Biology B.A.

Degree Requirements

Students must complete WVU General Education Curriculum requirements, College B.A. requirements, major requirements, and electives to total 120 hours. For complete details on these requirements, visit the B.A. Degrees tab on the Eberly College of Arts and Sciences (http://catalog.wvu.edu/archivedcatalog/2014-15/undergraduate/eberlycollegeofartsandsciences/#bachelorofartstext) pages.

Departmental Requirements for the B.A. in Biology

Students intending to graduate with a B.A. in Biology must earn a minimum of 32 hours in biology or approved courses in the biological sciences, with 120 hours total required for graduation (see Eberly B.A. pages when reaching 42 credits in Biology). Students must take at least 14 credits of upper-division biology electives; at least one of the selected courses must have a laboratory.

• Neuroscience Area of Emphasis (AOE): Students interested in completing an area of emphasis in Neuroscience must complete the requirements as outlined on in the Area of Emphasis section.

• Electives and Lab requirement: Upper-division electives may include any 300- or 400-level BIOL courses (except: BIOL 327, BIOL 490, BIOL 491, BIOL 494 and above). Lecture and lab courses can be found in the course catalog. Special topics courses, BIOL 493, can be used as electives. No more than one of the following non-BIOL courses may be counted as a BIOL elective: AEM 341, AGBI 410, BIOC 339, BIOC 531, GEOL 331, PHYS 225.

• Research option: With permission of the department, students may enroll in BIOL 386 or BIOL 486. Four hours of BIOL 386 and BIOL 486 may be used towards the 14 hours of Biology upper-division electives. One semester of BIOL 386 or BIOL 486 may be used to satisfy one of the lab requirement.

• Writing Course Requirement: The General Education Curriculum requires the successful completion of a writing course ("W"), preferably in the major. Biology majors can complete BIOL 312, BIOL 313, BIOL 351, BIOL 352, or BIOL 363.

• Capstone Requirement: The General Education Curriculum requires the successful completion of a Biology capstone course (BIOL 321). The three semester, BIOL 486, may be counted as the Biology Capstone Experience in place of BIOL 321. Two hours of BIOL 486 will be counted as part of the core requirements (replacing BIOL 321).

• Calculation of the GPA in the Biology major: A GPA of 2.0 in Biology course work is required for graduation. All attempts at the following courses will be used to calculate the GPA in the Biology major: BIOL 115, BIOL 117, BIOL 219, BIOL 221, BIOL 321, BIOL 327, and all upper-division courses counted as BIOL electives. If BIOL 101-104 are substituted for BIOL 115, they will be excluded from the GPA calculation, and no other 100- or 200-level Biology courses will be used to satisfy elective requirements, nor will they be used in the calculation of the Biology GPA.

• Benchmarks expectations: By the end of their third semester into the major, students are expected to have completed BIOL 115, BIOL 117, and CHEM 115 with a minimum grade of C- in each course and a 2.0 GPA overall. In addition, students must meet with their Biology adviser every semester. Students who do not meet their benchmarks may be removed from their major.

GENERAL EDUCATION CURRICULUM

Please use this link to view a list of courses that meet each GEC requirement. (http://registrar.wvu.edu/current_students/general_education_curriculum)

NOTE: Some major requirements will fulfill specific GEC requirements. Please see the curriculum requirements listed below for details on which GECs you will need to select.

General Education Curriculum

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 101 &amp; ENGL 102</td>
<td>Composition And Rhetoric and Composition And Rhetoric</td>
<td>3-6</td>
<td></td>
</tr>
<tr>
<td>or ENGL 103</td>
<td>Accelerated Academic Writing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEC 2A - Mathematics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEC 2B - Natural and Physical Science</td>
<td></td>
<td>7-8</td>
<td></td>
</tr>
<tr>
<td>GEC 2C - Additional GEC 2A, B or C</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GEC 3 - The Past and Its Traditions</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GEC 4 - Issues of Contemporary Society</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GEC 5 - Artistic Expression</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GEC 6 - The Individual in Society</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GEC 6F - First Year Seminar</td>
<td></td>
<td>1-3</td>
<td></td>
</tr>
<tr>
<td>GEC 7 - American Culture</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GEC 8 - Western Culture</td>
<td></td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
# Curriculum Requirements

## University Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>WVUE 191</td>
<td>First Year Seminar</td>
<td>31</td>
</tr>
</tbody>
</table>

GEC Requirements: credits may vary depending on overlap.

## College Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign Language</td>
<td>12</td>
</tr>
</tbody>
</table>

## Departmental Requirements

### Core Biology Courses (must be taken in the following sequence)

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 115</td>
<td>Principles of Biology</td>
</tr>
<tr>
<td>BIOL 117</td>
<td>Introductory Physiology</td>
</tr>
<tr>
<td>BIOL 219</td>
<td>The Living Cell</td>
</tr>
<tr>
<td>BIOL 221</td>
<td>Ecology And Evolution</td>
</tr>
<tr>
<td>BIOL 327</td>
<td>Professional Development</td>
</tr>
</tbody>
</table>

### Chemistry Requirement

Select one of the following:

- CHEM 115 & CHEM 116: Fundamentals of Chemistry and Fundamentals of Chemistry (should be taken concurrently with BIOL 115)
- CHEM 117 & CHEM 118: Principles of Chemistry and Principles of Chemistry

Take all the following:

- CHEM 233: Organic Chemistry
- CHEM 234: Organic Chemistry
- CHEM 235: Organic Chemistry Laboratory
- CHEM 236: Organic Chemistry Laboratory

### Mathematics and Statistics Requirement

Select one of the following:

- MATH 150: Applied Calculus
- MATH 153 & MATH 154: Calculus 1a with Precalculus and Calculus 1b with Precalculus
- MATH 155: Calculus 1

and:

- STAT 211: Elementary Statistical Inference
- STAT 215: Intro Probability & Statistics

### Physics Requirement

Select one of the following:

- PHYS 101 & PHYS 102: Introductory Physics and Introductory Physics
- PHYS 111 & PHYS 112: General Physics and General Physics
- PHYS 111 & PHYS 102: General Physics and Introductory Physics

### Biology Electives

The 14 hours of upper-division courses can include any 300- or 400-level BIOL course except: BIOL 327, BIOL 490, BIOL 491, BIOL 494, and above; they must include one class with a lab.

### Capstone Experience

Choose from the following:

- BIOL 321: Total Science Experience Lab

or three semesters of the following:
### GENERAL ELECTIVES

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of electives may vary depending on overlap and options chosen.</td>
<td></td>
</tr>
</tbody>
</table>

**Total Hours**: 120

* No more than one of the following classes maybe counted as a BIOL elective: AEM 341, AEM 401, AGBI 410, BIOC 339, BIOC 531, GEOL 331, PHYS 225.

** Please see an adviser to identify lab classes.

### B.A. SUGGESTED PLAN OF STUDY

#### First Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>WVUE 191</td>
<td>1</td>
<td>ENGL 101</td>
<td>3</td>
</tr>
<tr>
<td>Foreign Language</td>
<td></td>
<td>3 BIOL 117</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 115</td>
<td>4</td>
<td>CHEM 116</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 115</td>
<td>4</td>
<td>Select one of the following:</td>
<td>4</td>
</tr>
<tr>
<td>Select one of the following:</td>
<td></td>
<td>MATH 156</td>
<td></td>
</tr>
<tr>
<td>MATH 155</td>
<td>3</td>
<td>STAT 211</td>
<td></td>
</tr>
<tr>
<td>MATH 150</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

#### Second Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 102</td>
<td>3</td>
<td>BIOL 221</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 219</td>
<td></td>
<td>4 BIOL 321 (Does not satisfy upper division lab requirement)</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 233</td>
<td>3</td>
<td>CHEM 234</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 235</td>
<td>1</td>
<td>CHEM 236</td>
<td>1</td>
</tr>
<tr>
<td>Select one of the following:</td>
<td>4</td>
<td>Select one of the following:</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 101</td>
<td></td>
<td>PHYS 102</td>
<td></td>
</tr>
<tr>
<td>PHYS 111</td>
<td></td>
<td>PHYS 112</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BIOL 327</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>General Elective</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

#### Third Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEC Objective (Select from objectives 3, 4, 5, 6, 7, 8, or 9)</td>
<td>9</td>
<td>GEC Objective (Select from objectives 3, 4, 5, 6, 7, 8, or 9)</td>
<td>6</td>
</tr>
<tr>
<td>Foreign Language 101</td>
<td>3</td>
<td>Foreign Language 102</td>
<td>3</td>
</tr>
<tr>
<td>Required BIOL Elective</td>
<td>3</td>
<td>Required BIOL Elective**</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>General Elective</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

#### Fourth Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required BIOL Elective</td>
<td>6</td>
<td>Required BIOL Elective</td>
<td>3</td>
</tr>
<tr>
<td>GEC Objective (Select from objectives 3, 4, 5, 6, 7, 8, or 9)</td>
<td>3</td>
<td>Foreign Language 204</td>
<td>3</td>
</tr>
<tr>
<td>General Electives</td>
<td>3</td>
<td>General Elective</td>
<td>9</td>
</tr>
<tr>
<td>Foreign Language 204</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

**Total credit hours: 120**
Biology B.A.

* BIOL 321 (capstone) may be replaced with three semesters of BIOL 486 (research). The three-semester BIOL 486, Honor Investigation & Thesis, may be counted as the Biology Capstone Experience in place of BIOL 321, Total Science Experience. Two hours of BIOL 486 will be counted as part of the core requirements (replacing 321) and four hours may be used to satisfy upper division Biology electives.

** At least 1 upper division lab course must be taken (386 or 486 can substitute)

Bachelor of Arts in Biology: Neuroscience Area of Emphasis

A biology degree with an emphasis in Neuroscience provides the student with all the preparation necessary for graduate school in Neuroscience or medical school and the medical school entrance exam - the MCAT. Biology majors pursuing the area of emphasis in Neuroscience take two introductory courses to learn about basic features of neurons and the organization of the brain and then take a further concentration of courses in biology that are related to Neuroscience.

Neuroscience Emphasis Requirements:

- **Biology B.A. requirement:** Students intending to graduate with a B.A. in biology with a Neuroscience emphasis posted to the transcript must meet the requirements of the biology major B.A. degree, including a minimum of 14 hours of upper division courses with one upper division lab course.

- **Upper-division electives:** Upper-division electives include any 300 or 400 level BIOL course (except: BIOL 327, BIOL 490, BIOL 491, BIOL 494 and above. Lecture and lab courses can be found in the course catalog. Special topics courses, BIOL 493, can be used as electives. No more than one of the following non-BIOL courses may be counted as a BIOL elective: AEM 341, AGBI 410, BIOC 339, BIOC 531, GEOL 331, PHYS 225.

- **Capstone Requirement:** The General Education Curriculum requires the successful completion of a biology capstone course, BIOL 321. BIOL 486 may be counted as the biology capstone experience in place of BIOL 321 (https://futurecatalog.wvu.edu/shared/biolba_neuroscience_aoe). Two hours of BIOL 486 (https://futurecatalog.wvu.edu/shared/biolba_neuroscience_aoe) will be counted as part of the core requirements (replacing BIOL 321).

- **Calculation of the GPA in the biology major:** A GPA of 2.0 in biology course work is required for graduation. All attempts at the following courses will be used to calculate the GPA in the biology major: BIOL 115, BIOL 117, BIOL 219, BIOL 221, BIOL 321, BIOL 321, BIOL 327 and all upper-division courses counted as BIOL electives. If BIOL 101-104 are substituted for BIOL 115, they will be excluded from the GPA calculation, and no other 100 or 200 level biology courses will be used to satisfy elective requirements, nor will they be used in the calculation of the biology GPA.

Recommendations for Students Interested in Graduate or Professional School

- Research option: Students with aspirations to attend graduate school or top-rank medical schools should include at least three hours of independent research (BIOL 386 or BIOL 486) in their program of study if they are to be competitive. Permission of the department is required to enroll in BIOL 386 and BIOL 486. Four hours of BIOL 386 and BIOL 486 may be used towards the 14 hours of biology upper-division electives. One semester of BIOL 386 or BIOL 486 may be used to satisfy the lab requirement.

- **Students who are interested in medical school should consider taking courses such as BIOL 310, AGBI 410, BIOL 440, BIOL 441, BIOL 436, or other classes listed in the biology pre-med emphasis. Students planning to take the MCAT in 2015 or later should consider PSYC 101, SOCA 101, and SOCA 105 in order to be prepared for the new social sciences section of the MCAT - consult with your advisor for more detailed information.

**CURRICULUM REQUIREMENTS**

| BIOL 348: Neuroscience 1 | 3 |
| BIOL 349: Neuroscience 2 | 3 |
| **Select 2 of the following:** | 6-7 |
| BIOL 339: Animal Communication | |
| BIOL 439: Neuroethology | |
| BIOL 476: Computational Neuroscience | |
| BIOL 477: Development and Evolution of the Nervous System | |
| BIOL 478: Sensory Neural Systems and Behavior | |
| BIOL 479: Advances in Systems Neuroscience | |

Total Hours 12-13

**SUGGESTED PLAN OF STUDY**

**First Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>WVUE 191</td>
<td>1 ENGL 101</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CHEM 115</td>
<td>4 BIOL 117</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Foreign Language</td>
<td>3 CHEM 116</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>
BIOL 115 Foreign Language 3
Select 1 of the following:
  MATH 150 or 155
  3-4 STAT 211

15-16 17

Second Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 219</td>
<td>4</td>
<td>BIOL 221</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 233</td>
<td>3</td>
<td>BIOL 321</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 235</td>
<td>1</td>
<td>CHEM 234</td>
<td>3</td>
</tr>
<tr>
<td>Select one of the following:</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYS 101 or 111</td>
<td></td>
<td>Select one of the following:</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>PHYS 102 or 112</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Foreign Language</td>
<td>3</td>
<td>BIOL 327</td>
<td>1</td>
</tr>
<tr>
<td>ENGL 102</td>
<td></td>
<td>Foreign Language</td>
<td>3</td>
</tr>
</tbody>
</table>

18 17

Third Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 348**</td>
<td>3</td>
<td>BIOL 349: Neuroscience 2</td>
<td>3</td>
</tr>
<tr>
<td>Elective</td>
<td>3</td>
<td>GEC Objective (Select from objectives 3, 4, 5, 6, 7, 8, or 9)</td>
<td>9</td>
</tr>
<tr>
<td>GEC Objective (select from objectives 3, 4, 5, 6, 7, 8, or 9)</td>
<td>9</td>
<td>Elective</td>
<td>1</td>
</tr>
</tbody>
</table>

15 13

Fourth Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required BIOL Electives</td>
<td>6</td>
<td>Required BIOL Elective***</td>
<td>4</td>
</tr>
<tr>
<td>GEC Objective (Select from objectives 3, 4, 5, 6, 7, 8, or 9)</td>
<td>3</td>
<td>Electives</td>
<td>9</td>
</tr>
<tr>
<td>Electives</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12 13

Total credit hours: 120-121

* BIOL 321 does not satisfy upper division lab requirement. The BIOL 321 capstone may be replaced with three semesters of BIOL 486. Two hours of BIOL 486 will be counted as part of the ore requirements (replacing BIOL 321) and four hours may be used to satisfy an upper division laboratory Biology elective.

** BIOL 348 and BIOL 349: Neuroscience 2 are required for the neuroscience emphasis.

*** At least 1 upper division lab course must be taken (BIOL 386 or BIOL 486 can substitute).

COURSES

BIOL 101. General Biology. 3 Hours.
PR or CONC: BIOL 103. Introductory course in biology: cellular, organismal, and population genetics, including reproduction, growth and development, and evolution.

BIOL 102. General Biology. 3 Hours.
PR or CONC: BIOL 104. Introductory biology: energetics and physiology of cells, organisms, and populations, including regulation and control of multicellular organisms.

BIOL 103. General Biology Laboratory. 1 Hour.
PR or CONC: BIOL 101. Experiments in biology: genetics and evolution; reproduction, growth, and development of cells, organisms, and populations.

BIOL 104. General Biology Laboratory. 1 Hour.

BIOL 105. Environmental Biology. 3 Hours.
(Intended for non-biology majors.) Population growth and human impacts on the environment, including ecosystem destruction, biological diversity, pollution, and global climate change are explored to obtain the concepts necessary to understand complex environmental issues of our time.

BIOL 106. Environmental Biology Lab. 1 Hour.
CoReq: BIOL 105. Field and laboratory exercises explore fundamental ecological concepts and environmental problems, such as biodiversity, pollution, and natural resource utilization.
BIO 107. Biotechnology and Society. 3 Hours.
An overview of the use of biotechnology to solve agricultural, medical, and environmental problems. Bioethical concerns and societal impacts of the use of the technologies will be discussed.

BIO 115. Principles of Biology. 4 Hours.
An introductory course presenting basic principles of modern biology. This course represents the first in a four-course, integrated sequence required of biology majors. Topics include ecology and evolution, organismal biology, and cellular/molecular biology.

BIO 117. Introductory Physiology. 4 Hours.
PR: BIOL 115 or BIOL 101 and BIOL 102 AND BIOL 103 AND BIOL 104. Continuation of BIOL 115. The diversity of reproductive, developmental, functional, and integrative mechanisms in plants and animals.

BIO 122. Human Sexuality. 3 Hours.
A study of biological, behavioral and societal aspects of sexuality. Issues considered include changing fecundity, social-legal implications, sex roles, sexually transmitted diseases, populations, erotica, aging, dysfunctions, and decision-making skills for sex related issues.

BIO 124. The Human Environment. 3 Hours.
An examination of several aspects of current worldwide environmental deterioration caused by the actions of humans. Public policies and alternative mitigative strategies are also presented.

BIO 215. Cell-Biology for Pre-Pharmacy. 3 Hours.
PR: BIOL 115 and BIOL 117 and (CHEM 115 or CHEM 117). Structure, function and diversity of cells with an emphasis on gene expression and cellular phenotype including cell chemistry, energetics, and regulation of cell activities. This course is offered only to Pre-Pharmacy majors.

BIO 219. The Living Cell. 4 Hours.
PR: (CHEM 115 or CHEM 117) and BIOL 117. Continuation of BIOL 117. Structure, function and diversity of cells with an emphasis on gene expression and cellular phenotype including cell chemistry, energetics, and regulation of cell activities.

BIO 221. Ecology And Evolution. 3 Hours.

BIO 235. Human Physiology. 3 Hours.
PR: BIOL 101 and BIOL 102 and BIOL 103 and BIOL 104. (Intended for non-biology majors.) An introductory course in the function of the human.

BIO 236. Human Phys:Quantitative Lab. 1 Hour.
PR: MATH 156 and CHEM 116 and BIOL 115 and PR or CONC: BIOL 235. Optional lab for BIOL 235 incorporating engineering concepts, such as mass and energy balances, circuit theory, and chemical kinetics to quantify and help understand many aspects of human physiology.

BIO 293A-Z. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

BIO 298A-Z. Honors. 1-3 Hours.
PR: Students in the Honors Program and consent by the honors director. Independent reading, study, or research.

BIO 301. History Of Biology. 3 Hours.
PR: (BIOL 101 and BIOL 103 and BIOL 102 and BIOL 104) or BIOL 115. History of development of biological knowledge with philosophical and social backgrounds.

BIO 302. Biometry. 3 Hours.
PR: STAT 211. Application of quantitative methods and statistics to biological data with emphasis on hands-on hypothesis construction, experimental design, data analysis and biological interpretation of statistical results.

BIO 310. Adv Cellular/Molecular Biology. 3 Hours.

BIO 311. Adv Cellular/Molecular Biol Lab. 2 Hours.
PR or Conc: BIOL 310. Experimental approaches to the study of cellular systems.

BIO 312. Introduction To Virology. 3 Hours.

BIO 313. Molecular Basis of Cell Growth. 3 Hours.
PR: BIOL 219. Study of the integration of internal and external influences as they regulate the division, growth, and differentiation of cells. Topics include hormones as cell effectors, cancer, and stem cells.

BIO 316. Developmental Biology. 3 Hours.
PR: BIOL 115 and BIOL 117 and BIOL 219. A molecular genetic analysis of the mechanisms by which multicellular organisms develop from single cells.

BIO 317. Developmental Biology Lab. 1 Hour.
PR: BIOL 219. CoReq: BIOL 316. Experimental approaches to the genetic analysis of the mechanisms by which multicellular organisms develop from single cells.
BIOL 318. Writing Appalachian Ecology. 3 Hours.
This course encouraged students to think about the long-term future of our planet. What could our world be like in 200 years? How will current environmental problems change the future? How will relationships with the natural world change? Students address questions like these in creative nonfiction essays they write about research being conducted at the Fernow Experimental Forest in WV.

BIOL 321. Total Science Experience Lab. 2 Hours.
PR or Conc: BIOL 221. Biological research experience incorporating diverse learning experiences that take place in the process of being a research scientist; including writing grant proposals, manuscripts, and presentation of results in a public forum.

BIOL 324. Molecular Genetics. 3 Hours.
PR: BIOL 219. Theoretical and practical knowledge in genetics as a field of study and as an approach for investigating biological problems.

BIOL 325. Molecular Genetics Laboratory. 1 Hour.
PR: BIOL 219. CoReq: BIOL 324. The laboratory is a logical sequence of experiments providing actual research experience in molecular genetics. Must be taken at the same time as BIOL 324.

BIOL 327. Professional Development. 1 Hour.
PR: BIOL 219. This course provides an overview of opportunities for students graduating with degrees in the biological sciences. An assessment test will help identify strengths and weaknesses within the field.

BIOL 335. Cell Physiology. 3 Hours.
PR: BIOL 117. Emphasis on the unity and diversity of cells; membrane structure and function; and the role that intracellular compartments, cytoskeleton, and extracellular matrix play in cell physiology.

BIOL 336. Vertebrate Embryology. 4 Hours.
PR: BIOL 115 and BIOL 117 and BIOL 219 and BIOL 221. An experimental and descriptive analysis of vertebrate development.

BIOL 337. Physiological Psychology. 3 Hours.
PR: PSYC 301 and junior or senior standing. Advanced study of the physiological mechanisms of behavior. Topics include neural and endocrine mechanisms of behavior and issues, methods, and findings in behavioral neuroscience. (Also listed as PSYC 426.).

BIOL 338. Behavioral Ecology. 3 Hours.
PR: BIOL 221. Consideration of the influences of environmental factors on short- and long-term regulation, control, and evolution of the behavior of animals.

BIOL 339. Animal Communication. 3 Hours.
PR: BIOL 221 or consent. Communication mediates most interactions between individuals and the brain dedicates much of its resources to generating and processing these signals. This course examines why and how animals communicate, the physiological mechanisms involved in generating/ sensing communication signals, how evolution shapes communication, and how communication signals can influence decision making.

BIOL 340. Invertebrate Zoology. 4 Hours.
PR: BIOL 219 and BIOL 221. The evolution of animals without vertebral columns. The laboratory includes field trips, including one that takes an entire weekend. (Dissection kit required.).

BIOL 341. Ichthyology. 4 Hours.
Study of the internal and external structure of fishes, their systematic and ecological relationships, and their distribution in time and space. (Dissection kit required.).

BIOL 348. Neuroscience 1. 3 Hours.
PR: BIOL 219. An introduction to neuroscience, including basic neuroanatomical neuropsychology, and the relationship between the central nervous system, physiology, and behavior.

BIOL 349. Neuroscience 2. 3 Hours.
PR: BIOL 348. An introductory systems level course on organization of the nervous system, from an evolutionary to a clinical perspective. Topics include development and functional organization of sensory, motor, autonomic and cognitive systems. The evolutionary history and human health concerns associated with these systems will be addressed, through lecture, discussion, and readings in the primary literature.

BIOL 350. Plant Physiology. 4 Hours.
PR: CHEM 115 and CHEM 116 and ((BIOL 101 and BIOL 103) or BIOL 117). Physiochemical processes of plants.

BIOL 351. Plant Diversity. 4 Hours.
PR: (BIOL 101 and BIOL 102 and BIOL 103 and BIOL 104) or BIOL 115. Evolution, morphology, life cycles, ecology, and uses of cyanobacteria, lichens, algae, bryophytes, ferns, gymnosperms, and angiosperms. Laboratory emphasizes comparing living specimens with local field trips.

BIOL 352. Plant Anatomy/Development. 4 Hours.
PR: BIOL 117 or PLSC 206. How plants (especially angiosperms) develop, stand up, defend themselves, transport food and water, and reproduce; also evolution and uses of wood and bark. Students observe development from spores, seeds, and cuttings. (Two local field trips.).

BIOL 353. Flora Of West Virginia. 3 Hours.
PR: (BIOL 101 and BIOL 103 and BIOL 102 and BIOL 104) or BIOL 115. Identification of local woody and herbaceous seed plants, with emphasis on common native and introduced species. Conducted primarily through field trips to nearby areas with the use of dichotomous keys to determine the scientific names of observed specimens.
Biology B.A.

BIOL 361. Plant Ecology. 4 Hours.
PR: BIOL 221. Introduction to the four divisions of plant ecology, including physiological ecology, population ecology, community ecology and ecosystem ecology.

BIOL 362. Limnology. 4 Hours.
PR: (BIOL 101 and BIOL 103) or BIOL 115 or WMAN 224 or consent. Physical, chemical, and biological characteristics of inland waters with emphasis on the structure and function of stream ecosystems. (Also listed as WMAN 446.)

BIOL 363. Plant Geography. 3 Hours.
PR: BIOL 221. World-wide distribution patterns of plants and factors related to these distributions, including dispersal. Limiting factors, climate, isolation, evolutionary history, plate tectonics, pleistocene glaciations, and human activities. Plant communities and soils of polar, temperate, and tropical biomes are discussed.

BIOL 384. Marine EcoSystems Topics. 3 Hours.
Three-week field-based courses offered at the Marine Science Consortium in Virginia. Courses vary by year including marine ichthyology, marine mammals, and coral reef ecology. A maximum of six-hours counts toward the biology major.

BIOL 384A. Marine EcoSystems Topics. 3 Hours.
Three-week field-based courses offered at the Marine Science Consortium in Virginia. Courses vary by year including marine ichthyology, marine mammals, and coral reef ecology. A maximum of 6 hours counts toward the biology major.

BIOL 384B. Marine EcoSystems Topics. 3 Hours.
Three-week field-based courses offered at the Marine Science Consortium in Virginia. Courses vary by year including marine ichthyology, marine mammals, and coral reef ecology. A maximum of 6 hours counts toward the biology major.

BIOL 384C. Marine EcoSystems Topics. 3 Hours.
Three-week field based courses offered at the Marine Science Consortium in Virginia. Courses vary by year including marine ichthyology, marine mammals, and coral reef ecology. A maximum of 6 hours counts toward the biology major.

BIOL 386. Undergraduate Research. 1-4 Hours.
PR: Written consent of chair and a 2.7 grade point average in biology. (May be repeated for a maximum of 6 credit hours.) Individual laboratory or field experiments supervised by a faculty member.

BIOL 393A-Z. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

BIOL 410. Cell/Molecular Biology Methods. 3 Hours.
PR: BIOL 219. Introduction to the theory, application, ethic and economics of biotechnologies.

BIOL 411. Intro To Recombinant DNA. 4 Hours.
PR: BIOL 219. An introductory course covering the basic principles and techniques of recombinant DNA technology, includes molecular cloning, isolation of plasmid DNA, agarose/acrylamide gel electrophoresis, restriction enzyme mapping, nucleic acid hybridization, and DNA sequencing.

BIOL 413. Molecular Endocrinology. 3 Hours.
PR: BIOL 219. Hormonal action is discussed at the cellular and molecular levels. Topics include hormone production and regulation, receptor kinetics and activation, and receptor output.

BIOL 414. Molecular Endocrinology - Lab. 1 Hour.
CoReq: BIOL 413. Experimental techniques used to study hormones and receptors.

BIOL 415. Epigenetics. 3 Hours.
PR: BIOL 219 or consent. Explore he molecular mechanisms, phenotypic phenomena and current application of epigenetics and the study of how genetic information is used and maintained.

BIOL 420. Genomics. 3 Hours.
PR: BIOL 219. Advanced elective examining biology and evolution on a genome-wide scale. Topics include fields of study and methods of DNA sequence acquisition and annotation, including exploration of the human genome and its contribution to disease discovery.

BIOL 424. Protein Structure & Function. 4 Hours.
PR: BIOL 219 and (CHEM 231 or CHEM 233). Explores fundamentals of the protein structure; methods of structure determination; features of globular, membrane, and fibrous proteins; and approaches to protein classification.

BIOL 425. Developmental Genetics. 3 Hours.
PR: BIOL 219. This course covers the mechanisms by which genetics instructs the process of development. The complex interactions between cells, the environment, and the genome are presented.

BIOL 426. Molecular Biology of Cancer. 3 Hours.
PR: BIOL 219. Exploration of molecular pathways leading to the development of cancer with emphasis on gene expression, cell cycle regulation, and signaling pathways targeted in conventional therapies.

BIOL 430. Bioinformatics. 3 Hours.
PR: BIOL 219 or Consent. An introduction to algorithms and tools for analysis of genetic and genomic data in an evolutionary context.
BIOl 432. Forensic Biology. 4 Hours.
PR: BIOL 219. A lecture and laboratory course focusing on the latest advances in forensic identification technologies, including advantages and limitations of different approaches. Students can gain extensive hands-on experience in the isolation, qualification, and analysis of DNA.

BIOl 433. Herpetology. 3 Hours.
Investigation into the biology, ecology, and evolution of reptiles and amphibians, emphasizing North American species especially those found in the state of West Virginia. (One field exercise outside of regular time is required.).

BIOl 436. General Animal Physiology. 3 Hours.
PR: BIOL 115 and BIOL 117 and BIOL 119 and BIOL 221. In-depth, current treatment of physiological principles which operate at various levels of biological organization in animals of diverse taxonomic relationships. Understanding is developed from background lectures and student analyses in discussion sessions of research literature.

BIOl 438. Animal Behavior. 4 Hours.
PR: BIOL 221 and (BIOL 101 and BIOL 102 and BIOL 103 and BIOL 104 or BIOL 115). Introduction to animal behavior (ethology) emphasizing the ecology and evolution of individual and social behaviors. Laboratory includes independent investigation of behavioral phenomena. (Offered in even numbered years.).

BIOl 439. Neuroethology. 3 Hours.
PR: BIOL 348. Explores the way sensory systems process information to mediate behavior in a wide variety of animals in order to understand similarities and differences in neural mechanisms.

BIOl 440. Comparative Anatomy. 4 Hours.
PR: BIOL 115 and BIOL 117 and BIOL 219 and BIOL 221 or consent. A functional and evolutionary study of vertebrate structure. (Dissection kit required.).

BIOl 441. Vertebrate Microanatomy. 5 Hours.
PR: BIOL 115 and BIOL 117 and BIOL 219 and BIOL 221. Structural and functional approach to the study of tissues and organs of vertebrates.

BIOl 450. Plant Systematics. 4 Hours.
PR: (BIOL 101 and BIOL 103 and BIOL 102 and BIOL 104) or BIOL 117. Study of the taxonomy of flowering plants worldwide and related topics in angiosperm classification and evolution. Laboratories emphasize characteristics of selected families of monocotyledons and dicotyledons using living and herbarium material.

BIOl 451. Plant Development. 4 Hours.
PR: BIOL 221 and (CHEM 235 or AGBI 410). Experimental studies of plant growth and development.

BIOl 453. Molecular Basis of Disease. 3 Hours.
PR: BIOL 219. Examine medical, ethical, and legal/regulatory issues emerging from the Human Genome Project and its applications to personalized medicine.

BIOl 454. Immunology. 3 Hours.
PR: BIOL 219. Explores the fundamental principles and practices of immunology including how the immune system is organized, how it functions to keep us healthy, and how it can cause allergies and autoimmune disease.

BIOl 455. Evolution-Infectious Diseases. 3 Hours.
PR: BIOL 115 and BIOL 117 and BIOL 221. The application of phylogenetics, microbiology, immunology, and epidemiology towards understanding the evolution of infectious diseases. Students will develop a fundamental understanding of the significance of evolution and ecology in infectious disease emergence and control.

BIOl 456. Microbial Symbiosis. 3 Hours.
PR: BIOL 221. An understanding of the significance of microbial symbioses towards ecological and health processes will be developed. Molecular techniques used towards identifying the composition and functions of microbial communities will be discussed.

BIOl 461. Principles of Evolution. 3 Hours.
PR: BIOL 221. Introduction to the study of evolution, including genetics of evolutionary change, speciation and adaptation molecular evolution, the history of life, extinction, co-evolution and the origins of humans.

BIOl 463. Global Ecology. 3 Hours.
PR: BIOL 221. The Earth viewed as a changing biogeochemical system. Topics include the structure, composition and dynamics of the ecosphere, nutrient cycles, changing atmospheric composition, climate change, ozone depletion, land-use change, biological invasions, and changes in biodiversity.

BIOl 464. Population/Quantitative Genetics. 3 Hours.
PR: BIOL 221. Relationship of gene and genotype frequencies in populations of diploid organisms and the effects of mutation, selection, and non-random mating in relation to single gene pairs. Application of these concepts to multigenic inheritance of quantitative traits.

BIOl 477. CNS Evolution and Development. 3 Hours.
PR: BIOL 348. Origin and evolution of the central nervous system, focusing on development and genetic mechanisms underlying structural modifications that serve as the basis for the evolution of animal behavior.
BIOL 478. Sensory Neural System/Behavior. 3 Hours.
PR: BIOL 348. This course explores how brains acquire information about the external world and process this information to produce sensory perceptions. Students gain a deep understanding of sensory transduction and neural processing at the cellular, network and systems levels. Additionall the class is aimed at enhancing science communication.

BIOL 479. Current Topics-Neuroscience. 3 Hours.
PR: BIOL 348. Fundamental principles of nervous system organization with an emphasis on interactions between neurons and the consequences for behavior. There will be a focus on recent advances in our understanding of each organizational principle.

BIOL 486. Honor Investigation & Thesis. 1-4 Hours.
(May be repeated for credit; max credit 12 hr.) PR: Second semester of junior year, recommendation of advisor, biology majors only. Permission required. Supervised readings, investigation, and study.

BIOL 490. Teaching Practicum. 1-3 Hours.
PR: Consent. (May be repeated for a maximum of 9 credit hours.) Teaching practice as a tutor or assistant.

BIOL 491. Professional Field Experience. 1-18 Hours.
PR: Consent. (May be repeated up to a maximum of 18 hours.) Prearranged experiential learning program, to be planned, supervised, and evaluated for credit by faculty and field supervisors. Involves temporary placement with public or private enterprise for professional competence development.

BIOL 492A-Z. Directed Study. 1-3 Hours.
Directed study, reading, and/or research.

BIOL 493A-Z. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

BIOL 494A-Z. Seminar. 1-3 Hours.
PR: Consent. Presentation and discussion of topics of mutual concern to students and faculty.

BIOL 495. Independent Study. 1-6 Hours.
Faculty supervised study of topics not available through regular course offerings.

BIOL 496. Senior Thesis. 1-3 Hours.
PR: Consent.

BIOL 497. Research. 1-6 Hours.
Independent research projects.

BIOL 498A-Z. Honors. 1-3 Hours.
PR: Students in Honors Program and consent by the honors director. Independent reading, study or research.