
Biology

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Assistant Professors

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[Print Version of Catalog](#)



Department of Biology

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](#)¹
- Botany
- Clinical Laboratory Sciences
- Dentistry
- Ecology and Environmental Science
- Epidemiology
- Forensic Science
- [Forestry](#)²
- 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

1 See additional information regarding this cross disciplinary major.

2 See additional information regarding this affiliate program.

Students interested in pursuing any of these career opportunities should contact the biology office. An appropriate adviser will be assigned for mentoring and course selection.

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 140](#), [BIO 150](#), [BIO 240](#), [BIO 250](#), [CHEM 131](#), [CHEM 131L](#), [CHEM 132](#) and [CHEM 132L](#). In order to be considered as possible transfer credit for [BIO 140](#) and [BIO 150](#), the entire year of a freshman course must be completed at the "C" or higher level.

It is the student's responsibility to provide evidence to demonstrate that the subject content of the sequence taken is the same as [BIO 140](#) and [BIO 150](#) combined. In order for [BIO 270](#) and [BIO 290](#) credit to be transferred, both semesters of an Anatomy and Physiology course (A&P I and A&P II) must be completed at the "C" or higher level. A single semester of either of these sequences transfers as BIO 000. Practical hands-on experience in the field and/or laboratory is important content of laboratory based courses.

Transfer credit for courses including laboratories will only be awarded for those having skill and application content comparable to that of JMU courses. A maximum of four hours of lower division biology elective credit applicable toward the major or minor may be transferred as BIO 200. Upper division biology credits applicable toward the major or minor are transferred as specific courses or as [BIO 300](#) or [BIO 426](#). Credits not applicable toward the major or minor, but applicable toward the 120 hour degree requirement, are transferred as BIO 000. A maximum of eight credit hours of first year (100) level BIO courses may be applied to the biology major or minor requirements.

Students who declared a major in biology before fall 2016 should consult with their adviser about course requirements.

Degree and Major Requirements

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 140](#), [BIO 150](#), [BIO 240](#) and [BIO 250](#)), 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, statistics 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
General Education ¹	41
Quantitative requirement (in addition to General Education) ²	3
Scientific Literacy requirement (in addition to General Education) ²	3-4
Biology requirements (listed below)	40
Cognate requirements (listed below)	31-36
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	120

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 The quantitative and scientific literacy requirements are met by courses required in the major.

Major Requirements

Core Courses

	Credit Hours
BIO 140 . Foundations of Biology I	4
BIO 150 . Foundations of Biology II	4
BIO 240 . Genetics	4
BIO 250 . Ecology and Evolution	4
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	16

Additional Biology Course Requirements

Students in the biology major must complete at least 24 credit hours of approved biology courses and at least 20 of these must be at the 300 and 400 levels. Also, one course must be from a group of courses on organismal diversity, and two courses must have a laboratory component. Courses in both lists may count for both requirements. Three credits of independent research ([BIO 497](#) and/or [BIO 499](#)) may be used for one, but only one, of the laboratory courses.

1. Choose at least one organismal diversity courses:

- [BIO 305](#). Ornithology
- [BIO 309](#). Marine and Freshwater Invertebrates
- [BIO 310](#). General Entomology
- [BIO 320](#). Comparative Anatomy of Vertebrates
- [BIO 340](#). Morphology and Anatomy of Vascular Plants
- [BIO 345](#). Animal Field Biology
- [BIO 360](#). Plant Biology
- [BIO 364](#). Human Uses of Plants
- [BIO 386](#). Field Botany
- [BIO 412](#). Mammalogy
- [BIO 470](#). Morphology of Nonvascular Plants
- [BIO 486](#). Systematics of Vascular Plants

2. Choose at least two laboratory courses:

- [BIO 305](#). Ornithology
- [BIO 310](#). General Entomology
- [BIO 316L](#). Principles of Animal Development (taken with [BIO 316](#))
- [BIO 320](#). Comparative Anatomy of Vertebrates
- [BIO 340](#). Morphology and Anatomy of Vascular Plants
- [BIO/MATH 342](#). Mathematical Models in Biology
- [BIO 343L](#). Immunology Laboratory (must be taken with [BIO 343](#))
- [BIO 345](#). Animal Field Biology
- [BIO 346](#). Bacterial Discovery
- [BIO 348L](#). Medical Microbiology Lab (taken with [BIO 348](#))
- [BIO 364L](#). Laboratory in Human Uses of Plants taken with [BIO 364](#))
- [BIO 370](#). Animal Physiology
- [BIO 386](#). Field Botany
- [BIO 387L](#). Environmental Biology Lab (taken with [BIO 387](#))
- [BIO/GEOL 400](#). Geology and Ecology of the Bahamas
- [BIO/GEOG 402](#). Forest Ecology
- [BIO 403](#). Animal Communication

[BIO 410](#). Advanced Human Anatomy
[BIO 412](#). Mammalogy
[BIO 416](#). Human Embryology
[BIO 420L](#). Medical Parasitology Lab (taken with [BIO 420](#))
[BIO 432](#). Light Microscopy
[BIO 445](#). Neurobiology
[BIO 446](#). Experimental Neurobiology
[BIO 452](#). Population Ecology
[BIO 455](#). Plant Physiology
[BIO 456](#). Landscape Ecology
[BIO 457](#). Biological Applications of Geographic Information Systems
[BIO 459](#). Freshwater Ecology
[BIO 460](#). Plant Biotechnology
[BIO 465](#). Environmental Toxicology
[BIO 470](#). Morphology of Nonvascular Plants
[BIO 480](#). Advanced Molecular Biology
[BIO 481](#). Genomics
[BIO 482](#). Human Histology
[BIO 483](#). Bioinformatics
[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 organismal requirements. A list of the topics that may be used is available in the biology department office. These can be repeated with a change in topic, but only 12 credits from [BIO 426/427](#) can be applied toward the 40-hour biology course requirement.

When choosing additional biology courses to complete the 40 credit hour requirement, 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 and teaching courses with a faculty mentor, though a maximum of eight credits of [BIO 492](#), [BIO 494](#), [BIO 495](#), [BIO 496](#), [BIO 497](#), [BIO 499](#) and [ISCI 450](#) can be counted toward the biology major.

Cognate Requirements

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

Required Courses

1) Complete all of the following:
[CHEM 131](#). General Chemistry I
[CHEM 131L](#). General Chemistry Laboratory
[CHEM 132](#). General Chemistry II
[CHEM 132L](#). General Chemistry Laboratory

Credit Hours

11

CHEM 241 . Organic Chemistry I	
2) Choose one of the following: ¹	3
CHEM 242 . Organic Chemistry II	
BIO/CHEM 361 . Biochemistry I	
CHEM 353 . Environmental Chemistry	
GEOL/CHEM 355 . Geochemistry of Natural Waters	
3) Choose one of the following sets of courses: ²	4-7
MATH 231 . Calculus with Functions I	
MATH 232 . Calculus with Functions II	
or	
MATH 235 . Calculus I	
4) Choose one of the following courses: ³	3-4
MATH 220 . Elementary Statistics	
MATH 285 . Data Analysis	
MATH 318 . Introduction to Probability and Statistics	
5) Choose one of the following sets of courses:	8
PHYS 140 -140L . College Physics I with Laboratory	
PHYS 150 -150L . College Physics II with Laboratory	
or	
PHYS 240-140L . University Physics I with Laboratory	
PHYS 250 -150L . University Physics II with Laboratory	
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	30-33

1 Chemistry beyond the minimum requirement is recommended in many areas of biology. Consult with your adviser about which courses are appropriate. Students counting [CHEM 242](#) or [GEOL/CHEM 355](#) toward their cognate requirement may petition to count [BIO/CHEM 361](#) for biology major credit. [BIO/CHEM 361](#) may not be used for both a chemistry cognate and a biology major elective.

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

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

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 140](#), [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

	Credit Hours
BIO 140 . Foundations of Biology I ¹	4
BIO 150 . Foundations of Biology II	4
CHEM 131-132 . General Chemistry Lectures ¹	6
CHEM 131L-132L . General Chemistry Laboratories	2
Mathematics courses ¹	4-7
General Education: Cluster One	9-12
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	29-35

1 Fulfills General Education: Cluster Three.

Second Year

	Credit Hours
BIO 240 . Genetics	4
BIO 250 . Ecology and Evolution	4
CHEM 241 . Organic Chemistry I	3
CHEM 242 , BIO/CHEM 361 , CHEM 353 or GEOL/CHEM 355	3
Mathematics course	3-4
General Education: from Clusters Two, Four and Five	12
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	29-30

Third Year

	Credit Hours
Upper-level biology laboratory courses	8
Biology elective	3-4
Physics courses	8
General Education: from Clusters Two, Four and Five	7
Electives	6
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	32-33

Fourth Year

	Credit Hours
Upper-level biology laboratory course	4
Biology electives	9
General Education: from Clusters Two, Four and Five	3
Electives	15
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	31

Concentrations

Concentration in Ecology and Environmental Biology

The biology department offers a concentration within the biology major for students with interest in ecology, field biology, natural resources, environmental biology, conservation biology, evolution, animal behavior and organismal biology.

Students choosing a concentration in ecology and environmental biology must meet all of the requirements for the biology major as well as the following additional requirements. Courses for this concentration can also satisfy biology major requirements.

1. Students must complete at least 20 credit hours from the following list. 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. In addition to the courses listed below, a maximum of eight credits of [BIO 495](#), [BIO 496](#), [BIO 497](#) and [BIO 499](#) can be counted toward the EEB concentration.

[BIO 305](#). Ornithology^{1, 2}

[BIO 309](#). Marine and Freshwater Invertebrates¹

[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^{1,2}
[BIO 354](#). Global Climate Change and Life
[BIO 360](#). Plant Biology¹
[BIO 370](#). Animal Physiology²
[BIO 380](#). General Microbiology^{1,2}
[BIO 386](#). Field Botany^{1, 2}
[BIO 387](#). Environmental Microbiology
[BIO 387L](#). Environmental Microbiology Laboratory²
[BIO/PSYC 395](#). Comparative Animal Behavior
[BIO/GEOL 400](#). Geology and Ecology of the Bahamas
[BIO/GEOG 402](#). Forest Ecology²
[BIO 403](#). Animal Communication²
[BIO 404](#). Evolutionary Analysis
[BIO 412](#). Mammalogy^{1, 2}
[BIO 447](#). Evolution and Ecology of Infectious Disease
[BIO 449](#). Insect Ecology^{1,2}
[BIO 452](#). Population Ecology²
[BIO 453](#). Microbial Ecology and Evolution
[BIO 454](#). Introduction to Biometrics
[BIO 455](#). Plant Physiology²
[BIO 456](#). Landscape Ecology²
[BIO 457](#). Biological Applications of Geographic Information Systems²
[BIO 459](#). Freshwater Ecology²
[BIO 465](#). Environmental Toxicology²
[BIO 466](#). Toxicology Seminar
[BIO 470](#). Morphology of Nonvascular Plants^{1,2}
[BIO 486](#). Systematics of Vascular Plants^{1,2}

1 Meets the biology major requirement for an organismal diversity course.

2 Meets one of the biology major requirements for laboratory/field courses.

2. Students must take two additional cognate courses:

- [MATH 321](#). Analysis of Variance and Experimental Design or [MATH 322](#). Applied Linear Regression or [BIO 454](#). Introduction to Biometrics
- [GEOG 215](#). Geospatial Tools I - Cartography and GIS or [BIO 457](#). Biological Applications of Geographic Information Systems

It is highly recommended that students take additional upper-level degree elective courses in geography/GIS (such as [GEOG 466](#). GIS and Geographic Databases, or [GEOG 467](#). GIS Project Management) and in statistics (such as [MATH 322](#). Applied Linear Regression, or [MATH 324](#). Applied Nonparametric Statistics). Students should consult with their adviser about which courses are appropriate.

Concentration in Microbiology

The biology department offers a concentration within the biology major for students with interest in bacteriology, virology, immunology, parasitology and infectious disease.

Students choosing a concentration in microbiology must meet all the requirements for the biology major, including the following specific requirements.

Required Courses

	Credit Hours
BIO 245 . General Microbiology	4
BIO 246 . Microbiology Seminar	1
BIO 348 . Medical Microbiology	3
BIO 387 . Environmental Microbiology	3
Choose one of the following courses:	1-2
BIO 204 . Viral Genome and Bioinformatics	
BIO 346 . Bacterial Discovery ¹	
Choose two courses. With prior approval from the concentration coordinator, BIO 426 and/or BIO 427 may be substituted.	6
BIO 343 . Immunology	
BIO 420 . Medical Parasitology	
BIO 444 . Virology	
BIO 447 . Evolution and Ecology of Infectious Disease	
BIO 453 . Microbial Ecology and Evolution	

18-19

1 Meets one of the biology major requirements for a laboratory/field course.

Concentration in Neuroscience

The biology department offers a concentration within the biology major for students with interests in cell and molecular, systems, and behavioral aspects of the nervous system and its functionality.

Students choosing a concentration in neuroscience must meet all of the requirements for the biology major in addition to the following requirements. Courses for this concentration can also satisfy biology major requirements.

Required Courses

Choose one:

Credit Hours

3

[BIO 301](#). Introductory Neuroscience

[BIO/PSYC 385](#). Biopsychology

Choose one:

[BIO/CSD 415](#). Neuroanatomy and Neurogenic Communication Disorders

[BIO 445](#). Neurobiology¹

Neuroscience Concentration Electives: Choose three, of which at least one must be principally a neurobiology course ([BIO/PSYC 375](#), [BIO/CSD 415](#), [BIO 445](#), or [BIO 446](#)).

[BIO 316](#). Animal Development, with optional laboratory¹

[BIO/PSYC 375](#). Sensation and Perception

[BIO/CSD 415](#). Neuroanatomy and Neurogenic Communication Disorders²

[BIO 445](#). Neurobiology^{1, 2}

[BIO 446](#). Experimental Neurobiology¹

[BIO 480](#). Advanced Molecular Biology¹

[BIO 481](#). Genomics¹

[BIO 482](#). Human Histology¹

3-4

9-12

15-19

1 Meets one of the biology major requirements for a laboratory/field course.

2 [BIO 445](#) and [BIO/CSD 415](#): The course not taken as part of required neuroscience concentration core may be used to fulfill elective requirements.

Students should choose additional BIO courses at the 300-400 level, including a course that fulfills the organismal diversity major requirement, and are strongly encouraged to discuss their career interests with an adviser who can help select courses best suited to their needs. With prior approval from the concentration coordinator, [BIO 426](#) and/or [BIO 427](#) may be substituted. It is recommended that students participate in independent research ([BIO 497/499](#)) with a faculty mentor.

Dual Degree Program in Forest Biology

James Madison University Liaison: [Heather Griscom](#)

Phone: (540) 568-5525

This dual degree program makes it possible for the student to earn a B.S. degree in biology from James Madison University and a Master of Forestry degree from Virginia Tech in five years.

During the first three years at JMU, the student must complete 90 credit hours, including all JMU general education requirements, the biology core requirements, [BIO 402](#), Forest Ecology and four additional hours in biology.

Also, the student must take the cognate courses for biology majors in chemistry, mathematics and physics and a course in geology ([GEOL 110](#)).

During the fourth year of study the student will take further courses (at least 30 hours) at Virginia Tech for credit toward, following JMU transfer policy, 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, he/she will be admitted into the graduate program of the Department of Forestry at Virginia Tech, where he/she will spend an additional year taking forest biology and natural resources 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

For more detailed information on this cross disciplinary minor, refer to the [biochemistry and molecular biology section](#).

Biology Minor

Minor Advisor: [Julia Stutzman](#)

Students who declared a major in biology before fall 2016 should consult with their adviser about course requirements. The biology minor is not available to biotechnology majors.

Students choosing to minor in biology must complete the following courses:

Courses

[BIO 140](#). Foundations of Biology I

[BIO 150](#). Foundations of Biology II

[BIO 240](#). Genetics

[BIO 250](#). Ecology and Evolution

Biology elective (300-level and above)

Credit Hours

4

4

4

4

3-4

19-20

Credit by Examination

When evidence of sufficient background or preparation is presented, the Department of Biology offers credit by examination in many of its non-lab 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.