Biology, B.S. (Capital)

**Begin Campus:** Any Penn State Campus  
**End Campus:** Harrisburg

**Program Description**

*Not all options are available at every campus. Contact the campus you are interested in attending to determine which options are offered.*

Biology is the scientific study of life: the diversity and organization of organisms, from single-celled bacteria to multi-cellular plants and animals, including humans. These different levels of biological organization range from the molecules and cells that compose an organism, to the interacting organisms that make up an ecosystem. Hands-on experiences, from designing and conducting lab experiments to making field observations, using many different procedures and instruments, play an important role in gaining biological knowledge. Basic research in Biology provides many benefits. Faculty in the Biology Department at Penn State are exploring ways to cure neurological diseases, to conserve coral populations in tropical oceans, to discover more efficient ways to use plants for food and bioenergy, to develop vaccines for infectious diseases, and investigating many other facets of Biology, all with the goal of positively impacting humans and the environment.

**You Might Like This Program If...**

- You are interested in learning about aspects of the biology of organisms that live on Earth.
- You enjoy a dynamic field of study, with new discoveries being made every day.
- You are interested in hands-on experiences, including courses with integrated laboratories and conducting research with faculty.
- You plan to pursue a career in biology research, education or outreach, or attend professional school in areas including medicine and dentistry.

**Entrance Requirements**

In order to be eligible for entrance to the Biology major, a student must have:

1. attained at least a 2.00 cumulative grade point average;
2. completed BIOL 110, CHEM 110, MATH 140, and earned a grade of C or better in each of these courses; and
3. completed at least one of the following courses with a grade of C or better: BIOL 220W, BIOL 230W, or BIOL 240W.

**Degree Requirements**

For the Bachelor of Science degree in Biology, a minimum of 124 credits is required:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>45</td>
</tr>
<tr>
<td>Requirements for the Major</td>
<td>94</td>
</tr>
</tbody>
</table>

15 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 9 credits of GN courses; 6 credits of GQ courses.

**General Education**

Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (http://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

**Foundations** (grade of C or better is required.)

- Quantification (GQ): 6 credits
- Writing and Speaking (GWS): 9 credits

**Knowledge Domains**

- Arts (GA): 6 credits
- Health and Wellness (GHW): 3 credits
- Humanities (GH): 6 credits
- Social and Behavioral Sciences (GS): 6 credits
- Natural Sciences (GN): 9 credits

**Integrative Studies** (may also complete a Knowledge Domain requirement)

- Inter-Domain or Approved Linked Courses: 6 credits

**University Degree Requirements**

**First Year Engagement**

All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

**Cultures Requirement**

6 credits are required and may satisfy other requirements

- United States Cultures: 3 credits
- International Cultures: 3 credits

**Writing Across the Curriculum**

3 credits required from the college of graduation and likely prescribed as part of major requirements.

**Total Minimum Credits**

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.
Quality of Work
Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

Limitations on Source and Time for Credit Acquisition
The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80)). For more information, check the Suggested Academic Plan for your intended program.

Requirements for the Major
To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44).

Common Requirements for the Major (All Options)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescribed Courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 111</td>
<td>Experimental Chemistry I</td>
<td>1</td>
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<tr>
<td>CHEM 113</td>
<td>Experimental Chemistry II</td>
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<tr>
<td>MATH 141</td>
<td>Calculus with Analytic Geometry II</td>
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</tr>
<tr>
<td><strong>Prescribed Courses: Require a grade of C or better</strong></td>
<td></td>
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</tr>
<tr>
<td>BIOL 110</td>
<td>Biology: Basic Concepts and Biodiversity</td>
<td>4</td>
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<tr>
<td>BIOL 220W</td>
<td>Biology: Populations and Communities</td>
<td>4</td>
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<tr>
<td>BIOL 230W</td>
<td>Biology: Molecules and Cells</td>
<td>4</td>
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<tr>
<td>BIOL 240W</td>
<td>Biology: Function and Development of Organisms</td>
<td>4</td>
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<tr>
<td>CHEM 110</td>
<td>Chemical Principles I</td>
<td>3</td>
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<tr>
<td>CHEM 112</td>
<td>Chemical Principles II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 140</td>
<td>Calculus With Analytic Geometry I</td>
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<td>Additional Courses</td>
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<tr>
<td>Select one of the following:</td>
<td>8-12</td>
<td></td>
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<tr>
<td>PHYS 211</td>
<td>General Physics: Mechanics</td>
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</tr>
<tr>
<td>&amp; PHYS 212</td>
<td>and General Physics: Electricity and Magnetism</td>
<td></td>
</tr>
<tr>
<td>&amp; PHYS 213</td>
<td>and General Physics: Fluids and Thermal Physics</td>
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</tr>
<tr>
<td>&amp; PHYS 214</td>
<td>and General Physics: Wave Motion and Quantum Physics</td>
<td></td>
</tr>
<tr>
<td>PHYS 250</td>
<td>Introductory Physics I</td>
<td></td>
</tr>
<tr>
<td>&amp; PHYS 251</td>
<td>and Introductory Physics II</td>
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<tr>
<td>Select one of the following:</td>
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<tr>
<td>STAT 200</td>
<td>Elementary Statistics</td>
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<tr>
<td>STAT 240</td>
<td>Introduction to Biometry</td>
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</tr>
<tr>
<td>STAT 250</td>
<td>Introduction to Biostatistics</td>
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</tbody>
</table>

Requirements for the Option
Select one option: 46-51

Ecology Option (46-51 credits)
Available at the following campuses: Altoona, University Park
<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 434</td>
<td>Pathobiology of Emerging Infectious Disease</td>
<td></td>
</tr>
<tr>
<td>BIOL 436</td>
<td>Population Ecology and Global Climate Change</td>
<td></td>
</tr>
<tr>
<td>BIOL 438</td>
<td>Theoretical Population Ecology</td>
<td></td>
</tr>
<tr>
<td>BIOL 439</td>
<td>Practical Bioinformatics</td>
<td></td>
</tr>
<tr>
<td>BIOL 443</td>
<td>Evo-devo: Evolution of Developmental Mechanisms</td>
<td></td>
</tr>
<tr>
<td>BIOL 446</td>
<td>Physiological Ecology</td>
<td></td>
</tr>
<tr>
<td>BIOL 451</td>
<td>Biology of RNA</td>
<td></td>
</tr>
<tr>
<td>BIOL 460</td>
<td>Human Genetics</td>
<td></td>
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<tr>
<td>BIOL 463</td>
<td>General Ecology</td>
<td></td>
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<tr>
<td>BIOL 464</td>
<td>Sociobiology</td>
<td></td>
</tr>
<tr>
<td>BIOL 474</td>
<td>Astrobiology</td>
<td></td>
</tr>
<tr>
<td>BIOL 478</td>
<td>COMPARATIVE NEUROANATOMY</td>
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</table>

**Practicum Group:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIOL 400</td>
<td>Teaching in Biology</td>
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</tr>
<tr>
<td>BIOL 402W</td>
<td>Biological Experimental Design</td>
<td></td>
</tr>
<tr>
<td>BIOL 407</td>
<td>Plant Developmental Anatomy</td>
<td></td>
</tr>
<tr>
<td>BIOL 414</td>
<td>Taxonomy of Seed Plants</td>
<td></td>
</tr>
<tr>
<td>BIOL 417</td>
<td>Invertebrate Zoology</td>
<td></td>
</tr>
<tr>
<td>BIOL 419</td>
<td>Ecological and Environmental Problem Solving</td>
<td></td>
</tr>
<tr>
<td>BIOL 421</td>
<td>Comparative Anatomy of Vertebrates</td>
<td></td>
</tr>
<tr>
<td>BIOL 422</td>
<td>Advanced Genetics</td>
<td></td>
</tr>
<tr>
<td>BIOL/PPEM</td>
<td>Biology of Fungi</td>
<td>425</td>
</tr>
<tr>
<td>BIOL 433</td>
<td>Evolution of Vertebrates</td>
<td></td>
</tr>
<tr>
<td>BIOL 437</td>
<td>Histology</td>
<td></td>
</tr>
<tr>
<td>BIOL 439</td>
<td>Practical Bioinformatics</td>
<td></td>
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<tr>
<td>BIOL 444</td>
<td>Field Ecology</td>
<td></td>
</tr>
<tr>
<td>BIOL 450W</td>
<td>Experimental Field Biology</td>
<td></td>
</tr>
<tr>
<td>BIOL 461</td>
<td>Contemporary Issues in Science and Medicine</td>
<td></td>
</tr>
<tr>
<td>BIOL 473</td>
<td>Laboratory in Mammalian Physiology</td>
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<tr>
<td>BIOL 475N</td>
<td>Anatomy in Italy: Cadavers, Culture, and Science</td>
<td></td>
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<tr>
<td>BIOL 478</td>
<td>COMPARATIVE NEUROANATOMY</td>
<td></td>
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<tr>
<td>BIOL 482</td>
<td>Coastal Biology</td>
<td></td>
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<tr>
<td>BIOL 494</td>
<td>Research Project</td>
<td></td>
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<tr>
<td>BIOL 495</td>
<td>Internship in Biology</td>
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<tr>
<td>BIOL 496</td>
<td>Independent Studies</td>
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<tr>
<td>BIOL 499A</td>
<td>Tropical Field Ecology</td>
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<tr>
<td>BIOTC 459</td>
<td>Plant Tissue Culture and Biotechnology</td>
<td></td>
</tr>
<tr>
<td>SC 295</td>
<td>Science Co-op Work Experience I</td>
<td></td>
</tr>
<tr>
<td>SC 395</td>
<td>Science Co-op Work Experience II</td>
<td></td>
</tr>
<tr>
<td>SC 495</td>
<td>Science Co-op Work Experience III</td>
<td></td>
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</tbody>
</table>

**Supporting Courses and Related Areas**

Select 17-24 credits from department list 17-24

**General Biology Option (46-51 credits)**

Available at the following campuses: Abington, Altoona, Beaver, Berks, Brandywine, Harrisburg, Schuylkill, Scranton, University Park, York

**Code** | **Title**                                                                 | **Credits** |
---|---|---|

**Groups**

Select a minimum of 18 credits of 400-level biology courses, with at least 3 credits from each of the following groups (each course may be used to satisfy a requirement in only one group). Moreover, a maximum of 3 credits of BIOL 400, 494, 495, 496 and SC 295, 395, 495 may be used to fulfill the 18 credit minimum in the 400-level biology course requirements.

**Plant and Fungi Group:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 406</td>
<td>Symbiosis</td>
<td></td>
</tr>
<tr>
<td>BIOL 407</td>
<td>Plant Developmental Anatomy</td>
<td></td>
</tr>
<tr>
<td>BIOL 414</td>
<td>Taxonomy of Seed Plants</td>
<td></td>
</tr>
<tr>
<td>BIOL 420</td>
<td>Paleobotany</td>
<td></td>
</tr>
<tr>
<td>BIOL 424</td>
<td>Seeds of Change: The Uses of Plants</td>
<td></td>
</tr>
<tr>
<td>BIOL/PPEM</td>
<td>Biology of Fungi</td>
<td>425</td>
</tr>
<tr>
<td>BIOL 431</td>
<td>Reproductive Biology</td>
<td></td>
</tr>
<tr>
<td>BIOL 441</td>
<td>Plant Physiology</td>
<td></td>
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<tr>
<td>BIOL 444</td>
<td>Field Ecology</td>
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<tr>
<td>BIOL 446</td>
<td>Physiological Ecology</td>
<td></td>
</tr>
<tr>
<td>BIOL 448</td>
<td>Ecology of Plant Reproduction</td>
<td></td>
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<tr>
<td>BIOL 451</td>
<td>Biology of RNA</td>
<td></td>
</tr>
<tr>
<td>BIOL 482</td>
<td>Coastal Biology</td>
<td></td>
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<tr>
<td>BIOL 499A</td>
<td>Tropical Field Ecology</td>
<td></td>
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<tr>
<td>PPEM 427</td>
<td>Mycotoxins: Effects of Fungal Toxins on Human and Animal Health</td>
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</table>

**Evolution Group:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOL 405</td>
<td>Molecular Evolution</td>
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</tr>
<tr>
<td>BIOL 406</td>
<td>Symbiosis</td>
<td></td>
</tr>
<tr>
<td>BIOL 411</td>
<td>Medical Embryology</td>
<td></td>
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<tr>
<td>BIOL 414</td>
<td>Taxonomy of Seed Plants</td>
<td></td>
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<tr>
<td>BIOL 417</td>
<td>Invertebrate Zoology</td>
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<tr>
<td>BIOL 420</td>
<td>Paleobotany</td>
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<tr>
<td>BIOL 421</td>
<td>Comparative Anatomy of Vertebrates</td>
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</tr>
<tr>
<td>BIOL 422</td>
<td>Advanced Genetics</td>
<td></td>
</tr>
<tr>
<td>BIOL/PPEM</td>
<td>Biology of Fungi</td>
<td>425</td>
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<tr>
<td>BIOL 427</td>
<td>Evolution</td>
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<tr>
<td>BIOL 428</td>
<td>Population Genetics</td>
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<tr>
<td>BIOL 429</td>
<td>Animal Behavior</td>
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<tr>
<td>BIOL 432</td>
<td>Developmental Genetics</td>
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<tr>
<td>BIOL 433</td>
<td>Evolution of Vertebrates</td>
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<tr>
<td>BIOL 434</td>
<td>Pathobiology of Emerging Infectious Disease</td>
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<tr>
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<td>Biology of RNA</td>
<td></td>
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<tr>
<td>BIOL 460</td>
<td>Human Genetics</td>
<td></td>
</tr>
<tr>
<td>BIOL 463</td>
<td>General Ecology</td>
<td></td>
</tr>
<tr>
<td>BIOL 464</td>
<td>Sociobiology</td>
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</tr>
</tbody>
</table>
BIOL 474  Astrobiology  
BIOL 478  COMPARATIVE NEUROANATOMY  

Genetics and Developmental Biology Group:  
BIOL 404  Cellular Mechanisms in Vertebrate Physiology  
BIOL 405  Molecular Evolution  
BIOL 407  Plant Developmental Anatomy  
BIOL 411  Medical Embryology  
BIOL 413  Cell Signaling and Regulation  
BIOL 416  Biology of Cancer  
BIOL 422  Advanced Genetics  
BIOL 426  Developmental Neurobiology  
BIOL 428  Population Genetics  
BIOL 430  Developmental Biology  
BIOL 431  Reproductive Biology  
BIOL 432  Developmental Genetics  
BIOL 439  Practical Bioinformatics  
BIOL 443  Evo-devo: Evolution of Developmental Mechanisms  
BIOL 447  Evolution of Vertebrates  
BIOL 451  Biology of RNA  
BIOL 460  Human Genetics  
BIOL 469  Neurobiology  
MICRB 410  Principles of Immunology  

Ecology Group:  
BIOL 406  Symbiosis  
BIOL 412  Ecology of Infectious Diseases  
BIOL 415  Ecotoxicology  
BIOL 417  Invertebrate Zoology  
BIOL 419  Ecological and Environmental Problem Solving  
BIOL/PPEM 425  Biology of Fungi  
BIOL 429  Animal Behavior  
BIOL 435  Ecology of Lakes and Streams  
BIOL 436  Population Ecology and Global Climate Change  
BIOL 438  Theoretical Population Ecology  
BIOL 444  Field Ecology  
BIOL 446  Physiological Ecology  
BIOL 450W  Experimental Field Biology  
BIOL 463  General Ecology  
BIOL 464  Sociobiology  
BIOL 474  Astrobiology  
BIOL 482  Coastal Biology  
BIOL 499A  Tropical Field Ecology  

Physiology Group:  
BIOL 404  Cellular Mechanisms in Vertebrate Physiology  
BIOL 406  Symbiosis  
BIOL 409  Biology of Aging  
BIOL 411  Medical Embryology  
BIOL 412  Ecology of Infectious Diseases  
BIOL 413  Cell Signaling and Regulation  
BIOL 415  Ecotoxicology  
BIOL 416  Biology of Cancer  
BIOL 421  Comparative Anatomy of Vertebrates  
BIOL 424  Seeds of Change: The Uses of Plants  
BIOL 426  Developmental Neurobiology  
BIOL 430  Developmental Biology  
BIOL 431  Reproductive Biology  
BIOL 432  Developmental Genetics  
BIOL 437  Histology  
BIOL 443  Evo-devo: Evolution of Developmental Mechanisms  
BIOL 446  Physiological Ecology  
BIOL 460  Human Genetics  
BIOL 469  Neurobiology  
BIOL 470  Functional and Integrative Neuroscience  
BIOL 472  Mammalian Physiology  
BIOL 478  COMPARATIVE NEUROANATOMY  
BIOL 479  General Endocrinology  
BIOL 482  Coastal Biology  

Practicum Group:  
BIOL 400  Teaching in Biology  
BIOL 402W  Biological Experimental Design  
BIOL 407  Plant Developmental Anatomy  
BIOL 414  Taxonomy of Seed Plants  
BIOL 417  Invertebrate Zoology  
BIOL 419  Ecological and Environmental Problem Solving  
BIOL 421  Comparative Anatomy of Vertebrates  
BIOL 422  Advanced Genetics  
BIOL/PPEM 425  Biology of Fungi  
BIOL 433  Evolution of Vertebrates  
BIOL 437  Histology  
BIOL 439  Practical Bioinformatics  
BIOL 444  Field Ecology  
BIOL 450W  Experimental Field Biology  
BIOL 461  Contemporary Issues in Science and Medicine  
BIOL 473  Laboratory in Mammalian Physiology  
BIOL 475N  Anatomy in Italy: Cadavers, Culture, and Science  
BIOL 476  Advanced Human Anatomy - cadaver based  
BIOL 478  COMPARATIVE NEUROANATOMY  
BIOL 482  Coastal Biology  
BIOL 494  Research Project  
BIOL 495  Internship in Biology  
BIOL 496  Independent Studies  
BIOL 499A  Tropical Field Ecology  
BIOTC 459  Plant Tissue Culture and Biotechnology  
SC 295  Science Co-op Work Experience I  
SC 395  Science Co-op Work Experience II  
SC 495  Science Co-op Work Experience III  

Supporting Courses and Related Areas  
Select 20-27 credits from department list  

Genetics and Developmental Biology Option (46-51 credits)  
Available at the following campuses: Abington, Berks, Harrisburg, University Park, York
<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 322</td>
<td>Genetic Analysis</td>
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<tr>
<td>BIOL 430</td>
<td>Developmental Biology</td>
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<td>BMB 401</td>
<td>General Biochemistry</td>
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<tr>
<td>BMB 402</td>
<td>General Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 210</td>
<td>Organic Chemistry I</td>
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<tr>
<td>CHEM 212</td>
<td>Organic Chemistry II</td>
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<tr>
<td>CHEM 213</td>
<td>Laboratory in Organic Chemistry</td>
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</tbody>
</table>

**Additional Courses**

Select 2-5 credits from the following:  
**2-5**

- MATH 220  Matrices
- MATH 231  Calculus of Several Variables
- MICRB 201 Introductory Microbiology
- MICRB 202 Introductory Microbiology Laboratory

**Groups**

Select a minimum of 12 credits of 400-level courses, with at least 6 credits from the Genetics and Developmental Biology group, 3 credits from Evolution, and 3 credits from the Practicum group. A maximum of 3 credits of BIOL 400, 494, 495, 496 and SC 295, 395, 495 may be used to fulfill the 12 credit minimum in the 400-level biology course requirements.

**Genetics and Developmental Biology Group:**

- BIOL 404  Cellular Mechanisms in Vertebrate Physiology
- BIOL 405  Molecular Evolution
- BIOL 407  Plant Developmental Anatomy
- BIOL 411  Medical Embryology
- BIOL 413  Cell Signaling and Regulation
- BIOL 416  Biology of Cancer
- BIOL 422  Advanced Genetics
- BIOL 426  Developmental Neurobiology
- BIOL 428  Population Genetics
- BIOL 431  Reproductive Biology
- BIOL 432  Developmental Genetics
- BIOL 439  Practical Bioinformatics
- BIOL 443  Evo-devo: Evolution of Developmental Mechanisms
- BIOL 448  Ecology of Plant Reproduction
- BIOL 451  Biology of RNA
- BIOL 460  Human Genetics
- BIOL 467  Molecular Basis of Neurological Diseases
- BIOL 469  Neurobiology
- BMB 400  Molecular Biology of the Gene  
  or BMB 450  Microbial/Molecular Genetics  
  or BMB 464  Molecular Medicine  
  or BMB 484  Functional Genomics  
  or HORT 407  Plant Breeding  
  or MICRB 41  Principles of Immunology

**Evolution Group:**

- BIOL 405  Molecular Evolution
- BIOL 406  Symbiosis
- BIOL 411  Medical Embryology
- BIOL 414  Taxonomy of Seed Plants
- BIOL 417  Invertebrate Zoology
- BIOL 420  Paleobotany
- BIOL 421  Comparative Anatomy of Vertebrates
- BIOL 422  Advanced Genetics
- BIOL/PPEM 425  Biology of Fungi
- BIOL 427  Evolution
- BIOL 428  Population Genetics
- BIOL 429  Animal Behavior
- BIOL 432  Developmental Genetics
- BIOL 433  Evolution of Vertebrates
- BIOL 434  Pathobiology of Emerging Infectious Disease
- BIOL 436  Population Ecology and Global Climate Change
- BIOL 438  Theoretical Population Ecology
- BIOL 439  Practical Bioinformatics
- BIOL 443  Evo-devo: Evolution of Developmental Mechanisms
- BIOL 446  Physiological Ecology
- BIOL 451  Biology of RNA
- BIOL 460  Human Genetics
- BIOL 463  General Ecology
- BIOL 464  Sociobiology
- BIOL 474  Astrobiology
- BIOL 478  COMPARATIVE NEUROANATOMY

**Practicum Group:**

- BIOL 400  Teaching in Biology
- BIOL 405  Biological Experimental Design
- BIOL 407  Plant Developmental Anatomy
- BIOL 414  Taxonomy of Seed Plants
- BIOL 417  Invertebrate Zoology
- BIOL 419  Ecological and Environmental Problem Solving
- BIOL 421  Comparative Anatomy of Vertebrates
- BIOL 422  Advanced Genetics
- BIOL/PPEM 425  Biology of Fungi
- BIOL 433  Evolution of Vertebrates
- BIOL 437  Histology
- BIOL 439  Practical Bioinformatics
- BIOL 444  Field Ecology
- BIOL 450W  Experimental Field Biology
- BIOL 461  Contemporary Issues in Science and Medicine
- BIOL 473  Laboratory in Mammalian Physiology
- BIOL 475N  Anatomy in Italy: Cadavers, Culture, and Science
- BIOL 478  COMPARATIVE NEUROANATOMY
- BIOL 482  Coastal Biology
- BIOL 494  Research Project
- BIOL 495  Internship in Biology
- BIOL 496  Independent Studies
- BIOL 499A  Tropical Field Ecology
- SC 295  Science Co-op Work Experience I
- SC 395  Science Co-op Work Experience II
- SC 495  Science Co-op Work Experience III

**Supporting Courses and Related Areas**

Select 9-17 credits from department list  
**9-17**
Neuroscience Option (46-51 credits)
Available at the following campuses: University Park

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<td>3</td>
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<td>CHEM 212</td>
<td>Organic Chemistry II</td>
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Additional Courses
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<tr>
<td>BIOL 478</td>
<td>COMPARATIVE NEUROANATOMY</td>
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Groups
Select a minimum of 12 credits of 400-level biology courses, with at least 6 credits from the Neuroscience group, 3 credits from the Evolution group, and 3 credits from the Practicum group. A maximum of 3 credits of BIOL 400, 494, 495, 496 and SC 295, 395, 495 may be used to fulfill the 12 credit minimum in the 400-level biology course requirements.

Neuroscience Group:

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<td>BIOL 413</td>
<td>Cell Signaling and Regulation</td>
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<tr>
<td>BIOL 424</td>
<td>Seeds of Change: The Uses of Plants</td>
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<tr>
<td>BIOL 426</td>
<td>Developmental Neurobiology</td>
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<td>BIOL 430</td>
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<td>Histology</td>
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<tr>
<td>BIOL 467</td>
<td>Molecular Basis of Neurological Diseases</td>
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<td>BIOL 470</td>
<td>Functional and Integrative Neuroscience</td>
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<td>BIOL 472</td>
<td>Mammalian Physiology</td>
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<tr>
<td>BIOL 473</td>
<td>Laboratory in Mammalian Physiology</td>
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<td>BIOL 478</td>
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<td>BIOL 479</td>
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<td>or BBH 451</td>
<td>Pharmacological Influences on Health</td>
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<tr>
<td>or BBH 468</td>
<td>Neuroanatomical Bases for Disorders of Behavior and Health</td>
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<td>or HDFS 468</td>
<td>Biological Bases of Behavioral Development</td>
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<td>or NUTR 445</td>
<td>Energy and Macronutrient Metabolism</td>
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<td>or PSYCH 45</td>
<td>Learning and Memory</td>
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<td>or PSYCH 46</td>
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Evolution Group:

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<td>BIOL 406</td>
<td>Symbiosis</td>
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<tr>
<td>BIOL 411</td>
<td>Medical Embryology</td>
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<tr>
<td>BIOL 414</td>
<td>Taxonomy of Seed Plants</td>
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<tr>
<td>BIOL 417</td>
<td>Invertebrate Zoology</td>
<td></td>
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<tr>
<td>BIOL 420</td>
<td>Paleobotany</td>
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<tr>
<td>BIOL 421</td>
<td>Comparative Anatomy of Vertebrates</td>
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<tr>
<td>BIOL 422</td>
<td>Advanced Genetics</td>
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Supporting Courses and Related Areas
Select 14-19 credits from department list

Plant Biology Option (46-51 credits)
Available at the following campuses: University Park
### Prescribed Courses

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<tr>
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<td>BIOL 441</td>
<td>Plant Physiology</td>
<td>3</td>
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<tr>
<td>BMB 401</td>
<td>General Biochemistry</td>
<td>3</td>
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<tr>
<td>BMB 402</td>
<td>General Biochemistry</td>
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<tr>
<td>CHEM 210</td>
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<td>CHEM 212</td>
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<tr>
<td>CHEM 213</td>
<td>Laboratory in Organic Chemistry</td>
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</tr>
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</table>

### Additional Courses

**Groups**

Select a minimum of 12 credits of 400-level biology courses, with at least 6 credits from the Plant and Fungi group, 3 credits from the Evolution group, and 3 credits from the Practicum group. A maximum of 3 credits of BIOL 400, 494, 495, 496 and SC 295, 395, 495 may be used to fulfill the 12 credit minimum in the 400-level biology course requirements.

**Plant and Fungi Group:**
- BIOL 406: Symbiosis
- BIOL 414: Taxonomy of Seed Plants
- BIOL 420: Paleobotany
- BIOL 424: Seeds of Change: The Uses of Plants
- BIOL/PPEM 425: Biology of Fungi
- BIOL 431: Reproductive Biology
- BIOL 444: Field Ecology
- BIOL 446: Physiological Ecology
- BIOL 448: Ecology of Plant Reproduction
- BIOL 451: Biology of RNA
- BIOL 482: Coastal Biology
- BIOL 499A: Tropical Field Ecology

**Evolution Group:**
- BIOL 405: Molecular Evolution
- BIOL 406: Symbiosis
- BIOL 411: Medical Embryology
- BIOL 414: Taxonomy of Seed Plants
- BIOL 417: Invertebrate Zoology
- BIOL 420: Paleobotany
- BIOL 421: Comparative Anatomy of Vertebrates
- BIOL 422: Advanced Genetics
- BIOL/PPEM 425: Biology of Fungi
- BIOL 427: Evolution
- BIOL 428: Population Genetics
- BIOL 429: Animal Behavior
- BIOL 432: Developmental Genetics
- BIOL 433: Evolution of Vertebrates
- BIOL 434: Pathobiology of Emerging Infectious Disease
- BIOL 436: Population Ecology and Global Climate Change
- BIOL 438: Theoretical Population Ecology
- BIOL 439: Practical Bioinformatics
- BIOL 443: Evo-devo: Evolution of Developmental Mechanisms
- BIOL 446: Physiological Ecology

**Supporting Courses and Related Areas**
Select 14-19 credits from department list

**Vertebrate Physiology Option (46-51 credits)**

Available at the following campuses: Abington, Altoona, Brandywine, University Park

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<tr>
<td>BIOL 473</td>
<td>Laboratory in Mammalian Physiology</td>
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<tr>
<td>BMB 401</td>
<td>General Biochemistry</td>
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<td>CHEM 213</td>
<td>Laboratory in Organic Chemistry</td>
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</table>

**Additional Courses**

**Groups**
Select a minimum of 12 credits of 400-level courses, with at least 6 credits from the Physiology group, 3 credits from the Evolution group, and 3 credits from the Practicum group. A maximum of 3 credits of BIOL 400, 494, 495, 496 and SC 295, 395, 495 may be used to fulfill the 12 credit minimum in the 400-level biology course requirements.

**Physiology Group:**

- BIOL 404 Cellular Mechanisms in Vertebrate Physiology
- BIOL 406 Symbiosis
- BIOL 409 Biology of Aging
- BIOL 411 Medical Embryology
- BIOL 412 Ecology of Infectious Diseases
- BIOL 413 Cell Signaling and Regulation
- BIOL 415 Ecotoxicology
- BIOL 416 Biology of Cancer
- BIOL 421 Comparative Anatomy of Vertebrates
- BIOL 424 Seeds of Change: The Uses of Plants
- BIOL 426 Developmental Neurobiology
- BIOL 430 Developmental Biology
- BIOL 431 Reproductive Biology
- BIOL 432 Developmental Genetics
- BIOL 437 Histology
- BIOL 443 Evo-devo: Evolution of Developmental Mechanisms
- BIOL 446 Physiological Ecology
- BIOL 460 Human Genetics
- BIOL 469 Neurobiology
- BIOL 470 Functional and Integrative Neuroscience
- BIOL 478 COMPARATIVE NEUROANATOMY
- BIOL 479 General Endocrinology
- BIOL 482 Coastal Biology
- ANSC 431 Physiology of Animal Reproduction
  - or ANTH 466 The Skull
  - or BMB 484 Functional Genomics
  - or ENT 402 Biology of Animal Parasites
  - or MICRB 40 Microbial Physiology and Structure
  - or MICRB 41 Principles of Immunology
  - or MICRB 41 Medical Microbiology
  - or MICRB 43 Viral Pathogenesis
  - or PSYCH 46 Physiological Psychology

**Evolution Group:**

- BIOL 405 Molecular Evolution
- BIOL 406 Symbiosis
- BIOL 411 Medical Embryology
- BIOL 414 Taxonomy of Seed Plants
- BIOL 417 Invertebrate Zoology
- BIOL 420 Paleobotany
- BIOL 421 Comparative Anatomy of Vertebrates
- BIOL 422 Advanced Genetics
- BIOL/PPEM 425 Biology of Fungi
- BIOL 427 Evolution
- BIOL 428 Population Genetics
- BIOL 429 Animal Behavior
- BIOL 432 Developmental Genetics
- BIOL 433 Evolution of Vertebrates
- BIOL 434 Pathobiology of Emerging Infectious Disease
- BIOL 436 Population Ecology and Global Climate Change
- BIOL 438 Theoretical Population Ecology
- BIOL 439 Practical Bioinformatics
- BIOL 443 Evo-devo: Evolution of Developmental Mechanisms
- BIOL 446 Physiological Ecology
- BIOL 451 Biology of RNA
- BIOL 460 Human Genetics
- BIOL 463 General Ecology
- BIOL 464 Sociobiology
- BIOL 474 Astrobiology
- BIOL 478 COMPARATIVE NEUROANATOMY

**Practicum Group:**

- BIOL 400 Teaching in Biology
- BIOL 402W Biological Experimental Design
- BIOL 407 Plant Developmental Anatomy
- BIOL 414 Taxonomy of Seed Plants
- BIOL 417 Invertebrate Zoology
- BIOL 419 Ecological and Environmental Problem Solving
- BIOL 421 Comparative Anatomy of Vertebrates
- BIOL 422 Advanced Genetics
- BIOL/PPEM 425 Biology of Fungi
- BIOL 433 Evolution of Vertebrates
- BIOL 437 Histology
- BIOL 439 Practical Bioinformatics
- BIOL 444 Field Ecology
- BIOL 448 Ecology of Plant Reproduction
- BIOL 450W Experimental Field Biology
- BIOL 461 Contemporary Issues in Science and Medicine
- BIOL 473 Laboratory in Mammalian Physiology
- BIOL 475N Anatomy in Italy: Cadavers, Culture, and Science
- BIOL 476 Advanced Human Anatomy - cadaver based
- BIOL 478 COMPARATIVE NEUROANATOMY
- BIOL 482 Coastal Biology
- BIOL 494 Research Project
- BIOL 495 Internship in Biology
- BIOL 496 Independent Studies
- BIOL 499A Tropical Field Ecology
- BIOTC 459 Plant Tissue Culture and Biotechnology
- SC 295 Science Co-op Work Experience I
- SC 395 Science Co-op Work Experience II
- SC 495 Science Co-op Work Experience III

**Supporting Courses and Related Areas**

Select 15-20 credits from department list

---

**Program Learning Objectives**

1. Students will be able to apply the physical, chemical and biological concepts in a biological system.
2. Students will be able to integrate scientific concepts across the curriculum.
3. Demonstrate proficiency in laboratory techniques.
4. Evaluate data sets, apply statistical analyses, and infer conclusions.
5. Communicate the understanding of biological and chemical processes.
6. Apply the knowledge they have gained to recognize and solve real world problems.
7. Students will be expected to work successfully as team members, while simultaneously building upon their abilities to become self-directed learners.

**Academic Advising**

The objectives of the university’s academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee’s unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy)

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psubioadvising@psu.edu

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717-718-6705  
amv12@psu.edu

### Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2019-20 academic year. To access previous years’ suggested academic plans, please visit the archive (http://bulletins.psu.edu/undergraduate/archive) to view the appropriate Undergraduate Bulletin edition (Note: the archive only contain suggested academic plans beginning with the 2018-19 edition of the Undergraduate Bulletin).
Harrisburg Campus

Biology

The course series listed below provides only one of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an Academic Requirements or What If report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

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Second Year

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Third Year

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Fourth Year

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Total Credits 122-125

* Course requires a grade of C or better for the major
‡ Course requires a grade of C or better for General Education
# Course is an Entrance to Major requirement
† Course satisfies General Education and degree requirement

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy University Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of 'C' or better.

Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

Additional Notes

- Fall and Summer only: BIOL 110 (in the fall, for first-year and second-years only; spring for third-year and fourth-years only)
- Fall only: BIOL 230W
- Spring only: BIOL 220W, BIOL 240W

Program Notes:

Be aware that most 400 level biology courses are taught only in one semester and over time, the semester offering can change.

Biology, Genetics and Developmental Biology

The course series listed below provides only one of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an Academic Requirements or What If report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 110(^*)</td>
<td>4</td>
<td>BIOL 220W or 240W(^*)</td>
<td>4</td>
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<tr>
<td>CHEM 110(^†)</td>
<td>3</td>
<td>CHEM 112(^†)</td>
<td>3</td>
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<tr>
<td>CHEM 111(^†)</td>
<td>1</td>
<td>CHEM 113(^†)</td>
<td>1</td>
</tr>
<tr>
<td>MATH 140B(^†)</td>
<td>4</td>
<td>MATH 141B or 141(^†)</td>
<td>4</td>
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<tr>
<td>General Education</td>
<td>3</td>
<td>ENGL 15 or 30(^†)</td>
<td>3</td>
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<td>15</td>
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Second Year

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<tr>
<th>Fall</th>
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</thead>
<tbody>
<tr>
<td>BIOL 230W(^*)</td>
<td>4</td>
<td>BIOL 220W or BIOL 240W(^*)</td>
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<tr>
<td>CHEM 210</td>
<td>3</td>
<td>CHEM 212</td>
<td>3</td>
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<tr>
<td>CHEM 111(^†)</td>
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<td>CHEM 113(^†)</td>
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<tr>
<td>MATH 140B or 140(^†)</td>
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<td>MATH 141B or 141(^†)</td>
<td>4</td>
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<tr>
<td>General Education</td>
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<td>ENGL 15</td>
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### Third Year

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<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIOL 430</td>
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<td>PHYS 251 (or PHYS 213 and PHYS 214)</td>
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<tr>
<td>PHYS 250 or 212†</td>
<td>4</td>
<td>BIOL 4XX</td>
<td>3</td>
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<tr>
<td>STAT 200, 240, or 250†</td>
<td>3-4</td>
<td>BIOL 4XX</td>
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</tr>
<tr>
<td>General Education Course</td>
<td>3</td>
<td>General Education Course</td>
<td>3</td>
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<tr>
<td>Elective</td>
<td>3</td>
<td>Elective - Supporting Course</td>
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</table>

13.5-16.5 16.5 4

### Fourth Year

<table>
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<tr>
<th>Fall</th>
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<th>Spring</th>
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<tr>
<td>BMB 401</td>
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<td>BMB 402</td>
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<td>BIOL 4XX</td>
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<td>BIOL 4XX</td>
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<td>ENGL 202C†</td>
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<td>General Education Course</td>
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<td>General Education Course</td>
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<td>Elective - Supporting course</td>
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<tr>
<td>Elective - Supporting Course</td>
<td>3-4</td>
<td>Elective - Supporting Course</td>
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</tr>
</tbody>
</table>

15-16 15

Total Credits 126-131

* Course requires a grade of C or better for the major
† Course requires a grade of C or better for General Education
# Course is an Entrance to Major requirement
‡ Course satisfies General Education and degree requirement

### University Requirements and General Education Notes:

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Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

### Additional Notes

Scheduling patterns for courses not taught each semester:

- Fall and Summer only:
  - BIOL 110 (in the fall for first-year and second-years only; spring for third-year and fourth years only)

- Fall only:
  - BIOL 230W
  - BIOL 430

- Spring only:
  - BIOL 220W
  - BIOL 240W
  - BIOL 322

### Program Notes:

Be aware that most 400 level Biology courses are taught only in one semester and over time, the semester offering can change.

### Career Paths

A Biology BS degree provides an excellent foundation and the skills required for a wide range of technical careers. While many majors use a Biology degree to prepare for entrance into health professional schools, others follow career paths in research, education, and business. Students also pursue graduate study at universities both across the U.S. and internationally.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE BIOLOGY PROGRAM (http://bio.psu.edu/undergraduate-portal/after-graduation)

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (http://bio.psu.edu/graduate-portal)

### Contact

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