



Cellular & Molecular Biomedical Science (CMBS) 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

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

The curriculum in Cellular and Molecular Biomedical Science 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: <https://myadvising.lsa.umich.edu/appointments/offices/BME>. Questions about the BME coursework or master's program requirements/planning may be directed to bme-advising@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. Applications must be approved by the MCDB and BME departments for admission to the program.

Exclusions: Students who elect a major in CMBS may not elect the following majors: Biology; Biology, Health, and Society (BHS); Biotechnology & Bioenvironmental Sciences (BBS); Microbiology; Molecular, Cellular, and Developmental Biology (MCDB); Plant Biology; Neuroscience; Biochemistry; or Biomolecular Science. They also may not elect an academic minor in Biology or Biochemistry.

M.S.E. phase: Students 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/.

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. 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. 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) completion of the thesis program application via the Program in Biology web page,
- (3) participation in at least two terms of independent research, and
- (4) 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 Program in Biology website:

www.lsa.umich.edu/biology/transfercredit. Approved equivalent courses may count toward major requirements; transfer students are encouraged to meet with a major advisor to develop a course plan. **At least 20 of the 46 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.

- **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.
- **Neuroscience Students Association (NSA):** an organization for students with an interest in neuroscience. Email nsaleadteam@umich.edu for more information.
- **Microbiology Club:** An organization striving to introduce students to different topics within microbiology and explore the many opportunities within the field. Email olacomm@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, 312; EEB 300, 301, 302, 312, 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.

ADVANCED MCDB COURSES

Choose one course from the following list:

| | |
|---|---|
| MCDB 400 Advanced Independent Research** | MCDB 440 Cell Cycle Control and Cancer |
| MCDB 401 Advanced Topics (appropriate sections) | MCDB 441 Cell Biology and Disease |
| MCDB 403 Molecular and Cell Biology of the Synapse | MCDB 445 Advanced Biochem.: Molecular Basis of Biology & Medicine (no credit if MCDB 420 has been taken) |
| MCDB 405 Molecular Basis of Development | MCDB 447 Lysosomes and Diseases |
| MCDB 408 Genomic Biology | MCDB 448 Telomerase Function in Stem Cells and Cancers |
| MCDB 411 Protein Structure and Function | MCDB 451 Molecular Neurobiology of Health and Disease |
| MCDB 415 Microbial Genetics | MCDB 452 The Visual System |
| MCDB 417 Chromosome Structure & Function | MCDB 453 Ion Channels and their Channelopathies |
| MCDB 420 Structural Biology: The Architecture of Life (no credit if MCDB 445 has been taken) | MCDB 454 Cell Biology of the Cytoskeleton |
| MCDB 421 Topics in Cellular and Molecular Neurobiology | MCDB 458 Neuroepigenetics |
| MCDB 422 Brain Development, Plasticity, and Circuits | MCDB 459 Brain States and Behavior |
| MCDB 423 Research in Cellular and Molecular Neurobiology | 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 430 Plant Molecular Biology | MCDB 472 Building a Synthetic Cell |
| MCDB 435 Intracellular Trafficking | MCDB 475 Gene Regulatory Mechanisms |
| MCDB 436 Introductory Immunology | MCDB 488 Cell Shape and Movement |
| MCDB 439 Protein Post-translational Mod. in Health & Diseases | MCDB 489 Microbial Genes and Genomes |

**** 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.**

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

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 or BIO 196 (AP/IB) | | | |
| B: BIO 195 (AP/IB); & BIO 173 or BIO 196 (AP/IB) | | | |
| 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; 140 & 141 (preferred) ; 150 & 151; 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; 240 & 241 (preferred) ; 250 & 251; or 260 & 261. [PHYSICS 239 (AP) will also fulfill this requirement.] | | | |

Introductory Engineering:

| | | | |
|---|--|--|--|
| <input type="checkbox"/> ENGR 101 or EECS 183 | | | |
|---|--|--|--|

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: MCDB 310, BIOLCHEM 415, or CHEM 351 | | | |
| <input type="checkbox"/> Genetics Laboratory: MCDB 306 or Cell and Molecular Biology Laboratory: MCDB 429* | | | |
| <input type="checkbox"/> Molecular Biology: MCDB 427* | | | |
| <input type="checkbox"/> Cell Biology: MCDB 428* or 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"/> Circuits and Systems for Biomedical Engineering: BIOMEDE 211 | | | |
| <input type="checkbox"/> Biophysical Chemistry & Thermodynamics: BIOMEDE 221 | | | |
| <input type="checkbox"/> Biomechanics: BIOMEDE 231 | | | |
| <input type="checkbox"/> Choose two courses from the following options: Bioreaction Engineering & Design: BIOMEDE 321 Biofluid Mechanics: BIOMEDE 331 Biomedical Engineering Design: BIOMEDE 350 Quantitative Physiology: BIOMEDE 419 | | | |

CONSTRAINTS:

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

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. | | | |