Molecular, Cellular and Developmental Biology - Bachelor of Arts (BA)

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 courses must be completed with a grade of C- or better.

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.

<table>
<thead>
<tr>
<th>Required Courses and Credits</th>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>Required Courses</td>
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<tr>
<td>Introductory Coursework</td>
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<td>Select one:</td>
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<tr>
<td>MCDB 1150</td>
<td></td>
<td>Introduction to Cellular and Molecular Biology (MCDB 1152 is a recommended coseminar for MCDB 1150)</td>
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<tr>
<td>MCDB 1111</td>
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<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>Genetics</td>
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<tr>
<td>MCDB 2150</td>
<td></td>
<td>Principles of Genetics (MCDB 2152 is a recommended coseminar for MCDB 2150)</td>
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<tr>
<td>MCDB 2222</td>
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<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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<td>Research-Based Introductory Labs</td>
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<tr>
<td>MCDB 1161</td>
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<td>From Dirt to DNA: Phage Genomics Laboratory I</td>
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<tr>
<td>MCDB 1171</td>
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<td>Drug Discovery Through Hands-on Screens I</td>
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<tr>
<td>MCDB 1181</td>
<td></td>
<td>Biological Probiotic/Drug Discovery Through Hands-on Screens</td>
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<tr>
<td>MCDB 2171</td>
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<td>Drug Discovery Through Hands-On Screens</td>
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<tr>
<td>Cell Biology</td>
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<tr>
<td>MCDB 3135</td>
<td></td>
<td>Molecular Biology</td>
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<tr>
<td>MCDB 3140</td>
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<td>Cell Biology Laboratory</td>
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<td>MCDB 3145</td>
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<td>Cell Biology</td>
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<td>Development Biology</td>
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<tr>
<td>MCDB 4650</td>
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<td>Developmental Biology</td>
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<td>Upper-division capstone and scientific reasoning requirements</td>
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<tr>
<td>Capstone</td>
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<tr>
<td>MCDB 4300</td>
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<td>Immunology</td>
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<td>MCDB 4777</td>
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<td>Molecular Neurobiology</td>
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<tr>
<td>Scientific Reasoning</td>
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<tr>
<td>Select one (see department for full list of approved courses)</td>
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<tr>
<td>MCDB 4350</td>
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<td>Microbial Diversity and the Biosphere</td>
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<td>MCDB 4361</td>
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<td>Evolution and Development</td>
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<td>MCDB 4410</td>
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<td>Human Molecular Genetics</td>
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<td>MCDB 4420</td>
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<td>Genetics of Brain and Behavior</td>
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<td>MCDB 4422</td>
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<td>Molecular Biology of Free Radicals: Role(s) in Oxidative Stress, Signaling, Disease, Aging</td>
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<tr>
<td>MCDB 4425</td>
<td></td>
<td>Topics in Membrane Biology; Cell Biology, Physiology and Disease</td>
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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  

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 4811  Teaching and Learning Biology  

Total Credit Hours  31  

Code  Title  Credit Hours 
EBIO 1010  Introduction to Statistics and Quantitative Thinking for Biologists  
IPHY 2800  Introduction to Statistics  
PSYC 2111  Psychological Science I: Statistics  

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.  

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<tr>
<td>MCDB 1150 or MCDB 1111</td>
<td>Introduction to Cellular and Molecular Biology or Core Concepts in Biology I: Evolutionary, Molecular and Cell Biology</td>
<td>3</td>
</tr>
<tr>
<td>MCDB 2 Credit Hour Lab</td>
<td></td>
<td>2</td>
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<tr>
<td>MCDB 1152</td>
<td>Problem Solving Co-Seminar for Introduction to Molecular and Cellular Biology (strongly recommended in conjunction with MCDB 1150, not required)</td>
<td>1</td>
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<tr>
<td>CHEM 1113 &amp; CHEM 1114</td>
<td>General Chemistry 1 and Laboratory in General Chemistry 1</td>
<td>5</td>
</tr>
<tr>
<td>Gen. Ed. Skills course (example: Lower-division Written Communication)</td>
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<td>3</td>
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</tbody>
</table>
### Year One

#### Spring Semester
- **MCDB 2150** or **MCDB 2222**
  - Principles of Genetics
  - or Core Concepts in Biology II: Genes, Genetics and Phenotypes
  - 3
- **MCDB 2152**
  - Problem Solving Co-Seminars for Genetics (strongly recommended in conjunction with MCDB 2150, not required)
  - 1
- **CHEM 1133**
  - General Chemistry 2
  - & **CHEM 1134**
  - and Laboratory in General Chemistry 2
  - 5
- **Gen. Ed. Distribution course (example: Social Sciences)**
  - 3
- **Gen. Ed. Skills course (example: QRMS) or Elective if QRMS is fulfilled by major requirement.**
  - 3

#### Total Credit Hours
- 15

### Year Two

#### Fall Semester
- **MCDB 3135**
  - Molecular Biology
  - 3
- **MCDB 3140**
  - Cell Biology Laboratory
  - 2
- **CHEM 3311**
  - Organic Chemistry 1
  - & **CHEM 3321**
  - and Laboratory in Organic Chemistry 1
  - 5
- **Gen. Ed. Distribution/Diversity course (example: Social Sciences/Global Perspective)**
  - 3
- **Elective or MAPS**
  - 3

#### Total Credit Hours
- 16

#### Spring Semester
- **MCDB 3145**
  - Cell Biology
  - 3
- **MATH 1300 OR Statistics: Calculus 1 or Statistics OR (some students may decide to take Organic Chemistry 2 as an approved out of department, upper division MCDB elective, in that case, taking stats or calc is advised for later semesters)**
  - 3-5
- **Gen. Ed. Distribution course (example: Social Sciences)**
  - 3
- **Gen. Ed. Distribution course (example: Arts & Humanities)**
  - 3
- **Elective or MAPS (only if taking Statistics)**
  - 3

#### Total Credit Hours
- 15-17

### Year Three

#### Fall Semester
- **MCDB Upper-division Elective**
  - 3
- **BCHM 4611**
  - Principles of Biochemistry
  - 3
- **Gen. Ed. Skills course (example: Upper-division Written Communication)**
  - 3
- **Gen. Ed. Distribution course (example: Arts & Humanities)**
  - 3
- **Free Elective**
  - 3

#### Total Credit Hours
- 15

#### Spring Semester
- **MCDB Upper-division Elective**
  - 3
- **MCDB Capstone or MCDB Sci Reaosning**
  - 3
- **Gen. Ed. Distribution course (example: Social Sciences)**
  - 3
- **Upper-Division Elective**
  - 3
- **Upper-Division Elective**
  - 3

#### Total Credit Hours
- 15

### Year Four

#### Fall Semester
- **MCDB Capstone or MCDB Sci Reasoning**
  - 3
- **MCDB upper division elective**
  - 3

#### Total Credit Hours
- 15

#### Total Credit Hours
- 120-122