Biotechnology

Dr. Debra Mohler, Director
Phone: (540) 568-8803
Location: Physics Chemistry Building, Room 1124

Mission
In cooperation with the Department of Integrated Science and Technology and the Department of Chemistry and Biochemistry, the Department of Biology offers a four-year, cross-disciplinary B.S. degree program for a major in biotechnology. Students majoring in biotechnology will be prepared to enter the biotechnology workforce, or to pursue graduate education in a wide array of fields including medical, agricultural, or industrial biotechnology. Fields of research in biotechnology include applied molecular biology, bioinformatics, and genomics. Biotechnology majors must complete 47-53 credit hours of science foundation courses, 17 credit hours of biotechnology transition and core courses, and 15 credit hours of elective courses. Students may not receive dual credit toward the biotechnology major for 300- and 400-level biology courses that are applied toward the biology major

Major and Degree Requirements
Bachelor of Science in Biotechnology

Degree Requirements
General Education\(^1\)
41
Quantitative requirement\(^2\)
3
Scientific Literacy requirement\(^3\)
3-4
Major requirements (listed below) and electives
79
126

\(^1\) The General Education program contains a set of requirements each student must fulfill. The number of credit hours necessary to fulfill these requirements may vary.

\(^2\) In addition to General Education.

Major Requirements
Science Foundation Courses

Complete all of the following:
BIO 114. Organisms
BIO 124. Ecology and Evolution
BIO 214. Cell and Molecular Biology
BIO 224. Genetics and Development
CHEM 131. General Chemistry I
CHEM 131L. General Chemistry Laboratory
CHEM 132. General Chemistry II
CHEM 132L. General Chemistry Laboratory
CHEM 341. Organic Chemistry Lecture I
CHEM 342. Organic Chemistry Lecture II
CHEM 346L. Organic Chemistry Laboratory

Choose one of the following sets of courses:
MATH 231. Calculus with Functions I
MATH 232. Calculus with Functions II
OR MATH 235 Calculus I

Choose one of the following courses:
MATH 220. Elementary Statistics
MATH 285. Data Analysis

E-mail: mohlerdl@jmu.edu
Web site: http://www.jmu.edu/biology/biotechnology.shtml

Choose one of the following sets of courses:
PHYS 125. Principles of Physics with Biological Applications I
PHYS 126. Principles of Physics with Biological Applications II
OR
PHYS 140-140L. College of Physics I with Laboratory
PHYS 150-150L. College of Physics II with Laboratory

Biotechnology Transition & Core Courses

Complete all of the following:
BIO 106. Biotechnology Seminar
ISAT 305. Biotechnology Lab
ISAT 451. Biotechnology in Industry and Agriculture
ISAT 456. Ethical, Legal and Social Implications of Biotechnology
CHEM/BIO 361. Biochemistry I
CHEM 366L. Biochemistry Lab
BIO 480. Advanced Molecular Biology

Biotechnology Elective Courses

Select 15 credit hours from the following list. Other 300- and 400-level courses may meet the requirement but permission must be sought from the biotechnology program director.

BIO 316. Principles of Animal Development
BIO/MATH 342. Mathematical Models in Biology
BIO 364. Human Uses of Plants
BIO 365. Laboratory in Human Uses of Plants
BIO 370. Animal Physiology
BIO 380. General Microbiology
BIO 416. Human Embryology
BIO 420. Medical Parasitology
BIO 421. Medical Parasitology Lab
BIO 430. Human Genetics
BIO 442. Immunology
BIO 443. Immunology Laboratory
BIO 444. Virology
BIO 445. Neurobiology
BIO 448. Medical Microbiology
BIO 450. Evolutionary and Societal Impacts of Developmental Biology
BIO 454. Introduction to Biometrics
BIO 455. Plant Physiology
BIO 465. Environmental Toxicology
BIO 466. Toxicology Seminar
BIO 472. Human Metabolism
BIO 475. Advanced Cell Biology
BIO 481. Genomics
BIO 482. Human Histology
BIO 490. Biomechanics
CHEM 331. Physical Chemistry I
CHEM 336L. Applied Physical Chemistry Laboratory
CHEM 351. Analytical Chemistry
CHEM 352. Instrumental Analysis
CHEM 352L. Instrumental Analysis Laboratory
CHEM 370. Inorganic Chemistry I

http://www.jmu.edu/catalog/10
Students are highly encouraged to include academic credit for research, up to 8 credits of which may be applied to the concentration requirement.

**Recommended Schedule for Majors**

First semester, first year biotechnology majors are encouraged to start with a 14-15 hour course load. This will generally include a biology course (four credit hours), CHEM 131 and CHEM 131L, and/or a math course, plus General Education. The work load will then be increased in the second semester based on the level of success during the first semester.

<table>
<thead>
<tr>
<th>First Year</th>
<th>Credit Hours</th>
</tr>
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<tbody>
<tr>
<td>BIO 114. Organisms</td>
<td>4</td>
</tr>
<tr>
<td>BIO 124. Ecology and Evolution</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 131 &amp; CHEM 131L. General Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 132 &amp; CHEM 132L. General Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>Quantitative course</td>
<td>4-8</td>
</tr>
<tr>
<td>General Education: Cluster One</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>29-33</strong></td>
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</tbody>
</table>

### Second Year

<table>
<thead>
<tr>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>BIOT 260. Biotechnology Seminar</td>
</tr>
<tr>
<td>ISAT 305. Biotechnology Lab</td>
</tr>
<tr>
<td>BIO 214. Cell and Molecular Biology</td>
</tr>
<tr>
<td>BIO 224. Genetics and Development</td>
</tr>
<tr>
<td>CHEM 341-342. Organic Chemistry Lecture</td>
</tr>
<tr>
<td>CHEM 346L. Organic Chemistry Laboratory</td>
</tr>
<tr>
<td>Quantitative course</td>
</tr>
<tr>
<td>General Education: from Clusters Two, Four and Five</td>
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<tr>
<td><strong>Total</strong></td>
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### Third Year

<table>
<thead>
<tr>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>CHEM/BIO 361 and CHEM 366L. Biochemistry Lab</td>
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<tr>
<td>BIO 480. Advanced Molecular Biology</td>
</tr>
<tr>
<td>Biotechnology Electives</td>
</tr>
<tr>
<td>Physics courses</td>
</tr>
<tr>
<td>General Education: from Clusters Two, Four and Five</td>
</tr>
<tr>
<td>Electives</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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### Fourth Year

<table>
<thead>
<tr>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>ISAT 456. Social and Ethical Issues</td>
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<tr>
<td>ISAT 451. Biotechnology in Industry</td>
</tr>
<tr>
<td>Biotechnology Electives</td>
</tr>
<tr>
<td>General Education: from Clusters Two, Four and Five</td>
</tr>
<tr>
<td>Electives</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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