MAJOR IN MOLECULAR BIOLOGY, BIOCHEMISTRY AND BIOINFORMATICS

All students are required to complete 43 units of required courses offered by the MB3 Program or by the departments of Biological Sciences, Chemistry, and Computer and Information Sciences, and an additional 27-35 units within one of the three concentrations.

### Required Courses

<table>
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<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>BIOL 200</td>
<td>INTRODUCTION TO CELLULAR BIOLOGY AND GENETICS [LECTURE]</td>
<td>4</td>
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<tr>
<td>&amp; 200L</td>
<td>and INTRODUCTION TO CELLULAR BIOLOGY AND GENETICS [LAB]</td>
<td></td>
</tr>
<tr>
<td>BIOL 309</td>
<td>GENETICS</td>
<td>4</td>
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<tr>
<td>BIOL 409</td>
<td>MOLECULAR BIOLOGY</td>
<td>4</td>
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<tr>
<td>CHEM 131</td>
<td>GENERAL CHEMISTRY I LECTURE</td>
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<tr>
<td>&amp; 131L</td>
<td>and GENERAL CHEMISTRY I LABORATORY</td>
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<tr>
<td>CHEM 132</td>
<td>GENERAL CHEMISTRY II LECTURE</td>
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<td>&amp; 132L</td>
<td>and GENERAL CHEMISTRY II LABORATORY</td>
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<tr>
<td>CHEM 351</td>
<td>BIOCHEMISTRY I</td>
<td>3</td>
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<tr>
<td>MATH 237</td>
<td>ELEMENTARY BIOSTATISTICS</td>
<td>4</td>
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<tr>
<td>MATH 273</td>
<td>CALCULUS I</td>
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</tr>
<tr>
<td>MBBB 201</td>
<td>PROGRAMMING FOR BIOLOGISTS</td>
<td>4</td>
</tr>
<tr>
<td>or COSC 175</td>
<td>GEN COMPUTER SCI</td>
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<tr>
<td>MBBB 301</td>
<td>INTRO TO BIOINFORMATICS</td>
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<tr>
<td>MBBB 493</td>
<td>SEMINAR IN BIOETHICS</td>
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<tr>
<td>Select one of the following (courses may be repeated for a total of 6 units toward the major): 1</td>
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<tr>
<td>MBBB 495</td>
<td>CAPSTONE PROJECT IN MBBB</td>
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<tr>
<td>BIOL 491</td>
<td>ELECTIVE IN INDEPENDENT RESEARCH</td>
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<td>CHEM 491</td>
<td>RESEARCH IN CHEMISTRY</td>
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<td>COSC 495</td>
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1 Or an approved elective in BIOL, CHEM, COSC, CIS or MBBB 3XX, 4XX

### Concentrations:

**Molecular Biology Concentration (27-28 units)**

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<th>Code</th>
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<th>Units</th>
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<tbody>
<tr>
<td>BIOL 408</td>
<td>CELL BIOLOGY</td>
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<tr>
<td>Choose one of the following laboratory courses</td>
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<tr>
<td>BIOL 312</td>
<td>GENETICS LABORATORY</td>
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<tr>
<td>BIOL 410</td>
<td>MOLECULAR BIOLOGY LABORATORY</td>
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</tr>
<tr>
<td>BIOL 412</td>
<td>CELL BIOLOGY LABORATORY</td>
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<tr>
<td>Required Chemistry and Physics courses</td>
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<tr>
<td>CHEM 331</td>
<td>ORGANIC CHEMISTRY I</td>
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<tr>
<td>&amp; CHEM 332</td>
<td>and ORGANIC CHEMISTRY II</td>
<td></td>
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<tr>
<td>PHYS 211 &amp; PHYS 212</td>
<td>GENERAL PHYSICS I; NON CALCULUS-BASED and GENERAL PHYSICS II; NON CALCULUS-BASED</td>
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<td>Biology upper-level elective</td>
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**Biochemistry Concentration (33 units)**

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<tr>
<td>CHEM 210</td>
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<td>CHEM 331</td>
<td>ORGANIC CHEMISTRY I</td>
<td>10</td>
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<tr>
<td>&amp; CHEM 332</td>
<td>and ORGANIC CHEMISTRY II</td>
<td></td>
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<td>CHEM 345</td>
<td>PRINCIPLES PHYSICAL CHEM</td>
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<td>CHEM 356</td>
<td>BIOCHEMISTRY LAB</td>
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<td>CHEM 357</td>
<td>BIOCHEMISTRY II</td>
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<td>CHEM 372</td>
<td>PHYSICAL CHEMISTRY LABORATORY</td>
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<tr>
<td>PHYS 211</td>
<td>GENERAL PHYSICS I; NON CALCULUS-BASED</td>
<td>8</td>
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<tr>
<td>&amp; PHYS 212</td>
<td>and GENERAL PHYSICS II; NON CALCULUS-BASED</td>
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<tr>
<td>or PHYS 241 &amp; PHYS 242</td>
<td>GENERAL PHYSICS I CALCULUS-BASED and GENERAL PHYSICS II CALCULUS-BASED</td>
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**Bioinformatics Concentration (30–35 units)**

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<tr>
<td>CHEM 330</td>
<td>ESSENTIALS OF ORGANIC CHEMISTRY 1</td>
<td>5-10</td>
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<tr>
<td>or CHEM 331</td>
<td>ORGANIC CHEMISTRY I</td>
<td></td>
</tr>
<tr>
<td>&amp; CHEM 332</td>
<td>and ORGANIC CHEMISTRY II</td>
<td></td>
</tr>
<tr>
<td>COSC 236</td>
<td>INTRODUCTION TO COMPUTER SCIENCE I</td>
<td>8</td>
</tr>
<tr>
<td>&amp; COSC 237</td>
<td>and INTRODUCTION TO COMPUTER SCIENCE II</td>
<td></td>
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<tr>
<td>COSC 336</td>
<td>DATA STRUCTURES AND ALGORITHM ANALYSIS</td>
<td>4</td>
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<tr>
<td>COSC 457</td>
<td>DATABASE MANAGEMENT SYSTEMS</td>
<td>3</td>
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<tr>
<td>or CIS 458</td>
<td>ORGANIZATIONAL DATABASE MANAGEMENT</td>
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<tr>
<td>MATH 263</td>
<td>DISCRETE MATHEMATICS</td>
<td>3</td>
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<tr>
<td>or MBBB 315</td>
<td>GENOMICS</td>
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<td>MATH 274</td>
<td>CALCULUS II</td>
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<td>MBBB 401</td>
<td>ADVANCED BIOINFORMATICS</td>
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<tr>
<td>Total Units</td>
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</table>

1 Note: Many graduate and professional programs require two terms of physics and two terms of organic chemistry and/or calculus. Students who are contemplating education beyond the undergraduate level (graduate school, medical school, etc.) need to talk with an adviser.

Note: Below are idealized plans of study for each of the three concentrations within the MB3 major. Actual plans of study will vary significantly between students depending on high school preparation, performance in classes, additional commitments and career goals.
Biochemistry Concentration Suggested Four-Year Plan

Based on course availability and student needs and preferences, the selected sequences will probably vary from those presented below. Students should consult with their adviser to make the most appropriate elective choices.

Freshman

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Units Term 2</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>MATH 273 or 237 (Core 3)</td>
<td>4 BIOL 200 &amp; 200L</td>
<td>4</td>
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<tr>
<td>CHEM 131 &amp; 131L (Core 7)</td>
<td>4 CHEM 132 &amp; 132L (Core 8)</td>
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</tr>
<tr>
<td>Core 1 (or Core 2)</td>
<td>3 Core 2 (or Core 1)</td>
<td>3</td>
</tr>
<tr>
<td>Core 4</td>
<td>3 Core 5</td>
<td>3</td>
</tr>
</tbody>
</table>

Sophomore

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Units Term 2</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 331</td>
<td>5 CHEM 332</td>
<td>5</td>
</tr>
<tr>
<td>BIOL 309</td>
<td>4 MATH 237 or 237</td>
<td>4</td>
</tr>
<tr>
<td>MBBB 201 or COSC 175</td>
<td>4 MBBB 493</td>
<td>1</td>
</tr>
<tr>
<td>Core 6</td>
<td>3 Core 9</td>
<td>3</td>
</tr>
<tr>
<td>Core 10</td>
<td>3</td>
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Junior

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Units Term 2</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>CHEM 210</td>
<td>5 CHEM 351</td>
<td>3</td>
</tr>
<tr>
<td>MBBB 301 or BIOL 409</td>
<td>4 CHEM 356</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 211 or 241</td>
<td>4 BIOL 409 or MBBB 301</td>
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<tr>
<td>Core 11</td>
<td>3 PHYS 212 or 242</td>
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<tr>
<td>Core 12</td>
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Senior

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<tr>
<th>Term 1</th>
<th>Units Term 2</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>CHEM 357, BIOL 450, or CHEM 450</td>
<td>3 CHEM 345</td>
<td>3</td>
</tr>
<tr>
<td>Research</td>
<td>3 CHEM 372</td>
<td>2</td>
</tr>
<tr>
<td>Elective</td>
<td>3-4 Elective</td>
<td>3-4</td>
</tr>
<tr>
<td>Core 13</td>
<td>3 Elective</td>
<td>2-3</td>
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<tr>
<td>Core 14</td>
<td>3 Elective</td>
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Total Units 120-122

Bioinformatics Concentration Suggested Four-Year Plan

Based on course availability and student needs and preferences, the selected sequences will probably vary from those presented below. Students should consult with their adviser to make the most appropriate elective choices.

Freshman

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<th>Term 1</th>
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<td>BIOL 200</td>
<td>4 CHEM 132 &amp; 200L &amp; 132L (Core 8)</td>
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<tr>
<td>CHEM 131 &amp; 131L (Core 7)</td>
<td>4 MATH 273 or 237 (Core 3)</td>
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</tr>
<tr>
<td>Core 1 (or Core 2)</td>
<td>3 Core 2 (or Core 1)</td>
<td>3</td>
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<tr>
<td>Core 4</td>
<td>3 Core 5</td>
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Sophomore

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<tr>
<th>Term 1</th>
<th>Units Term 2</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 309</td>
<td>4 PHYS 211</td>
<td>4</td>
</tr>
<tr>
<td>MBBB 201 or COSC 175</td>
<td>4 MATH 237 or 273</td>
<td>4</td>
</tr>
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<td>Elective</td>
<td>4 MBBB 493</td>
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<tr>
<td>Core 6</td>
<td>3 Elective</td>
<td>4</td>
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<td>Core 9</td>
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Junior

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<th>Units Term 2</th>
<th>Units</th>
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<tbody>
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<td>5 CHEM 332</td>
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<tr>
<td>PHYS 212</td>
<td>4 BIOL 409</td>
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<td>Core 10</td>
<td>3 Elective</td>
<td>3-4</td>
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<td>Core 11</td>
<td>3 Core 12</td>
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Senior

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<tr>
<th>Term 1</th>
<th>Units Term 2</th>
<th>Units</th>
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<tbody>
<tr>
<td>BIOL 312, 410, or 412</td>
<td>2 BIOL 408</td>
<td>4</td>
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<tr>
<td>CHEM 351</td>
<td>3 Upper Level Bio Elective</td>
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<td>MBBB 301</td>
<td>4 Elective</td>
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<tr>
<td>Research</td>
<td>3 Elective</td>
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<tr>
<td>Core 13</td>
<td>3 Core 14</td>
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Total Units 120-122

Molecular Biology Concentration Suggested Four-Year Plan

Based on course availability and student needs and preferences, the selected sequences will probably vary from those presented below. Students should consult with their adviser to make the most appropriate elective choices.

Freshman

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<tr>
<td>BIOL 200</td>
<td>4 COSC 236</td>
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<td>COSC 175</td>
<td>4 MATH 273 (Core 3)</td>
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<td>Core 1 (or Core 2)</td>
<td>3 Core 2 (or Core 1)</td>
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<td>Core 4</td>
<td>3 Core 5</td>
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Sophomore

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<tr>
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<th>Units Term 2</th>
<th>Units</th>
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<tbody>
<tr>
<td>COSC 237</td>
<td>4 CHEM 131 &amp; 131L (Core 7)</td>
<td>4</td>
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<tr>
<td>Major in Molecular Biology, Biochemistry and Bioinformatics</td>
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**Junior**

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<td>CHEM 132 &amp; 132L (Core 8)</td>
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<td>MBBB 301</td>
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<td>3 MBBB 315 or MATH 263</td>
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<td>COSC 457 or CIS 458</td>
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**Senior**

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<td>MBBB 401</td>
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<td>CHEM 351</td>
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<td>BIOL 409</td>
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<td>Research</td>
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**Total Units 125-126**

1. Demonstrate mastery of content in the disciplines of Molecular Biology, Biochemistry and Bioinformatics.
2. Ability to solve problems by the application of relevant concepts and analytical tools.
3. Ability to conduct quantitative analysis of Molecular Biology and Biochemical data.
4. Ability to correctly summarize and critically analyze new scientific information in the literature.