



Molecular, Cellular, & Developmental Biology (MCDB) Major Requirements

Program in Biology Student Services

📍: 1140 Undergrad. Science Bldg. (USB)

🌐: <http://www.lsa.umich.edu/biology>

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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 Molecular, Cellular, and Developmental Biology?

The curriculum in Molecular, Cellular, and Developmental Biology offers students an integrated program of study and training in the biological and physical sciences. It is a pathway to graduate study in areas of biology and medicine that emphasize a quantitative and analytical approach to the life sciences. 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.

What's the difference between the MCDB and Microbiology majors?

MCDB and Microbiology are related majors, but MCDB focuses on cellular and molecular structures and their functions, whereas Microbiology includes the study of viruses, algae, bacteria, protozoa, fungi, and immunobiology.

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

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. 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 CMB 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.

CURRENT COURSES ACCEPTABLE as ADVANCED MCDB COURSES and ELECTIVES

NOTE: No course may be used to satisfy two requirements.

I. ADVANCED MCDB LABORATORY COURSES (2 courses required)

MCDB 306 Genetics Laboratory
MCDB 400 Advanced Independent Research (*Must be taken for 3 credits in one term; 3 credit max. applies; see CONSTRAINTS.*)
MCDB 423 Research in Cellular and Molecular Neurobiology Laboratory
MCDB 424 Behavioral Neurobiology Laboratory
MCDB 429 Laboratory in Cellular and Molecular Biology

II. ADVANCED MCDB COURSES (2 courses required)

MCDB 401 Advanced Topics	MCDB 436 Introductory Immunology
MCDB 402 Molecular Biology of Pain and Sensation	MCDB 440 Cell Cycle Control and Cancer
MCDB 403 Molecular and Cell Biology of the Synapse	MCDB 441 Cell Biology and Disease
MCDB 404 Genetics, Development, and Evolution	MCDB 444 Bacterial Cell Biology
MCDB 405 Molecular Basis of Development	MCDB 447 Lysosomes and Diseases
MCDB 406 Modern Genetic Advances	MCDB 448 Telomerase Function in Stem Cells and Cancers
MCDB 408 Genomic Biology	MCDB 450 Genetics and Molecular Biology of Complex Behavior
MCDB 409 Investigational and Experimental Bacteriology	MCDB 451 Molecular Neurobiology of Health and Disease
MCDB 410 MCDB Capstone	MCDB 452 The Visual System
MCDB 411 Protein Structure and Function	MCDB 453 Ion Channels and their Channelopathies
MCDB 415 Microbial Genetics (formerly MCDB 513)	MCDB 454 Cell Biology of the Cytoskeleton
MCDB 416 Introduction to Bioinformatics	MCDB 455 Cell Biology of Neurodegeneration
MCDB 417 Chromosome Structure & Function	MCDB 456 Genes, Circuits, and Behavior
MCDB 418 Endocrinology	MCDB 457 Neurobiology of Sexual and Aggressive Behavior
MCDB 420 Structural Biology: The Architecture of Life	MCDB 458 Neuroepigenetics
MCDB 421 Topics in Cellular and Molecular Neurobiology	MCDB 459 Brain States and Behavior
MCDB 422 Brain Development, Plasticity, and Circuits	MCDB 462 Epigenetics
MCDB 425 Biotechnology: From Concepts to Technologies	MCDB 463 Sensory Circuits and Diseases
MCDB 426 Molecular Endocrinology	MCDB 464 Cellular Diversity in the Immune and Nervous Systems
MCDB 427 Molecular Biology (<i>if not used for core</i>)	MCDB 465 Computation & Sensory Processing in the Neocortex
MCDB 428 Cell Biology (<i>if not used for core</i>)	MCDB 469 Signal Transduction
MCDB 430 Plant Molecular Biology	MCDB 471 Advanced Methods in Biochemistry
MCDB 433 Plant Biochemistry	MCDB 472 Building a Synthetic Cell
MCDB 434 Protein Misfolding Diseases	MCDB 489 Microbial Genes and Genomes
MCDB 435 Intracellular Trafficking	MCDB 589 Microbial Evolution

NOTE: Additional courses from Group I may be used to meet this requirement.

III. BIOLOGY AND CHEMISTRY ELECTIVES: Choose course(s) from the following list to reach 31 credits in major:

1. Additional courses from Groups I or II (above)
2. Any specific BIOLOGY, EEB, or MCDB course at the 200-, 300-, or 400-level not used to fulfill another requirement (**except** BIOLOGY 200, 201, 215, 241, 299; or EEB 300, 301, 302; or MCDB 300, 301, 302, 320, 360, 412, 460, or 461)
3. CHEM 230 or CHEM 260

MCDB MAJOR REQUIREMENTS

****Effective Fall 2020****

MOLECULAR, CELLULAR, and DEVELOPMENTAL BIOLOGY PREREQUISITES:

Introductory Biology Sequence:

	TERM:	COURSE:	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			
<i>*Students may declare the major after completing the intro bio sequence with a C average*</i>			

Chemistry Sequence:

<input type="checkbox"/> CHEM 210 & 211			
<input type="checkbox"/> CHEM 215 & 216			

Quantitative Analysis Sequence:

Choose four courses from the following options: <ul style="list-style-type: none"> <input type="checkbox"/> Calculus 1: MATH 115, 120 (AP), 175, 185, or 295 <input type="checkbox"/> Calculus 2: MATH 116, 121 (AP), 156, 176, 186, or 296 <input type="checkbox"/> PHYSICS I: PHYSICS 125, 135, 139 (AP), 140, or 160 <input type="checkbox"/> PHYSICS II: PHYSICS 126, 235, 239 (AP), 240 or 260 <input type="checkbox"/> Computer Programming: EECS 183, 203, and/or 280 <input type="checkbox"/> Statistics: [STATS 180 (AP), 206, 250, or 280]; and/or STATS 400-level or above (min. 3 credits) <input type="checkbox"/> BIOLOGY 202 <input type="checkbox"/> 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."]			
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MOLECULAR, CELLULAR, and DEVELOPMENTAL BIOLOGY MAJOR:

Core Courses

<input type="checkbox"/> Choose one from: Fundamentals of Cell Biology (BIO 272) or Developmental Biology (BIO 205)			
<input type="checkbox"/> Genetics: BIO 305			
<input type="checkbox"/> Biochemistry: Choose one from: MCDB 310, BIOLCHEM 415, or CHEM 351			
<input type="checkbox"/> Cellular or Molecular Biology: Choose one from MCDB 427 or MCDB 428			

I. Advanced MCDB Laboratory Courses

<input type="checkbox"/> Choose two courses from attached list.			
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II. Advanced MCDB Courses

<input type="checkbox"/> Choose two courses from attached list.			
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III. Biology & Chemistry Electives

<input type="checkbox"/> Choose course(s) from attached list to reach 31 credits in major.			
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CONSTRAINTS:

<ul style="list-style-type: none"> • Prerequisites, introductory science courses, and non-specific (departmental) transfer courses are EXCLUDED from the 31 cr. required for the major. • <u>A maximum of three credits of independent research</u> (MCDB 400, et al.) may count toward the major. Three credits must be completed in one term to meet the Advanced MCDB Laboratory requirement or the Advanced MCDB Course requirement. 			
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Total Units and GPA Requirement for Molecular, Cellular, and Developmental Biology

<input type="checkbox"/> Minimum 31 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, and MCDB.			