



## Cellular & Molecular Biomedical Science (CMBS) Major Requirements

Program in Biology Student Services

📍: 1140 Undergrad. Science Bldg. (USB)

🌐: <http://www.lsa.umich.edu/biology>

✉: [lsa-biology-advising@umich.edu](mailto:lsa-biology-advising@umich.edu)

☎: 734-763-7984

### Who should major in the 5-year B.S./M.S.E. Program in Cellular & Molecular Biomedical Science?

The curriculum in Cellular and Molecular 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. The CMBS program is designed for students enrolled in the College of Literature, Science and the Arts. The program is jointly administered by the Molecular, Cellular, and Developmental Biology (MCDB) Department (College of LS&A) and the Biomedical Engineering (BME) Department (College of Engineering). A matriculating student will receive the B.S. in Cellular and Molecular Biomedical Science (CMBS) from the College of LS&A and the M.S.E. in Biomedical Engineering (BME) from the College of Engineering upon completion of both programs' requirements.

### How do I declare?

Students who wish to declare a major in CMBS must complete the following steps:

1. Meet with an advisor in **both** MCDB and BME to discuss the program requirements, your academic and professional goals, and make a tentative course plan.
  - MCDB advising appointments are scheduled online through the Program in Biology website:  
<http://www.lsa.umich.edu/biology/>
  - BME advising appointments are scheduled online through the Biomedical Engineering website:  
<http://www.bme.umich.edu>
2. Complete all prerequisite courses for CMBS (see the attached checklist) with a GPA of 3.2 or greater.
3. Meet the minimum GPA requirement. A minimum GPA of 3.2, both overall and in the major, is required. (Note that major GPA consists of all mandatory prerequisites, all courses used for major requirements, and all courses in BIOLOGY, EEB, or MCDB.)
4. Write a 1-2 paragraph personal statement describing your academic and professional goals and how the CMBS major will help you achieve them.
5. Complete and submit the CMBS program application.

***Students will receive email confirmation informing them of the results of their application to the CMBS program.***

***Admission to the program requires approval from advisors in both MCDB and BME.***

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

**M.S.E. phase:** A student may apply to the M.S.E. phase during the fourth year, when the student has achieved senior standing. At this time, the student must formally apply to the Rackham Graduate School for admission to the M.S.E. program in Biomedical Engineering. Students with a 3.2 or higher cumulative GPA in the B.S. program in CMBS and who are judged by both academic advisors as making timely progress towards the B.S. degree will be admitted to the M.S.E. phase. Students will be charged graduate tuition for only one academic year. Students are never jointly enrolled in LS&A and Rackham; however, students can begin to take graduate BME courses as undergraduates with the permission of the instructor. Please see the Rackham website for specific policies:

[http://www.rackham.umich.edu/help/academic\\_records/sugs\\_information\\_for\\_engineering/](http://www.rackham.umich.edu/help/academic_records/sugs_information_for_engineering/).

### 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.

## **\*\*Effective Fall 2019\*\***

<b>BIOLOGY 171</b> ...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.	<b>BIOLOGY 172 or 174 (prerequisite: prior or concurrent credit for CHEM 130)</b> ...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.)
<b>BIOLOGY 173 (prerequisite = BIOLOGY 171, 172, 174, 191, or 195)</b> ...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](#).

### **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](http://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 47 credits required for the CMBS 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](http://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](mailto: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](mailto:nsaleadteam@umich.edu) for more information.

## **BIOLOGY ELECTIVES**

Choose one course:

Any Biology, EEB, or MCDB course at the 200-, 300-, or 400-level (**EXCEPT** BIO 200, 201, 241, 299; EEB 300, 301, 302, 399, or 499; MCDB 300, 301, 302, 360, 399, 412, 460, 461, or 499). An additional Advanced MCDB course listed below can be used to meet this requirement.

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## **ADVANCED MCDB COURSES**

Choose one course from the following list:

MCDB 400 Advanced Independent Research**	MCDB 436 Introductory Immunology
MCDB 401 Advanced Topics (appropriate sections)	MCDB 440 Cell Cycle Control and Cancer
MCDB 402 Molecular Biology of Pain and Sensation	MCDB 441 Cell Biology and Disease
MCDB 403 Molecular and Cell Biology of the Synapse	MCDB 444 Bacterial Cell Biology
MCDB 404 Genetics, Development, and Evolution	MCDB 447 Lysosomes and Diseases
MCDB 405 Molecular Basis of Development	MCDB 448 Telomerase Function in Stem Cells and Cancers
MCDB 406 Modern Genetic Advances	MCDB 450 Genetics and Molecular Biology of Complex Behavior
MCDB 408 Genomic Biology	MCDB 451 Molecular Neurobiology of Health and Disease
MCDB 409 Investigational and Experimental Bacteriology	MCDB 452 The Visual System
MCDB 410 MCDB Capstone	MCDB 453 Ion Channels and their Channelopathies
MCDB 411 Protein Structure and Function	MCDB 454 Cell Biology of the Cytoskeleton
MCDB 415 Microbial Genetics (formerly MCDB 513)	MCDB 455 Cell Biology of Neurodegeneration
MCDB 416 Introduction to Bioinformatics	MCDB 456 Genes, Circuits, and Behavior
MCDB 417 Chromosome Structure & Function	MCDB 457 Neurobiology of Sexual and Aggressive Behavior
MCDB 418 Endocrinology	MCDB 458 Neuroepigenetics
MCDB 419 Endocrinology Laboratory	MCDB 459 Brain States and Behavior
MCDB 420 Structural Biology: The Architecture of Life	MCDB 462 Epigenetics
MCDB 421 Topics in Cellular and Molecular Neurobiology	MCDB 463 Sensory Circuits and Diseases
MCDB 422 Brain Development, Plasticity, and Circuits	MCDB 464 Cellular Diversity in the Immune and Nervous Systems
MCDB 423 Research in Cellular and Molecular Neurobiology	MCDB 465 Computation & Sensory Processing in the Neocortex
MCDB 425 Biotechnology: From Concepts to Technologies	MCDB 469 Signal Transduction
MCDB 426 Molecular Endocrinology	MCDB 471 Advanced Methods in Biochemistry
MCDB 430 Plant Molecular Biology	MCDB 472 Building a Synthetic Cell
MCDB 433 Plant Biochemistry	MCDB 489 Microbial Genes and Genomes
MCDB 434 Protein Misfolding Diseases	MCDB 589 Microbial Evolution
MCDB 435 Intracellular Trafficking	

*\*\* Three credits must be completed in one term to meet the Advanced MCDB course requirement. A maximum of three credits of independent research (MCDB 400) may count toward the major.*

## CMBS - UNDERGRADUATE MAJOR REQUIREMENTS

**CMBS UNDERGRADUATE 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			

**Chemistry Sequence:**

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

**Calculus Sequence:**

<input type="checkbox"/> CALCULUS I: MATH 115, 120 (AP), or 185			
<input type="checkbox"/> CALCULUS II: MATH 116, 121 (AP), 156, or MATH 186			

**Physics Sequence:**

<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.]			

**Introductory Engineering:**

<input type="checkbox"/> ENGR 101 or EECS 183			
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**CMBS UNDERGRADUATE MAJOR:**

**Biology Core Courses:**

<input type="checkbox"/> Biology Elective: Choose one course from attached list.			
<input type="checkbox"/> Genetics: BIO 305			
<input type="checkbox"/> Biochemistry: Choose from: MCDB 310, BIOLCHEM 415, or CHEM 351			
<input type="checkbox"/> Genetics Laboratory: MCDB 306 <b>or</b> Cell and Molecular Biology Laboratory: MCDB 429*			
<input type="checkbox"/> Molecular Biology: MCDB 427*			
<input type="checkbox"/> Cell Biology: MCDB 428* <b>or</b> BIOMEDE 418*			
<input type="checkbox"/> Advanced MCDB Course: Choose one course from attached list.			

**Engineering Core Courses:**

<input type="checkbox"/> Calculus III: Math 215			
<input type="checkbox"/> Differential Equations: Math 216			
<input type="checkbox"/> Biophysical Chem. & Thermodynamics: BIOMEDE 221			
<input type="checkbox"/> Biomechanics: BIOMEDE 231			
<input type="checkbox"/> Bioreaction Engineering & Design: BIOMEDE 321			
<input type="checkbox"/> Biofluid Mechanics: BIOMEDE 331			
<input type="checkbox"/> Biomedical Engineering Design: BIOMEDE 350			

**CONSTRAINTS:**

<ul style="list-style-type: none"> <li>Prerequisites, introductory science courses, and non-specific (departmental) transfer courses are EXCLUDED from the 46 cr. required for the major.</li> <li>A maximum of three credits of independent research (MCDB 400) may count toward the major. Three credits must be completed in one term to meet the Advanced MCDB course requirement.</li> </ul>			
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**Total Units and GPA Requirement for CMBS**

<input type="checkbox"/> Minimum 46 cr. in Major			
<input type="checkbox"/> Minimum 3.2 Cumulative GPA is needed for admission to the M.S.E. program			
<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.			

\*See Rackham policies on transfer and double-counting, and consult with the BME Master's Program regarding graduate requirements.