The undergraduate degree in molecular, cellular and developmental biology emphasizes knowledge and awareness of:

- the biological sciences in general and a detailed understanding of currently important aspects of cellular biology, molecular biology, biochemistry, genetics and developmental biology; and
- the relationship of the specialty area to broader areas of science and to society in general, including ethical issues raised by current biological research and by the rapid growth of biotechnology as an important shaping force for the future.

In addition, students completing the degree in molecular, cellular and developmental biology are expected to acquire the ability and skills to:

- learn detailed laboratory procedures rapidly when the need arises;
- demonstrate a scientific vocabulary and an understanding of research methods that permits the comprehension of current journal articles, extraction of pertinent information and judgment of the quality of the work described;
- evaluate a biological problem, determine which aspects are understood and apply basic research methods and techniques to the unknown aspects; and
- communicate scientific concepts and analytical arguments clearly and concisely, both orally and in writing.

Requirements

Prerequisites

It is MCDB policy to enforce the course prerequisites listed in the course catalog. If you have not either taken and passed (C- or better) the prerequisites for a course, or obtained permission from the instructor or a departmental advisor to take the course based on equivalent preparatory coursework or experience here or elsewhere, you may be administratively dropped from the course.

Course Requirements

Students must complete the general requirements of the College of Arts and Sciences and the required courses listed below. All required major courses and all required ancillary courses must be passed with a C- or better and cannot be taken pass/fail. Students must have a grade point average of at least 2.000 in the major in order to graduate.

It is strongly recommended that MCDB majors consult with a departmental advisor before applying AP, IB or CLEP credit. Students majoring in MCDB who transfer biology credit from other institutions also must consult a departmental advisor.

Students who plan to double major with biochemistry or chemistry are encouraged to meet with an academic advisor to understand how their chemistry courses will apply to the MCDB major.

Students who plan to also pursue a degree in engineering are encouraged to meet with an academic advisor to understand how their chemistry and calculus courses will apply to the MCDB major.

Required Courses and Credits

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCDB 1150</td>
<td>Introduction to Cellular and Molecular Biology (MCDB 1152 is a recommended coseminar for MCDB 1150)</td>
<td>3</td>
</tr>
<tr>
<td>MCDB 1111</td>
<td>Core Concepts in Biology I: Evolutionary, Molecular and Cell Biology (MCDB 1152 is not a recommended coseminar for MCDB 1111)</td>
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<tr>
<td>MCDB 2150</td>
<td>Principles of Genetics (MCDB 2152 is a recommended coseminar for MCDB 2150)</td>
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<tr>
<td>MCDB 2222</td>
<td>Core Concepts in Biology II: Genes, Genetics and Phenotypes (MCDB 2152 is not a recommended coseminar for MCDB 2222)</td>
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<tr>
<td>MCDB 1161</td>
<td>From Dirt to DNA: Phage Genomics Laboratory I</td>
<td>2</td>
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<tr>
<td>MCDB 1171</td>
<td>Drug Discovery Through Hands-on Screens I</td>
<td>3</td>
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<tr>
<td>MCDB 1181</td>
<td>Biological Probiotic/Drug Discovery Through Hands-on Screens</td>
<td>3</td>
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<td>MCDB 2171</td>
<td>Drug Discovery Through Hands-On Screens 2</td>
<td>2</td>
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<td>MCDB 3135</td>
<td>Molecular Biology</td>
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<td>MCDB 3140</td>
<td>Cell Biology Laboratory</td>
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<tr>
<td>MCDB 3145</td>
<td>Cell Biology</td>
<td>3</td>
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<tr>
<td>MCDB 4650</td>
<td>Developmental Biology</td>
<td>3</td>
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<tr>
<td>MCDB 4300</td>
<td>Immunology</td>
<td>3</td>
</tr>
<tr>
<td>MCDB 4777</td>
<td>Molecular Neurobiology</td>
<td>3</td>
</tr>
<tr>
<td>MCDB 4150</td>
<td>Biology of Aging and Longevity</td>
<td>3</td>
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<tr>
<td>MCDB 4350</td>
<td>Microbial Diversity and the Biosphere</td>
<td>3</td>
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<tr>
<td>MCDB 4361</td>
<td>Evolution and Development</td>
<td>3</td>
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<tr>
<td>MCDB 4410</td>
<td>Human Molecular Genetics</td>
<td>3</td>
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<tr>
<td>MCDB 4420</td>
<td>Genetics of Brain and Behavior</td>
<td>3</td>
</tr>
<tr>
<td>MCDB 4422</td>
<td>Molecular Biology of Free Radicals: Role(s) in Oxidative Stress, Signaling, Disease, Aging</td>
<td>3</td>
</tr>
<tr>
<td>MCDB 4425</td>
<td>Topics in Membrane Biology, Cell Biology, Physiology and Disease</td>
<td>3</td>
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</tbody>
</table>
MCDB 4426  Cell Signaling and Developmental Regulation
MCDB 4427  Biology of the Visual System
MCDB 4444  Cellular Basis of Disease
MCDB 4471  Mechanisms of Gene Regulation in Eukaryotes
MCDB 4550  Cells, Molecules and Tissues: A Biophysical Approach
MCDB 4615  Biology of Stem Cells
MCDB 4680  Mechanisms of Aging
MCDB 4750  Animal Virology
MCDB 4810  Insane in the Membrane: The Biology and Biophysics of the Membrane
MCDB 4811  Teaching and Learning Biology

Electives
An additional 6 credit hours of upper-division electives (see department for approved courses)  

MCDB 3010  Undergraduate Teaching in Course-Based Undergraduate Research Experiences
MCDB 3160  Infectious Disease
MCDB 3333  Biomedical Innovations and Discoveries
MCDB 3501  Structural Methods for Biological Macromolecules
MCDB 3650  The Brain - From Molecules to Behavior
MCDB 4101  Manipulating Genomes-Discovering Gene Functions
MCDB 4201  From Bench to Bedside: The Role of Science in Medicine
MCDB 4202  The Python Project
MCDB 4312  Quantitative Optical Imaging
MCDB 4300  Immunology
MCDB 4777  Molecular Neurobiology
MCDB 4790  Oocytes, Stem Cells, Organisms: Experiments to Discoveries

Total Credit Hours  

Code # Title  Credit Hours

Required Ancillary Courses:
Complete the following chemistry and biochemistry courses: 18
CHEM 1113  General Chemistry 1
& CHEM 1114  and Laboratory in General Chemistry 1
CHEM 1133  General Chemistry 2
& CHEM 1134  and Laboratory in General Chemistry 2
CHEM 3311  Organic Chemistry 1
& CHEM 3321  and Laboratory in Organic Chemistry 1
BCHM 4611  Principles of Biochemistry
Select one of the following calculus or statistics courses: 4 3-5
Calculus:
MATH 1300  Calculus 1
MATH 1310  Calculus for Life Sciences
APPM 1350  Calculus 1 for Engineers
Statistics:
MATH 2510  Introduction to Statistics

EBIO 1010  Introduction to Statistics and Quantitative Thinking for Biologists
IPHYS 2800  Introduction to Statistics
PSYC 2111  Psychological Science I: Statistics

Total Credit Hours 21-23

1  EBIO 1210 is an acceptable alternative to MCDB 1150.
2  EBIO 2070 is accepted in place of MCDB 2150.
3  Up to 6 hours of MCDB 4840 Upper-Division Independent Study, MCDB 4980 Honors Research, MCDB 4990 Honors Thesis, or select courses from outside MCDB may be used. A minimum of 3 credit hours of MCDB upper-division electives must be taken on the Boulder campus. See department for details.
4  Not all the courses in this category will also meet the QRMS component of the Gen Ed Skills Requirement.

Graduating in Four Years
Consult the Four-Year Guarantee Requirements for information on eligibility. The concept of “adequate progress” as it is used here only refers to maintaining eligibility for the four-year guarantee; it is not a requirement for the major. To maintain adequate progress in molecular, cellular and developmental biology, students should meet the following requirements:

- In the first semester, declare the MCDB major. (If the major is not started in the first year, the student must meet with an MCDB academic advisor to ensure that it is still possible to complete the major in four years.)
- During the first and second semesters, complete either general chemistry or the introductory MCDB sequence.
- By the end of the fourth semester, complete general chemistry and the introductory MCDB sequence with a C- or better.
- By the end of the eighth semester, complete the major.

Recommended Four-Year Plan of Study
Through the required coursework for the major, students will fulfill all 12 credits of the Natural Sciences area of the Gen Ed Distribution Requirement, including the Lab requirement, and, potentially, the QRMS component of the Gen Ed Skills Requirement.

Course  Title  Credit Hours

Year One
Fall Semester
MCDB 1150  Introduction to Cellular and Molecular Biology 3
MCDB 1111  or Core Concepts in Biology I: Evolutionary, Molecular and Cell Biology

MCDB 2 Credit Hour Lab
MCDB 1152  Problem Solving Co-Seminar for Introduction to Molecular and Cellular Biology (strongly recommended in conjunction with MCDB 1150, not required) 2
CHEM 1113  General Chemistry 1 5
& CHEM 1114  and Laboratory in General Chemistry 1
<table>
<thead>
<tr>
<th>Year Four</th>
<th>Fall Semester</th>
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<tbody>
<tr>
<td>MCDB Capstone or MCDB Sci Reasoning 3</td>
<td>MCDB upper division elective 3</td>
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<tr>
<td>Gen. Ed. Distribution/Diversity course (example: Arts &amp; Humanities) 3</td>
<td>Free Elective 3</td>
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<th>Fall Semester</th>
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<tr>
<td>MCD Upper-division Elective 3</td>
<td>BCHM 4611 Principles of Biochemistry 3</td>
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<tr>
<td>Free Elective 3</td>
<td>Free Elective 3</td>
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<td>Credit Hours 15</td>
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<table>
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<th>Year Three</th>
<th>Spring Semester</th>
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</thead>
<tbody>
<tr>
<td>MCD Upper-division Elective 3</td>
<td>MCD Capstone or MCD Sci Reasoning 3</td>
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<tr>
<td>Gen. Ed. Distribution course (example: Social Sciences) 3</td>
<td>Upper-Division Elective 3</td>
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<tr>
<td>Free elective 3</td>
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