

BIOLOGY, B.S. (UNIVERSITY COLLEGE)

Begin Campus: Any Penn State Campus

End Campus: Beaver, Brandywine, Schuylkill, Scranton, York

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 Department of Biology 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:

Requirement	Credits
General Education	45
Requirements for the Major	94

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)

Code	Title	Credits
Prescribed Courses		
CHEM 111	Experimental Chemistry I	1
CHEM 113	Experimental Chemistry II	1
MATH 141	Calculus with Analytic Geometry II	4
<i>Prescribed Courses: Require a grade of C or better</i>		
BIOL 110	Biology: Basic Concepts and Biodiversity	4
BIOL 220W	Biology: Populations and Communities	4
BIOL 230W	Biology: Molecules and Cells	4
BIOL 240W	Biology: Function and Development of Organisms	4
CHEM 110	Chemical Principles I	3
CHEM 112	Chemical Principles II	3
MATH 140	Calculus With Analytic Geometry I	4
Additional Courses		
Select one of the following:		8-12
PHYS 211 & PHYS 212 & PHYS 213 & PHYS 214	General Physics: Mechanics and General Physics: Electricity and Magnetism and General Physics: Fluids and Thermal Physics and General Physics: Wave Motion and Quantum Physics	
PHYS 250 & PHYS 251	Introductory Physics I and Introductory Physics II	
Select one of the following:		3-4
STAT 200	Elementary Statistics	
STAT 240	Introduction to Biometry	
STAT 250	Introduction to Biostatistics	
Requirements for the Option		
Select an option		46-51

Requirements for the Option Ecology Option (46-51 credits)

Available at the following campuses: Altoona, Schuylkill, University Park

Code	Title	Credits
Prescribed Courses		
BIOL 463	General Ecology	3
Additional Courses		
STAT 462 or STAT 464	Applied Regression Analysis Applied Nonparametric Statistics	3
Select one of the following:		6-8
CHEM 202 & CHEM 203	Fundamentals of Organic Chemistry I and Fundamentals of Organic Chemistry II	
CHEM 210 & CHEM 212 & CHEM 213	Organic Chemistry I and Organic Chemistry II and Laboratory in Organic Chemistry	
Groups		
Select a minimum of 15 credits of 400-level biology courses, with at least 6 credits from the Ecology 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 15 credits minimum in the 400-level biology course requirements.		15
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 464	Sociobiology	
BIOL 474	Astrobiology	
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
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 450W	Experimental Field Biology
BIOL 461	Contemporary Issues in Science and Medicine
BIOL 473	Laboratory in Mammalian Physiology
BIOL 475N	
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 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
Additional Courses		
Select one of the following:		6-8
CHEM 202 & CHEM 203	Fundamentals of Organic Chemistry I and Fundamentals of Organic Chemistry II	

CHEM 210 & CHEM 212 & CHEM 213	Organic Chemistry I and Organic Chemistry II and Laboratory in Organic Chemistry
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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:

BIOL 406	Symbiosis
BIOL 407	Plant Developmental Anatomy
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 441	Plant Physiology
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
PPEM 427	Mycotoxins: Effects of Fungal Toxins on Human and Animal Health

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 421	Comparative Anatomy of Vertebrates
BIOL 478	COMPARATIVE NEUROANATOMY	BIOL 424	Seeds of Change: The Uses of Plants
Genetics and Developmental Biology Group:			
BIOL 404	Cellular Mechanisms in Vertebrate Physiology	BIOL 426	Developmental Neurobiology
BIOL 405	Molecular Evolution	BIOL 430	Developmental Biology
BIOL 407	Plant Developmental Anatomy	BIOL 431	Reproductive Biology
BIOL 411	Medical Embryology	BIOL 432	Developmental Genetics
BIOL 413	Cell Signaling and Regulation	BIOL 437	Histology
BIOL 416	Biology of Cancer	BIOL 443	Evo-devo: Evolution of Developmental Mechanisms
BIOL 422	Advanced Genetics	BIOL 446	Physiological Ecology
BIOL 426	Developmental Neurobiology	BIOL 460	Human Genetics
BIOL 428	Population Genetics	BIOL 469	Neurobiology
BIOL 430	Developmental Biology	BIOL 470	Functional and Integrative Neuroscience
BIOL 431	Reproductive Biology	BIOL 472	Mammalian Physiology
BIOL 432	Developmental Genetics	BIOL 478	COMPARATIVE NEUROANATOMY
BIOL 439	Practical Bioinformatics	BIOL 479	General Endocrinology
BIOL 443	Evo-devo: Evolution of Developmental Mechanisms	BIOL 482	Coastal Biology
BIOL 448	Ecology of Plant Reproduction	Practicum Group:	
BIOL 451	Biology of RNA	BIOL 400	Teaching in Biology
BIOL 460	Human Genetics	BIOL 402W	Biological Experimental Design
BIOL 467	Molecular Basis of Neurological Diseases	BIOL 407	Plant Developmental Anatomy
BIOL 469	Neurobiology	BIOL 414	Taxonomy of Seed Plants
MICRB 410	Principles of Immunology	BIOL 417	Invertebrate Zoology
Ecology Group:			
BIOL 406	Symbiosis	BIOL 419	Ecological and Environmental Problem Solving
BIOL 412	Ecology of Infectious Diseases	BIOL 421	Comparative Anatomy of Vertebrates
BIOL 415	Ecotoxicology	BIOL 422	Advanced Genetics
BIOL 417	Invertebrate Zoology	BIOL/PPEM 425	Biology of Fungi
BIOL 419	Ecological and Environmental Problem Solving	BIOL 433	Evolution of Vertebrates
BIOL/PPEM 425	Biology of Fungi	BIOL 437	Histology
BIOL 429	Animal Behavior	BIOL 439	Practical Bioinformatics
BIOL 435	Ecology of Lakes and Streams	BIOL 444	Field Ecology
BIOL 436	Population Ecology and Global Climate Change	BIOL 450W	Experimental Field Biology
BIOL 438	Theoretical Population Ecology	BIOL 461	Contemporary Issues in Science and Medicine
BIOL 444	Field Ecology	BIOL 473	Laboratory in Mammalian Physiology
BIOL 446	Physiological Ecology	BIOL 475N	
BIOL 450W	Experimental Field Biology	BIOL 476	Advanced Human Anatomy - cadaver based
BIOL 463	General Ecology	BIOL 478	COMPARATIVE NEUROANATOMY
BIOL 464	Sociobiology	BIOL 482	Coastal Biology
BIOL 474	Astrobiology	BIOL 494	Research Project
BIOL 482	Coastal Biology	BIOL 495	Internship in Biology
BIOL 499A	Tropical Field Ecology	BIOL 496	Independent Studies
Physiology Group:			
BIOL 404	Cellular Mechanisms in Vertebrate Physiology	BIOL 499A	Tropical Field Ecology
BIOL 406	Symbiosis	BIOTC 459	Plant Tissue Culture and Biotechnology
BIOL 409	Biology of Aging	SC 295	Science Co-op Work Experience I
BIOL 411	Medical Embryology	SC 395	Science Co-op Work Experience II
BIOL 412	Ecology of Infectious Diseases	SC 495	Science Co-op Work Experience III
BIOL 413	Cell Signaling and Regulation	Supporting Courses and Related Areas	
BIOL 415	Ecotoxicology	Select 20-27 credits from department list	
BIOL 416	Biology of Cancer	20-27	
Genetics and Developmental Biology Option (46-51 credits)			
<i>Available at the following campuses: Abington, Berks, Harrisburg, Schuylkill, University Park, York</i>			

Code	Title	Credits
Prescribed Courses		
BIOL 322	Genetic Analysis	3
BIOL 430	Developmental Biology	3
BMB 401	General Biochemistry	3
BMB 402	General Biochemistry	3
CHEM 210	Organic Chemistry I	3
CHEM 212	Organic Chemistry II	3
CHEM 213	Laboratory in Organic Chemistry	2

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 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		
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*

Code	Title	Credits
Prescribed Courses		
BIOL 469	Neurobiology	3
BMB 401	General Biochemistry	3
BMB 402	General Biochemistry	3
CHEM 210	Organic Chemistry I	3
CHEM 212	Organic Chemistry II	3
CHEM 213	Laboratory in Organic Chemistry	2
Additional Courses		
Select 3 credits from the following:		3
BIOL 426	Developmental Neurobiology	
BIOL 470	Functional and Integrative Neuroscience	
BIOL 478	COMPARATIVE NEUROANATOMY	
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.		12
Neuroscience Group:		
BIOL 404	Cellular Mechanisms in Vertebrate Physiology	
BIOL 413	Cell Signaling and Regulation	
BIOL 424	Seeds of Change: The Uses of Plants	
BIOL 426	Developmental Neurobiology	
BIOL 430	Developmental Biology	
BIOL 437	Histology	
BIOL 467	Molecular Basis of Neurological Diseases	
BIOL 470	Functional and Integrative Neuroscience	
BIOL 472	Mammalian Physiology	
BIOL 473	Laboratory in Mammalian Physiology	
BIOL 478	COMPARATIVE NEUROANATOMY	
BIOL 479	General Endocrinology	
BBH 432	Biobehavioral Aspects of Stress	
or BBH 451	Pharmacological Influences on Health	
or BBH 468	Neuroanatomical Bases for Disorders of Behavior and Health	
or HDFS 468		
or NUTR 445	Energy and Macronutrient Metabolism	
or PSYCH 45	Learning and Memory	
or PSYCH 46	Physiological Psychology	
or PSYCH 47	Clinical Neuropsychology	
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 450W	Experimental Field Biology
BIOL 461	Contemporary Issues in Science and Medicine
BIOL 473	Laboratory in Mammalian Physiology
BIOL 475N	
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 14-19 credits from department list

14-19

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

Code	Title	Credits
Prescribed Courses		
BIOL 407	Plant Developmental Anatomy	3
BIOL 441	Plant Physiology	3
BMB 401	General Biochemistry	3
BMB 402	General Biochemistry	3
CHEM 210	Organic Chemistry I	3
CHEM 212	Organic Chemistry II	3
CHEM 213	Laboratory in Organic Chemistry	2
Additional Courses		
<i>Groups</i>		
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.	12	
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	

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 450W	Experimental Field Biology
BIOL 461	Contemporary Issues in Science and Medicine
BIOL 473	Laboratory in Mammalian Physiology
BIOL 475N	
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 14-19 credits from department list 14-19

Vertebrate Physiology Option (46-51 credits)*Available at the following campuses: Abington, Altoona, Brandywine, Schuylkill, University Park*

Code	Title	Credits
Prescribed Courses		
BIOL 472	Mammalian Physiology	3
BIOL 473	Laboratory in Mammalian Physiology	2
BMB 401	General Biochemistry	3
BMB 402	General Biochemistry	3
CHEM 210	Organic Chemistry I	3
CHEM 212	Organic Chemistry II	3
CHEM 213	Laboratory in Organic Chemistry	2
Additional Courses		
<i>Groups</i>		

Select a minimum of 12 credits of 400-level courses, with at least 6 12 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 402W 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	
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

15-20

Program Learning Outcomes

- KEY LITERACIES:** describe how heritable changes can lead to differences in populations over time that might result in speciation; trace energy/matter transformation, storage, and mobilization; explain how information is exchanged and stored; recognize how changes in biological structures can have varying effects on function;

and/or describe the interactions and interconnections among systems across biological scales and over evolutionary time scales

2. **PROCESS OF SCIENCE:** apply the elements of the process of science such as posing questions, generating novel hypotheses based on the scientific literature; developing appropriate technical skills for research; designing/conducting experiments to test hypotheses in laboratory and/or field settings; summarizing/interpreting data; integrating/evaluating findings in the broader scientific field to construct new knowledge; and/or participating in the peer review/revision process
3. **SCIENTIFIC EVIDENCE EVALUATION:** discriminate among scientific claims presented in a variety of sources based on the strength of evidence; find appropriate published scientific literature; and/or analyze and critically evaluate data/conclusions from the scientific peer-reviewed literature
4. **QUANTITATIVE REASONING AND DATA SCIENCE:** apply basic quantitative competencies such as algebra, probability, statistics, unit conversions, and fundamental biological equations; organize, summarize, and interpret quantitative data; use modeling/simulation to approach problems from across various scales; and/or find and analyze large databases using statistical methods and/or other approaches
5. **INTERDISCIPLINARY THINKING:** integrate knowledge among biological subfields and between biology and other disciplines
6. **COLLABORATION AND COMMUNICATION:** engage with diverse communities and leverage the skills in the community to pose and solve biological questions; demonstrate the ability to work in teams to solve biological problems; and/or communicate in a variety of formal and informal ways in the discussion of biological research
7. **SCIENCE AND SOCIETY:** explore the impacts of scientific research on society and the environment and how society influences/relies on research to inform decision-making; evaluate the ethical implications of biological research; recognize ethical issues in a variety of settings; and/or describe how different perspectives and the resulting alternative approaches might be evaluated using ethical principles to identify a solution to an issue
8. **PROFESSIONAL EXPERIENCES:** communicate in a professional manner and learn/use professional behaviors in all aspects of college and career building activities, including participation in opportunities such as research, internships, cooperative education, teaching and tutoring, study abroad, and/or volunteer work

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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Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2020-21 academic year. To access previous years' suggested academic plans, please visit the archive (<https://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*).

Beaver Campus

General Option

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

Fall	Credits Spring	Credits
BIOL 110 ^{*#}	4 BIOL 240W ^{*#}	4
CHEM 108 (Recommended)	1 CHEM 112 ^{*†}	3
CHEM 110 ^{*#†}	3 CHEM 113 [†]	1
CHEM 111 [†]	1 MATH 141 [‡]	4
MATH 140 ^{*†#†}	4 General Education Course (GA/GS/GH)	3
ENGL 15 or 30 [‡]	3 General Education Course (GHW)	1.5
BIOL 1	1	
PSU 8	1	
	18	16.5

Second Year

Fall	Credits Spring	Credits
BIOL 220W ^{*#}	4 BIOL 230W ^{*#}	4
CHEM 210	3 CHEM 212	3
CAS 100 [‡]	3 CHEM 213	2
General Education Course	3 General Education Course	3
General Education Course	3 General Education Course	3
	General Education Course	1.5
	16	16.5

Third Year

Fall	Credits Spring	Credits
BIOL 4XX (Group I) ¹	3 BIOL 4XX (Group III) ¹	3
BIOL 4XX (Group II) ¹	3 BIOL 4XX (Group IV) ¹	3
PHYS 250 ²	4 ENGL 202C [†]	3
STAT 200 or 250	3 PHYS 251 ²	4
Elective / Supporting Course	3 Elective / Supporting Course	3
General Education Course	1.5	
	17.5	16

Fourth Year

Fall	Credits Spring	Credits
BIOL 4XX Group V ¹	3 BIOL 4XX	3
BIOL 4XX Group VI ¹	3 BIOL 4XX	3
General Education Course	3 Elective / Supporting Course	3
Elective / Supporting Course	3 Elective / Supporting Course	3
Elective / Supporting Course	3 Elective / Supporting Course	3
	15	15

Total Credits 130.5

- * 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

¹ *BIOL course groupings: **Group I** = Plants & fungi; **Group II** = Evolutionary biology; **Group III** = Genetics; **Group IV** = Ecology; **Group V** = Animal physiology; **Group VI** = Practicum

² Students in 2+2 biology program are recommended to take PHYS 250 and PHYS 251 in year 2 rather than year 3

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.

Brandywine Campus

General Option

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

Fall	Credits Spring	Credits
BIOL 110*	4 BIOL 240W*	4
CHEM 110*	3 CHEM 112*	3
CHEM 111	1 CHEM 113	1
ENGL 15 or 30 [†]	3 PHYS 250 or 211	4
MATH 140*	4 MATH 141	4
PSU 16	1	
General Education course (GHW)	1.5	
	17.5	16

Second Year

Fall	Credits Spring	Credits
BIOL 230W*	4 BIOL 220W*	4
PHYS 251 or 212	4 PHYS 213 (or Elective)	2
CHEM 210	3 PHYS 214 (or Elective)	2
CAS 100 [†]	3 CHEM 212	3
General Education course	3 CHEM 213	2
	Biology Option	3
	17	16

Third Year

Fall	Credits Spring	Credits
MICRB 201 (or Biology Option)	3 Biology Option	3
ENGL 202C [†]	3 STAT 200 or 250	3-4
BIOL 4XX Group I	3 Elective	3
BIOL Option	3 BIOL 4XX Group II	3
General Education course	3 General Education course	3
	15	15-16

Fourth Year

Fall	Credits Spring	Credits
BIOL 4 XX Group III	3 BIOL 4XX Group V	3
BIOL 4XX Group IV	3 BIOL 4 XX Group VI	3
General Education course	3 Elective	3
Biology Option	6 General Education course	6
General Education course (GHW)	1.5	
	16.5	15

Total Credits 128-129

* 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.

Vertebrate Physiology Option

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

Fall	Credits Spring	Credits
BIOL 110*	4 BIOL 240W*	4
CHEM 110*	3 CHEM 112*	3
CHEM 111	1 CHEM 113	1
ENGL 15 or 30 [†]	3 PHYS 250 or 211	4
MATH 140*	4 MATH 141	4
PSU 16	1	
General Education course (GWH)	1.5	
	17.5	16

Second Year

Fall	Credits Spring	Credits
BIOL 230W*	4 BIOL 220W*	4
PHYS 251 or 212	4 PHYS 213 (or Elective)	2
CHEM 210	3 PHYS 214 (or Elective)	2
CAS 100 [†]	3 CHEM 212	3
General Education course	3 CHEM 213	2
	BIOL 322	3
	17	16

Third Year

Fall	Credits Spring	Credits
MICRB 201 (or Biology Option)	3 Biology Option	3
ENGL 202C [†]	3 STAT 200 (or STAT 250)	4
BMB 401	3 BMB 402	3
Biology Option	3 BIOL 4 XX Group I	3

General Education	3 General Education course	3
	15	16
Fourth Year		
Fall	Credits Spring	Credits
BIOL 430	3 BIOL 4 XX Group II	3
BIOL 4 XX Group I	3 BIOL 4 XX Group III	3
Biology Option	6 General Education course	6
General Education course	3 Electives	6
General Education course (GHW)	1.5	
	16.5	18

Total Credits 132

- * 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.

Schuylkill Campus**Ecology Option**

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		
Fall	Credits Spring	Credits
BIOL 110 ^{*#†}	4 BIOL 240W ^{*#†}	4
CHEM 110 ^{*#†}	3 CHEM 112 ^{*†}	3
CHEM 111 [†]	1 CHEM 113 [†]	1
ENGL 15, 30, or ESL 15 [‡]	3 MATH 141B [‡]	4
MATH 140B ^{*‡#1}	4 General Education Course	3
PSU 16	1 General Education Course	1.5
	16	16.5

Second Year		
Fall	Credits Spring	Credits
BIOL 220W ^{*#†}	4 General Education Course	3
BIOL 230W ^{*#†}	4 BIOL 463	3
STAT 200 [†]	4 CAS 100 [‡]	3
General Education Course	3 General Education Course	3
General Education Course	1.5 Elective-supporting course (consult with academic adviser for options)	3
	16.5	15

Third Year		
Fall	Credits Spring	Credits
BIOL 4XX (consult with academic adviser for options)	3 BIOL 4XX (consult with academic adviser for options)	3
STAT 462 or 464	3 ENGL 202C [‡]	3
CHEM 210	3 CHEM 212	3
General Education Course	3 CHEM 213	2
Elective- supporting course (consult with academic adviser for options)	3 Elective- supporting course (consult with academic adviser for options)	3
	15	14

Fourth Year		
Fall	Credits Spring	Credits
BIOL 4XX (consult with academic adviser for options)	3 BIOL 4XX (consult with academic adviser for options)	3
Elective - supporting course (consult with academic adviser for options)	4 Elective - supporting course (consult with academic adviser for options)	4
General Education Course	3 General Education Course	3
PHYS 250 [†]	4 PHYS 251 [†]	4
BIOL 4XX (consult with academic adviser for options)	3	
	17	14

Total Credits 124

- * 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

¹ If ALEKS placement is not for MATH 140, then a student may need to start with a pre-requisite MATH course (MATH 21, MATH 22, MATH 26)

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.

General Option

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

Fall	Credits Spring	Credits
BIOL 110 ^{*#}	4 BIOL 240W ^{*#}	4
CHEM 110 ^{*#}	3 CAS 100 [‡]	3
CHEM 111	1 CHEM 112 [*]	3
ENGL 15 or 30 [†]	3 CHEM 113	1
MATH 140 or 140B ^{*#1}	4 MATH 141 or 141B	4
PSU 16	1 General Education Course (GHW)	1.5
	16	16.5

Second Year

Fall	Credits Spring	Credits
BIOL 220W ^{*#}	4 BIOL 4xx (consult with an Academic Adviser for options)	3
BIOL 230W ^{*#}	4 ENGL 202C [‡]	3
General Education Course (GHW)	1.5 STAT 200	4
General Education Course	3 General Education Course	3
General Education Course	3 General Education Course	3
	15.5	16

Third Year

Fall	Credits Spring	Credits
CHEM 210	3 CHEM 212	3
BIOL 4XX (consult with academic adviser for options)	3 CHEM 213	2
BIOL 4XX (consult with academic adviser for options)	3 Elective-supporting Course (consult with academic adviser for options)	3
General Education Course	3 Elective-supporting Course (consult with academic adviser for options)	3
Elective-supporting Course (consult with academic adviser for options)	3 General Education Course	3
	15	14

Fourth Year

Fall	Credits Spring	Credits
PHYS 250	4 PHYS 251	4
BIOL 4XX (consult with academic adviser for options)	3 BIOL 4XX (consult with academic adviser for options)	3
BIOL 4XX (consult with academic adviser for options)	3 Elective-supporting Course (consult with academic adviser for options)	3
Elective-supporting Course (consult with academic adviser for options)	3 Elective-supporting Course (consult with academic adviser for options)	3
Elective-supporting Course (consult with academic adviser for options)	3 Elective-supporting Course (consult with academic adviser for options)	3
	16	16

Total Credits 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

¹ If placement is not for MATH 140, then review math courses will be needed (MATH 21, MATH 22, & MATH 26).

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.

Integrative Studies (either Inter-domain or Linked Courses):

Integrative Studies may be completed within the 30 Knowledge Domain credits and must be completed with either Inter-domain or Linked courses, not a combination of both. For Inter-domain courses, credit may apply to both Knowledge Domain designations but does not reduce the total number of credits within the Knowledge Domains and at least 3 credits of single-domain coursework are required in each of the 5 Knowledge Domains. Linked courses used for the Integrative Studies requirement must represent two different Knowledge Domains.

Genetics and Developmental Biology Option

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

Fall	Credits	Spring	Credits
BIOL 110 ^{*#†}	4	BIOL 240W ^{*#†}	4
CHEM 110 ^{*#†}	3	CHEM 112 ^{*†}	3
CHEM 111 [†]	1	CHEM 113 [†]	1
ENGL 15, 30, or ESL 15 [‡]	3	MATH 141B [‡]	4
MATH 140B ^{*†#1}	4	General Education Course	3
PSU 16	1	General Education Course	1.5
	16		16.5

Second Year

Fall	Credits	Spring	Credits
BIOL 220W ^{*#†}	4	BIOL 322	3
BIOL 230W ^{*#†}	4	General Education Course	3
CHEM 210	3	CAS 100 [‡]	3
General Education Course	3	CHEM 212	3
General Education Course	1.5	CHEM 213	2
	15.5		14

Third Year

Fall	Credits	Spring	Credits
BMB 401	3	BMB 402	3
STAT 200 [†]	4	ENGL 202C [‡]	3
Elective-supporting course (consult with academic adviser for options)	3	BMB 400	3
General Education Course	3	MICRB 201 & MICRB 202	5
General Education Course	3	Elective - supporting course (consult with academic adviser for options)	3
	16		17

Fourth Year

Fall	Credits	Spring	Credits
BIOL 460H	4	BIOL 4XX (consult with academic adviser for options)	3
BIOL 4XX (consult with academic adviser for options)	3	Elective - supporting course (consult with academic adviser for options)	3
General Education Course	3	General Education Course	3
PHYS 250 [†]	4	PHYS 251 [†]	4
		BIOL 430	3
	14		16

Total Credits 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

¹ If ALEKS placement is not for MATH 140, then a student may need to start with a pre-requisite MATH course (MATH 21, MATH 22, MATH 26)

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.

Vertebrate Physiology Option

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

Fall	Credits	Spring	Credits
BIOL 110 ^{*#†}	4	BIOL 240W ^{*#†}	4
CHEM 110 ^{*#†}	3	CHEM 112 ^{*†}	3
CHEM 111 [†]	1	CHEM 113 [†]	1
ENGL 15, 30, or ESL 15 [‡]	3	MATH 141B [‡]	4
MATH 140B ^{*†#1}	4	General Education Course	3
PSU 16	1	General Education Course	1.5
	16		16.5

Second Year

Fall	Credits	Spring	Credits
BIOL 220W ^{*#†}	4	STAT 200 [†]	4
BIOL 230W ^{*#†}	4	General Education Course	3
CHEM 210	3	CAS 100 [‡]	3
General Education Course	3	CHEM 212	3
General Education Course	1.5	CHEM 213	2
	15.5		15

Third Year

Fall	Credits	Spring	Credits
BMB 401	3	BMB 402	3
BIOL 4XX (consult with academic adviser for options)	3	ENGL 202C [‡]	3
Elective - supporting course (consult with academic adviser for options)	3	BIOL 4XX (consult with academic adviser for options)	3

General Education Course	3 General Education Course	3
General Education Course	3 Elective - supporting course (consult with academic adviser for options)	3
15		15
Fourth Year		
Fall	Credits Spring	Credits
BIOL 472	3 BIOL 4XX (consult with academic adviser for options)	3
BIOL 473	2 Elective - supporting course (consult with academic adviser for options)	3
BIOL 4XX (consult with academic adviser for options)	3 Elective - supporting course (consult with academic adviser for options)	3
PHYS 250 [†]	4 PHYS 251 [†]	4
Elective - supporting course (consult with academic adviser for options)	3 Elective - supporting course (consult with academic adviser for options)	2
15		15
Total Credits 123		

- * 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
- ¹ If ALEKS placement is not for MATH 140, then a student may need to start with a pre-requisite MATH course (MATH 21, MATH 22, MATH 26)

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.

Scranton Campus

General Option

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

Fall	Credits Spring	Credits
BIOL 110 ^{*#}	4 BIOL 230W or 240W ^{*#}	4
CHEM 110 ^{*#†}	3 CHEM 112 ^{*†}	3
CHEM 111 [†]	1 CHEM 113 [†]	1
ENGL 15 or 30	3 CAS 100	3
MATH 140 or 140B ^{*#†}	4 MATH 141 or 141B [†]	4
PSU 8	1 General Education Course (GHW)	1.5
16		16.5

Second Year

Fall	Credits Spring	Credits
BIOL 220W ^{*#}	4 BIOL 230W or 240W ^{*#}	4
PHYS 250 (GN) [†]	4 PHYS 251 (GN) [†]	4
CHEM 210	3 CHEM 212 & CHEM 213	5
General Education Course	3 STAT 200	4
General Education Course	3	
17		17

Third Year

Fall	Credits Spring	Credits
BIOL 4XX Group VI - BIOL 421	3 BIOL 4XX Group I - Plants and Fungi	3
Elective Supporting Course	3 General Education Course	3
General Education Course	3 General Education Course	3
Elective Supporting Course	3 Elective Supporting Course	3
Elective	3 Elective	3
General Education Course (GHW)	1.5	
16.5		15

Fourth Year

Fall	Credits Spring	Credits
ENGL 202C	3 BIOL 4XX Group IV - Ecology	3
BIOL 4XX Group II - Evolutionary Biology	3 BIOL 4XX Group V - Animal Physiology	3
BIOL 4XX Group III - BIOL 422	3 Elective Supporting Course	3
Elective Supporting Course	3 Elective Supporting Course	3
General Education Course	3 Elective	3
15		15

Total Credits 128

- * 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).

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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.

Major Requirements Notes:

Students may take PHYS 211, PHYS 212, PHYS 213, & PHYS 214 in place of PHYS 250 & PHYS 251. See adviser.

BIOL 220W is only offered in the fall semesters.

BIOL 421 is only offered every fall in odd years.

Students must take 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) (sem: 5-8).

Group I (Plants and Fungi); Group II Evolutionary Biology; Group III (Genetics and Development); Group IV (Ecology); Group V (Animal Physiology); Group VI (Practicum). Courses offered to complete these major requirements may be offered on a rotating basis.

York Campus

General Biology Option

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

Fall	Credits Spring	Credits
BIOL 110*	4 BIOL 240W*	4
CHEM 110*	3 CHEM 112*	3
CHEM 111	1 CHEM 113	1
ENGL 15 or 30 [†]	3 PHYS 250 or 211	4
MATH 140*	4 MATH 141	4
General Education Course (GHW)	1.5	
	16.5	16

Second Year

Fall	Credits Spring	Credits
BIOL 230W*	4 BIOL 220W*	4
MICRB 201 (or Biology Option)	3 PHYS 213 (or Elective)	2
PHYS 251 or 212	4 PHYS 214 (or Elective)	2
CHEM 210	3 CHEM 212	3

CAS 100 [‡]	3 CHEM 213 (or General Education Course)	2-3
	Biology Option	3
	17	16-17

Third Year

Fall	Credits Spring	Credits
ENGL 202C [‡]	3 Biology Option	3
CHEM 213 (or General Education Course)	2-3 STAT 200 or 250	3-4
BIOL 4XX Group I	3 Elective	3
BIOL Option	3 BIOL 4XX Group II	3
General Education Course	3 General Education Course	3
	14-15	15-16

Fourth Year

Fall	Credits Spring	Credits
BIOL 4 XX Group III	3 BIOL 4XX Group V	3
BIOL 4XX Group IV	3 BIOL 4 XX Group VI	3
General Education Course	3 Elective	3
Biology Option	6 General Education Course	6
General Education Course (GHW)	1.5	
	16.5	15

Total Credits 126-129

- * 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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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.

Genetics and Developmental Biology Option

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

Fall	Credits Spring	Credits
BIOL 110*	4 BIOL 240W*	4
CHEM 110*	3 CHEM 112*	3
CHEM 111	1 CHEM 113	1
ENGL 15 or 30 [‡]	3 PHYS 250 or 211	4
MATH 140*	4 MATH 141	4
General Education Course (GWH)	1.5	
	16.5	16

Second Year

Fall	Credits Spring	Credits
BIOL 230W*	4 BIOL 220W*	4
MICRB 201 (or Biology Option)	3 PHYS 213 (or Elective)	2
PHYS 251 or 212	4 PHYS 214 (or Elective)	2
CHEM 210	3 CHEM 212	3
CAS 100 [‡]	3 CHEM 213	2
General Education Course	3 BIOL 322	3
	20	16

Third Year

Fall	Credits Spring	Credits
ENGL 202C [‡]	3 Biology Option	3
BMB 401	3 STAT 200 (or STAT 250)	4
CHEM 213 (or General Education Course)	2-3 BMB 402	3
Biology Option	3 BIOL 4 XX Group I	3
General Education Course	3 General Education Course	3
	14-15	16

Fourth Year

Fall	Credits Spring	Credits
BIOL 430	3 BIOL 4 XX Group II	3
BIOL 4 XX Group I	3 BIOL 4 XX Group III	3
Biology Option	6 General Education Course	6
General Education Course	3 Electives	6
General Education Course (GHW)	1.5	
	16.5	18

Total Credits 133-134

- * 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).

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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.

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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/>)

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