Department of Biology

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E-mail: cockinwd@jmu.edu

Professors

Associate Professors

Assistant Professors
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Instructor
A. Pesce

Mission Statement
The Department of Biology holds as its primary core value a commitment to providing superlative teaching for students. To accomplish this mission, we will create an environment for learning that will include opportunities for undergraduate research, a broadly based academic program, a supportive, diverse and collaborative faculty, an understanding of the process of science, and a recognition of the importance of community outreach and involvement.

Career Opportunities and Advanced Fields of Study
- Anthropology
- Aquatic Science
- Biodiversity
- Bioinformatics
- Biotechnology
- Botany
- Clinical Laboratory Sciences
- Dentistry
- Ecology and Environmental Science
- Epidemiology
- Forensic Science
- Forestry
- Genetic Counseling
- Graduate School in the Biological Sciences
- Immunology
- Landscape Architecture
- Medicine
- Microbiology
- Microscopy
- Neurobiology
- Nursing
- Occupational Therapy
- Optometry
- Pharmacology
- Physical Therapy
- Physician Assistant
- Physiology
- Research Assistant
- Scientific Writing
- Secondary Education
- U.S. Fish and Wildlife Service
- Veterinary Medicine
- Virology
- Zoology

Students interested in pursuing any of the career opportunities mentioned above should contact the biology office at (540) 568-6225. An appropriate adviser will be assigned for mentoring and course selection purposes.

Co-curricular Activities and Organizations
Biology majors participate in activities such as
- Weekly departmental seminars
- Tri-Beta, a national biology society
- Pre-professional health clubs and honor society
- EARTH, an environmental action club
- Summer and academic-year research opportunities
- Summer courses at biological field stations
- Internships with various organizations
- Aiding in teaching as student assistants
- Presenting papers at meetings
- Volunteering at Rockingham Memorial Hospital and with the rescue squad

Special Requirements
To be used as prerequisites for biology courses, grades of “C-” or higher should be earned in the following: BIO 103, BIO 114, BIO 124, BIO 214, BIO 224, CHEM 131, CHEM 131L, CHEM 132, and CHEM 132L. In order to be considered as possible transfer credit for BIO 114 and 124, the entire year of a freshman course must be completed at the “C” or higher level. Matriculated JMU students may not obtain BIO 114 and 124 through transfer credit. In order for BIO 270 and 290 credit to be transferred, both semesters of an Anatomy and Physiology course (A&P I and A&P II) must be completed with a grade of “C” or higher. Additional information is available on Page 90.
Bachelor of Science in Biology

The department offers a four-year B.S. degree program for a major in biology and for a major in biology qualifying for the Secondary Collegiate Professional License. Requirements for the B.A. degree can be met by adding the completion of an intermediate level foreign language and three credit hours in philosophy. Students may not receive dual credit toward the biology major for 300- and 400-level BIO courses that are applied toward the biotechnology major.

Biology majors must complete 40 credit hours of biology courses including 20 credit hours at the 300 and 400 level. Specific requirements include four core courses (BIO 114, BIO 124, BIO 214 and BIO 224), at least two upper-division laboratory courses and one course from a list of courses with an emphasis on organismal diversity. In addition, biology majors must complete a set of cognate courses in chemistry, mathematics and physics that are listed below. Students are encouraged to participate in independent research with a faculty mentor. Credits earned doing research will count toward the biology major but some restrictions apply. When requested, senior biology majors are expected to participate in program assessment test activities as a graduation requirement. Assessment information helps the department modify the curriculum to meet student needs.

Degree Requirements

Required Courses

Credit Hours

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>41</td>
</tr>
<tr>
<td>Quantitative requirement (in addition to General Education)</td>
<td>3</td>
</tr>
<tr>
<td>Scientific Literacy requirement (in addition to General Education)</td>
<td>3-4</td>
</tr>
<tr>
<td>Major requirements (listed below) and electives</td>
<td>70-74</td>
</tr>
</tbody>
</table>

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.

Major Requirements

Core Courses

Credit Hours

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<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>BIO 214. Cell and Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIO 224. Genetics and Development</td>
<td>4</td>
</tr>
</tbody>
</table>

Cognate Requirements

The following five groups of support courses are required for the biology major. Consult your academic adviser about which courses are appropriate.

Upper-level Biology Course Requirements

Students in the biology major must complete at least 20 credit hours at the 300 and 400 level. One course must be from a group of courses on organismal diversity. Two courses must have a laboratory component. Three credits of independent research (BIO 495, 497 and/or 499) may be used for one, but only one, of the laboratory courses.

1) Complete all of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 131. General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 131L. General Chemistry Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 132. General Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 132L. General Chemistry Laboratory</td>
<td>1</td>
</tr>
</tbody>
</table>

2) Complete all of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 341. Organic Chemistry Lecture I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 342. Organic Chemistry Lecture II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 346L. Organic Chemistry Laboratory</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: Chemistry beyond the minimum requirement, especially biochemistry, is recommended in many areas of biology. Consult with your adviser about which courses are appropriate.

3) Choose one of the following sets of courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 231. Calculus with Functions I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 232. Calculus with Functions II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 235. Calculus I</td>
<td>4</td>
</tr>
</tbody>
</table>

Note: Mathematics beyond the minimum requirement is desirable in many areas of biology. Consult with your adviser about which courses are appropriate.

4) Choose one of the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 220. Elementary Statistics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 285. Data Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MATH 318. Introduction to Probability and Statistics</td>
<td>4</td>
</tr>
</tbody>
</table>

Note: Statistics beyond the minimum requirement is desirable in many areas of biology. Consult with your adviser about which courses are appropriate.

5) Choose one of the following sets of courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 125. Principles of Physics with Biological Applications</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 126. Principles of Physics with Biological Applications II</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 140-140L. College Physics I with Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 150-150L. College Physics II with Laboratory</td>
<td>4</td>
</tr>
</tbody>
</table>

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BIO 370. Animal Physiology
BIO 380. General Microbiology
BIO 386. Field Botany
BIO 403. Animal Communication
BIO 410. Advanced Human Anatomy
BIO 421. Medical Parasitology Laboratory (must be taken with BIO 420)
BIO 443. Immunology Laboratory (must be taken with BIO 442)
BIO 445. Neurobiology
BIO 451. Ecological Systems
BIO 452. Population Ecology
BIO 455. Plant Physiology
BIO 456. Landscape Ecology
BIO 458. Comparative Animal Physiology
BIO 459. Freshwater Ecology
BIO 460. Plant Cell and Tissue Culture
BIO 470. Morphology of Nonvascular Plants
BIO 480. Advanced Molecular Biology
BIO 482. Human Histology
BIO 486. Systematics of Vascular Plants
BIO 490. Biomechanics

Only one Topics in Biology (BIO 426/427) may fulfill one of the laboratory course and/or of organismal requirements. A list of the topics that may be used is available in the biology department office, Burruss 242. These can be repeated with a change in topic. Only up to 12 credits can be applied toward the 40-hour biology course requirement.

Elective Biology Courses
Additional biology courses must be selected to complete the 40 credit hour program. Students are strongly encouraged to discuss their career interests with an adviser who can help select courses best suited to their needs. Students are encouraged to participate in independent research with a faculty mentor (to a maximum of eight credits).

A maximum of eight credits of BIO 494, 495, 496, 497, 499 and ISCI 450 can be counted toward the biology major.

Recommended Schedule for Majors
First semester first year biology majors are encouraged to start with a 14-15 hour course load. This will generally include BIO 114, 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 first semester success.

First Year
BIO 114. Organisms 4
BIO 124. Ecology and Evolution 4
CHEM 131-132. General Chemistry Lectures 6
CHEM 131L-132L. General Chemistry Laboratories 2
Mathematics courses 4-8
General Education: Cluster One 9-12

Total: 29-33

Second Year
BIO 214. Cell and Molecular Biology 4
BIO 224. Genetics and Development 4
CHEM 341-342. Organic Chemistry Lecture 6
CHEM 346L. Organic Chemistry Laboratory 2
Mathematics course 3-4
General Education: from Clusters Two, Four and Five 12

Total: 31-32

Third Year
Upper-level Biology laboratory courses 8
Biology elective 3-4
Physics courses 3-4
General Education: from Clusters Two, Four and Five Electives 6

Total: 32-33

Concentration in Ecology and Environmental Biology
Students choosing a concentration in ecology and environmental biology (biology/EEB) must complete 40 credit hours of biology courses. Specific requirements include four core courses and at least 24 credit hours chosen from a list of elective courses at the 300 and 400 level. This must include one course with an emphasis on organismal diversity and at least two upper-division laboratory or field courses. Three credit hours of independent research (BIO 497 and/or 499) may be used for one, but only one, of the laboratory courses.

In addition, biology/EEB majors must choose from a set of cognate courses that include chemistry, geography, mathematics, statistics and physics. Students are encouraged to participate in independent research with a faculty mentor. Credits earned doing research will count toward the biology/EEB major, but some restrictions apply.

The biology/EEB concentration differs from the biology major in the following ways:

- Students must take two additional cognate courses:
  - MATH 321. Analysis of Variance and Experimental Design
  - BIO 454. Introduction to Biometrics
  - GEOG 366. Introduction to Geographic Information Science
  - or BIO 457. Biological Applications of Geographic Information Systems

- For their upper-level Biology course requirements, students must complete at least 24 credit hours from the following list. At least one of these must be an organismal diversity course and at least two must be laboratory/field courses. With prior approval from the concentration coordinator, BIO 426 and/or BIO 427 may be substituted. Students are strongly encouraged to discuss their career interests with an adviser who can help select courses best suited to their needs. Students are encouraged to participate in independent research with a faculty mentor (to a maximum of eight credits).

In addition to the courses listed below, a maximum of eight credits of BIO 494, 495, 496, 497, 499 and ISCI 450 can be counted toward the biology/EEB concentration.

BIO 305. Ornithology 1, 2
BIO 310. General Entomology 1, 2
BIO 320. Comparative Anatomy of Vertebrates 1, 2
BIO 340. Morphology and Anatomy of Vascular Plants 1, 2
BIO/MATH 342. Mathematical Models in Biology
BIO 345. Animal Field Biology
BIO 370. Animal Physiology 2
BIO 380. General Microbiology 1, 2
BIO 386. Field Botany 1, 2
BIO/PSCY 395. Comparative Animal Behavior
BIO 403. Animal Communication
BIO 404. Evolutionary Analysis
BIO 409. Marine and Freshwater Invertebrates 1
BIO 451. Ecological Systems 2
BIO 452. Population Ecology 2
BIO 453. Microbial Ecology and Evolution
BIO 454. Introduction to Biometrics
BIO 455. Advanced Molecular Biology
BIO 456. Landscape Ecology
BIO 457. Biological Applications of Geographic Information Systems
BIO 458. Comparative Animal Physiology
BIO 459. Freshwater Ecology
BIO 460. Plant Cell and Tissue Culture
BIO 470. Morphology of Nonvascular Plants
BIO 480. Advanced Molecular Biology
BIO 482. Human Histology
BIO 486. Systematics of Vascular Plants
BIO 490. Biomechanics
BIO 491. Comparative Animal Physiology
BIO 492. Principles of Evolution
BIO 493. Introduction to Animal Behavior
BIO 494. Field Ecology and Evolution
BIO 495. Field Ecology and Evolution
BIO 496. Field Ecology and Evolution
BIO 497. Independent Research (Research Option)
BIO 498. Independent Research (Independent Study Option)
BIO 499. Independent Research (Independent Study Option)

College of Science and Mathematics: Department of Biology

http://www.jmu.edu/catalog/09
During the fourth year of study the student will take further courses (at least 30 hours) at Virginia Tech for credit toward the B.S. in biology from JMU.

A total of 38 semester hours of biology and biology-related courses (taken at JMU and Virginia Tech) will be required for the JMU B.S. in biology, which will be conferred after the fourth year of study. If the student’s academic record is satisfactory, then they will be admitted into the graduate program of the Department of Forestry at Virginia Tech, where they will spend approximately three semesters (12 months) taking additional forestry and forestry-related courses to obtain the degree of Master of Forestry. To apply for the dual degree program, the student must have the permission of the dean of the College of Science and Mathematics. Information about the program can be obtained from the Department of Biology. Students are encouraged to inquire as early as possible in their undergraduate careers.

Minor Requirements
Biochemistry and Molecular Biology Minor

See Page 101 for the description of the interdisciplinary biochemistry and molecular biology minor.

Biology Minor

Students choosing to minor in biology must complete a program of at least 20 credit hours including:

<table>
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<td>BIO 124. Ecology and Evolution</td>
<td>4</td>
</tr>
<tr>
<td>BIO 214. Cell and Molecular Biology</td>
<td>3-4</td>
</tr>
<tr>
<td>or BIO 220. Cell Biology</td>
<td></td>
</tr>
<tr>
<td>Biology electives</td>
<td>8-9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>

Credit by Examination

When evidence of sufficient background or preparation is presented, the Department of Biology offers credit by examination in most of its courses at the discretion of the course instructor or coordinator. Students seeking such credit should make arrangements with the course instructor or coordinator and obtain approval of the department head.

Teaching Licensure

Biology majors need courses in physics and geology as well as inorganic and organic chemistry for many science education positions. In addition to the general education and academic major requirements, biology majors desiring secondary teacher licensure must be admitted to teacher education, complete the pre-professional program in secondary education at the undergraduate level and complete the graduate level Master of Arts in Teaching degree.

It is critical that students seeking licensure consult regularly with both their education adviser and their major adviser to support their progression through the programs. For a full description of the program in secondary teaching, refer to the Department of Middle, Secondary and Mathematics Education, in addition to the College of Education section of the catalog.