 2.

GROUP 1: SPECIFIED ELECTIVES: Select a minimum of four courses, 12 credits.

- EEB 315 Ecology and Evolution of Infectious Diseases (3)
- EEB 416/MCDB 416 Introduction to Bioinformatics (4)
- EEB 446 Microbial Ecology (3)
- EEB 468 Biology of Fungi (4)
- EEB 470 Microbial Diversity (3)
- EPID 460 Introduction to Bacterial Pathogenesis (3)
- MCDB 408 Genomic Biology (3)
- MCDB 415 Microbial Genetics (3)
- MCDB 436 or MICRBIOL 440 Immunology (3) *(only one of these will count toward the major)*
- MICDB 444 Bacterial Cell Biology (3)
- MCDB 489 Genes and Genomes (3)
- MICRBIOL 320/INTMED 320 Bacterial Growth & Function (4)
- MICRBIOL 415 Virology (3)
- MICRBIOL 430 Microbial Symbiosis
- MICRBIOL 460 / INTMED 460 Eukaryotic Microbiology (3)

GROUP 2: ADDITIONAL ELECTIVES: Select additional courses to bring Upper-Level Electives to 19 credits.

NOTE: Additional Group 1 Electives may be used to meet this requirement.

Earth
- EARTH 313/EEB 313 Geobiology (4)
- EARTH 413 Geomicrobiology (3)

Ecology
- EEB 390, EEB 391, or EEB 392 Evolution (3-5)
- EEB 401 Advanced Topics (3)
- EEB 476 Ecosystem Ecology (3)
- EEB 482 or EEB 483 Freshwater Ecosystems: Limnology (4-5)

Epidemiology
- EPID 504 Polymicrobial Communities Laboratory (3) *Only if not used as a Core Course*
- 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)

Math
- Any MATH course with MATH 116 as a prerequisite

MCDB
- MCDB 401 Advanced Topics (3)
- MCDB 411 or CHEM 452 Advanced Biochemistry (3-4)
- MCDB 427 Molecular Biology (4)
- MCDB 428 Cellular Biology (4)

Science Elective
- BIOLOGY 225 (3) or CHEM 230 (3) *(only one of these will count toward the major)*

Statistics
- Any STATS course at the 400-level or above

Research
- Students may select from: EPID 399; MICRBIOL 399; two terms of INTMED 499; EEB 400; or MCDB 400.
- 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.
MICROBIOLOGY MAJOR REQUIREMENTS

MICROBIOLOGY PREREQUISITES:

Introductory Biology Sequence:

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

Chemistry Sequence:

□ CHEM 210 & 211
□ CHEM 215 & 216

Quantitative Analysis Sequence:

□ CALCULUS I: MATH 115, 120 (AP), 175, 185, or 295
□ One course from: MATH 116, 121 (AP), 156, 176, 186, or 296; STATS 180 (AP), 250 or 280; 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. 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.”]

Physics Sequence:

□ 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.]

MICROBIOLOGY MAJOR:

Core Courses:

□ Microbiology: BIO 207
□ Genetics: BIO 305
□ Biochemistry: Choose from: MCDB 310, BIOLCHEM 415, or CHEM 351
□ Advanced Laboratory: Choose from: MCDB 306, MCDB 429, or EPID 504

Upper-Level Elective Requirement  (A minimum of 19 credits is required.):

□ Group 1: Specified Electives – choose four courses (min. 12 credits) from the approved list (attached).
□ Group 2: Additional Electives – choose courses from the approved list (attached) to bring Upper-Level Electives to 19 credits.

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, EPID 399, INTMED 499, or MICRBIOL 399) may count toward the major.
• Only one of MCDB 436 and MICRBIOL 440 will count toward the major.
• Only one of BIOLOGY 225 and CHEM 230 will count toward 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.