BIOLOGY B.S. - CELLULAR AND MOLECULAR BIOLOGY

Bachelor of Science - Biology; Cellular & Molecular Biology Concentration

College of Humanities & Sciences

Degree Specific Credits: 81-87
Required Cumulative GPA: 2.0
Catalog Year: 2018-2019

Note: Cellular and Molecular Biology is the study of cellular, molecular, and physiological aspects of Biology. This concentration is a graduate prep program and is for students interested in academia or research jobs in private or government laboratories. It is also an excellent concentration for pre-medical sciences students.

General Education Requirements

Information regarding these requirements can be found in the General Education Section (http://catalog.umt.edu/academics/general-education-requirements) of the catalog.

Summary

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Biology/Microbiology Lower-Division Core</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Upper-Division Core Courses Required by Cellular &amp; Molecular Biology Concentration</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Additional Upper-Division Major Courses Required for the Cellular &amp; Molecular Biology Concentration</td>
<td>7-12</td>
</tr>
<tr>
<td></td>
<td>Disease Elective</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Additional Upper-Division Depth Courses - Lecture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Additional Upper-Division Depth Courses - Laboratory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Required Courses Outside of the Major</td>
<td>37-38</td>
</tr>
<tr>
<td></td>
<td>Mathematics - Calculus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chemistry</td>
<td></td>
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<tr>
<td></td>
<td>Additional Depth in Chemistry</td>
<td></td>
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<tr>
<td></td>
<td>Physics</td>
<td></td>
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<tr>
<td></td>
<td>Advanced College Writing Requirement</td>
<td></td>
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<tr>
<td></td>
<td>Total Hours</td>
<td>81-87</td>
</tr>
</tbody>
</table>

Biology/Microbiology Lower-Division Core

Note: The lower-division core should be completed before attempting most upper-division major courses. AP Biology credit with a score of 3 may be substituted for either BIOB 160N/BIOB 161N or BIOB 170N/BIOB 171N.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 160N</td>
<td>Principles of Living Systems</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 161N</td>
<td>Prncpls of Living Systems Lab</td>
<td>1</td>
</tr>
<tr>
<td>BIOB 170N</td>
<td>Prncpls Biological Diversity</td>
<td>3</td>
</tr>
</tbody>
</table>

Upper-Division Core Courses Required by Cellular & Molecular Biology Concentration

Complete all of the following courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCH 480</td>
<td>Advanced Biochemistry I</td>
<td>3</td>
</tr>
<tr>
<td>BCH 482</td>
<td>Advanced Biochemistry II</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 301</td>
<td>Developmental Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 375</td>
<td>General Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 425</td>
<td>Adv Cell &amp; Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOM 360</td>
<td>General Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOM 361</td>
<td>General Microbiology Lab</td>
<td>2</td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

Minimum Required Grade: C-

Additional Upper-Division Major Courses Required for the Cellular & Molecular Biology Concentration

Rule: Complete the following subcategories.

Disease Elective

Complete one of the following courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 410</td>
<td>Immunology</td>
<td>3</td>
</tr>
<tr>
<td>BIOM 435</td>
<td>Virology</td>
<td></td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Minimum Required Grade: C-

Additional Upper-Division Depth Courses - Lecture

Complete one of the following courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOB 440</td>
<td>Biological Electron Microscopy</td>
<td>2-4</td>
</tr>
<tr>
<td>BIOB 468</td>
<td>Endocrinology</td>
<td></td>
</tr>
<tr>
<td>BIOB 483</td>
<td>Phylogenics and Evolution</td>
<td></td>
</tr>
<tr>
<td>BIOB 486</td>
<td>Genomics</td>
<td></td>
</tr>
<tr>
<td>BIOL 435</td>
<td>Comparative Animal Physiology</td>
<td></td>
</tr>
<tr>
<td>BIOM 410</td>
<td>Microbial Genetics</td>
<td></td>
</tr>
<tr>
<td>BIOM 450</td>
<td>Microbial Physiology</td>
<td></td>
</tr>
<tr>
<td>BIOO 433 &amp; BIOM 434</td>
<td>Plant Physiology and Plant Physiology Lab</td>
<td></td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td>2-4</td>
</tr>
</tbody>
</table>

Minimum Required Grade: C-

Additional Upper-Division Depth Courses - Laboratory

Complete two of the following courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCH 486</td>
<td>Biochemistry Research Lab</td>
<td>2-5</td>
</tr>
</tbody>
</table>
### BIOB 411 Immunology Laboratory
### BIOM 411 Exprmntl Microbial Genetcs Lab
### BIOM 451 Microbial Physiology Lab
### BIOM 490 Adv Undergrad Research

Total Hours: 2-5

Minimum Required Grade: C-

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**Required Courses Outside of the Major**

**Rule:** Complete the following subcategories.

### Mathematics - Calculus

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 162</td>
<td>Applied Calculus</td>
<td>4</td>
</tr>
<tr>
<td>M 171</td>
<td>Calculus I</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Hours: 4

Minimum Required Grade: C-

### Chemistry

<table>
<thead>
<tr>
<th>Code &amp; Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMY 141N &amp; CHMY 142N College Chemistry I and College Chemistry I Lab</td>
<td>5</td>
</tr>
<tr>
<td>CHMY 143N &amp; CHMY 144N College Chemistry II and College Chemistry II Lab</td>
<td>5</td>
</tr>
<tr>
<td>CHMY 221 &amp; CHMY 222 Organic Chemistry I and Organic Chemistry I Lab</td>
<td>5</td>
</tr>
<tr>
<td>CHMY 223 &amp; CHMY 224 Organic Chemistry II and Organic Chemistry II Lab</td>
<td>5</td>
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</table>

Total Hours: 20

Minimum Required Grade: C-

### Additional Depth in Chemistry

<table>
<thead>
<tr>
<th>Code &amp; Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHMY 311 Analytical Chem-Quant Analysis</td>
<td>3-4</td>
</tr>
<tr>
<td>CHMY 360 Applied Physical Chemistry</td>
<td></td>
</tr>
<tr>
<td>CHMY 373 Phys Chem-Kntcs &amp; Thrmodynamcs</td>
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</tbody>
</table>

Total Hours: 3-4

Minimum Required Grade: C-

### Physics

<table>
<thead>
<tr>
<th>Code &amp; Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 205N &amp; PHSX 206N College Physics I and College Physics I Laboratory</td>
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</tr>
<tr>
<td>PHSX 207N &amp; PHSX 208N College Physics II and College Physics II Laboratory</td>
<td></td>
</tr>
</tbody>
</table>

**Algebra- and Trigonometry-based Physics:**

<table>
<thead>
<tr>
<th>Code &amp; Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 215N Fund of Physics w/Calc I and Physics Laboratory I w/Calc</td>
<td></td>
</tr>
<tr>
<td>PHSX 216N Fund of Physics w/Calc II and Physics Laboratory II w/Calc</td>
<td></td>
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</table>

**Calculus-based Physics:**

<table>
<thead>
<tr>
<th>Code &amp; Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSX 217N Fund of Physics w/Calc II and Physics Laboratory II w/Calc (require M 171 and M 172)</td>
<td>10</td>
</tr>
</tbody>
</table>

Total Hours: 10

Minimum Required Grade: C-

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**Advanced College Writing Requirement**

**Rule:** To complete the Advanced College Writing Requirement, Biology students complete 2 or 3 partial writing courses (either three 1/3 writing courses or one 1/3 writing course and one 2/3 writing course) or one complete writing course. The Cellular & Molecular Biology concentration requires two 1/3 writing courses: BCH 482 and BIOB 425. The Advanced College Writing Requirement is completed with one additional course, chosen from any of the following.

Minimum Required Grade: C-

### 1/3 Advanced Writing Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCH 482</td>
<td>Advanced Biochemistry II</td>
<td>3</td>
</tr>
<tr>
<td>BIO 410</td>
<td>Immunology</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 425</td>
<td>Adv Cell &amp; Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOB 483</td>
<td>Phylogenics and Evolution</td>
<td>3</td>
</tr>
<tr>
<td>BIOE 403</td>
<td>Vert Design &amp; Evolution</td>
<td>5</td>
</tr>
<tr>
<td>BIOE 409</td>
<td>Behavior &amp; Evolution Discussion</td>
<td>1</td>
</tr>
<tr>
<td>BIOE 428</td>
<td>Freshwater Ecology</td>
<td>5</td>
</tr>
<tr>
<td>BIOL 484</td>
<td>Plant Evolution</td>
<td>3</td>
</tr>
<tr>
<td>BIOM 402</td>
<td>Medical Bacteriology&amp; Mycology</td>
<td>3</td>
</tr>
<tr>
<td>BIOO 320</td>
<td>General Botany</td>
<td>5</td>
</tr>
<tr>
<td>BIOO 434</td>
<td>Plant Physiology Lab</td>
<td>1</td>
</tr>
<tr>
<td>BIOO 470</td>
<td>Ornithology</td>
<td>4</td>
</tr>
<tr>
<td>BIOO 475</td>
<td>Mammalogy</td>
<td>4</td>
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</tbody>
</table>

Minimum Required Grade: C-

### 2/3 Advanced Writing Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCH 486</td>
<td>Biochemistry Research Lab</td>
<td>3</td>
</tr>
<tr>
<td>BCH 499</td>
<td>Senior Thesis/Capstone</td>
<td>3-6</td>
</tr>
<tr>
<td>BIOB 411</td>
<td>Immunology Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>BIO 499</td>
<td>Undergraduate Thesis</td>
<td>3-6</td>
</tr>
<tr>
<td>BIOE 342</td>
<td>Field Ecology</td>
<td>5</td>
</tr>
<tr>
<td>BIOE 371</td>
<td>Gen Ecology Lab (equiv to 271)</td>
<td>2</td>
</tr>
<tr>
<td>BIOM 411</td>
<td>Exprmntl Microbial Genetcs Lab</td>
<td>1</td>
</tr>
<tr>
<td>BIOM 499</td>
<td>Undergraduate Thesis</td>
<td>3-6</td>
</tr>
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Minimum Required Grade: C-

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**Complete Advanced Writing Course**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOP 462</td>
<td>Principles Medical Physiology</td>
<td>3</td>
</tr>
</tbody>
</table>

Minimum Required Grade: C-