BIOLOGY, B.S. (ALTOONA)

Begin Campus: Any Penn State Campus

End Campus: Altoona

Program Description

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 To Major

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.

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 (https://senate.psu.edu/students/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/).

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
Prescribed Courses: Require a grade of C or better		
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	Applied Regression Analysis	3
or STAT 464	Applied Nonparametric Statistics	
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/ PPEMREQUIRE FOR THE MAJOR425	Biology of Fungi
BIOL 429	Animal Behavior
BIOL 435	Ecology of Lakes and Streams
BIOL 436	Population Ecology and Global Climate Change
BIOL 438	
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/ PPEMREQUIREMENTS FOR THE MAJOR425	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	
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/ PPEMREQUIRE FOR THE MAJOR425	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, Lehigh Valley, 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	
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.		18
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/ PPEMREQUIREMENTS FOR THE MAJOR425	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/ PPEMREQUIRE FOR THE MAJOR425	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	
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
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 448	Ecology of Plant Reproduction
BIOL 451	Biology of RNA
BIOL 460	Human Genetics
BIOL 467	Molecular Basis of Neurological Diseases
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/ PPEMREQUIREMENTS FOR THE MAJOR425	Biology of Fungi
BIOL 429	Animal Behavior
BIOL 435	Ecology of Lakes and Streams
BIOL 436	Population Ecology and Global Climate Change
BIOL 438	
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	Human 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/ PPEMREQUIRE FOR THE MAJOR425	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 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	20-27

Genetics and Developmental Biology Option (46-51 credits)

Available at the following campuses: Abington, Berks, Harrisburg, Schuylkill, University Park, York

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.		12

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/PPEMREQUIRE FOR THE MAJOR425	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	
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/PPEMREQUIREMENTS FOR THE MAJOR425	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	Human 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/ PPEMREQUIRE FOR THE MAJOR425	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	
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/ PPEMREQUIREMENTS FOR THE MAJOR425	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		
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.		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/ PPEMREQUIREMENTS FOR THE MAJOR425	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/ PPEMREQUIRE FOR THE MAJOR425	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		
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/ PPEMREQUIREMENTS FOR THE MAJOR425	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	Human 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		
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.		12
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 Pathogensis	
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/PPEMREQUIRE FOR THE MAJOR425	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	
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/PPEMREQUIREMENTS FOR THE MAJOR425	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

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 (https://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 and Inter-Domain courses do not meet this requirement.)

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

Breadth in the Knowledge Domains (Inter-Domain courses do not meet this requirement.)

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

Integrative Studies

- **Inter-Domain Courses (Inter-Domain):** 6 credits

Exploration

- **GN,** may be completed with Inter-Domain courses: 3 credits
- **GA, GH, GN, GS, Inter-Domain courses.** This may include 3 credits of World Language course work beyond the 12th credit level or the requirements for the student's degree program, whichever is higher**:** 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 (https://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.

Program Learning Outcomes

1. Students will be able to 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. Students will be able to 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. Students will be able to 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. Students will be able to 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. Students will be able to integrate knowledge among biological subfields and between biology and other disciplines.
6. Students will be able to 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. Students will 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. Students will be able to 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 (https://senate.psu.edu/students/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 2024-25 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.

General Biology Option: Biology, B.S. at Altoona Campus

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 220W or 240W*	4
CHEM 110*#†	3	CHEM 112*†	3
CHEM 111†	1	CHEM 113†	1
MATH 140B or 140*#†	4	MATH 141B or 141	4
PSU 3	1	ENGL 15, 30H, or ESL 15‡	3
General Education Course	3		
	16		**15**

Second Year

Fall	Credits	Spring	Credits
BIOL 230W*	4	BIOL 220W or 240W*	4
CHEM 202 or 210 (see adviser for alternative)	3	CHEM 203 (or (CHEM 212 and CHEM 213))	3-5
STAT 200 or 250‡	4	CAS 100‡	3
General Education Course	3	General Education Course	3
Elective Course or Supporting Course	1	General Education (GHW)	1.5
	15		**14.5-16.5**

Third Year

Fall	Credits	Spring	Credits
Biology 400-level Selection (consult with an academic adviser for options)	3	PHYS 251 (see adviser for alternative)	4
PHYS 250 (see adviser for alternative)	4	Biology 400-level Selection (consult with an academic adviser for options)	3
General Education Course	3	Elective Course or Supporting Course	3
Elective Course or Supporting Course	2-4	General Education Course	3
Elective Course or Supporting Course	3	Elective Course or Supporting Course	3
	15-17		**16**

Fourth Year

Fall	Credits	Spring	Credits
Biology 400-level Selection (consult with an academic adviser for options)	3	Biology 400-level Selection (consult with an academic adviser for options)	3
Biology 400-level Selection (consult with an academic adviser for options)	3	Biology 400-level Selection (consult with an academic adviser for options)	3
ENGL 202C	3	General Education Course	3
Elective Course or Supporting Course	3	Elective Course or Supporting Course	3
Elective Course or Supporting Course	3-4	Elective Course or Supporting Course	4
General Education Course (GHW)	1.5		
	16.5-17.5		**16**

Total Credits 124-129

* 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 Cultural Diversity 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.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

Vertebrate Physiology Option: Biology, B.S. at Altoona Campus

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 220W or 240W*	4
CHEM 110*#†	3	CHEM 112*†	3
CHEM 111†	1	CHEM 113†	1
MATH 140B or 140*#†	4	MATH 141B or 141	4
PSU 3	1	ENGL 15, 30H, or ESL 15‡	3
General Education Course	3		
	16		**15**

Second Year

Fall	Credits	Spring	Credits
BIOL 230W*	4	BIOL 220W or 240W*	4
CHEM 210	3	CHEM 212 & CHEM 213	5
STAT 200 or 250	4	CAS 100‡	3
General Education Course	3	General Education Course	3
Elective Course or Supporting Course	1	General Education Course (GHW)	1.5
		Elective Course or Supporting Course	1
	15		**17.5**

Third Year

Fall	Credits	Spring	Credits
BIOL 472	3	Biology 400-level Selection (consult with an academic adviser for options)	3
BIOL 473	2	Biology 400-level Selection (consult with an academic adviser for options)	3
PHYS 250 (see adviser for alternative)	4	PHYS 251 (see adviser for alternative)	4
General Education Course	3	Elective Course or Supporting Course	3
Elective Course or Supporting Course	3	General Education Course	3
		General Education Course (GHW)	1.5
	15		**17.5**

Fourth Year

Fall	Credits	Spring	Credits
BMB 401	3	BMB 402	3
Biology 400-level Selection (consult with an academic adviser for options)	3	Biology 400-level Selection (consult with an academic adviser for options)	3
ENGL 202C‡	3	General Education Course	3
Elective Course or Supporting Course	3	Elective Course or Supporting Course	3-4
Elective or Supporting Course or Biology 400-level Selection (consult with an academic adviser for options)	3-4	Elective Course or Supporting Course	3
	15-16		**15-16**

Total Credits 126-128

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy Cultural Diversity 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.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

Ecology Option: Biology, B.S. at Altoona Campus

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 220W or 240W*	4
CHEM 110*#†	3	CHEM 112*†	3
CHEM 111†	1	CHEM 113†	1
MATH 140B or 140*#†	4	MATH 141B or 141†	4
PSU 3	1	ENGL 15, 30H, or ESL 15‡	3
General Education Course	3		
	16		**15**

Second Year

Fall	Credits	Spring	Credits
BIOL 230W*	4	BIOL 220W or 240W*	4
CHEM 202 or 210	3	CHEM 203 (or (CHEM 212 and CHEM 213))	3-5
STAT 200 or 250	4	CAS 100‡	3
General Education Course	3	General Education Course	3
Elective Course or Supporting Course	1	General Education Course (GHW)	1.5
	15		**14.5-16.5**

Third Year

Fall	Credits	Spring	Credits
BIOL 463	3	PHYS 251 (see adviser for alternative)	4
PHYS 250 (see adviser for alternative)	4	STAT 462 or 464	3
General Education Course	3	Biology 400-level Selection (consult with an academic adviser for options)	3
Elective Course or Supporting Course	2-4	Elective Course or Supporting Course	3
Elective Course or Supporting Course	3	General Education Course	3
		General Education Course (GHW)	1.5
	15-17		**17.5**

Fourth Year

Fall	Credits	Spring	Credits
Biology 400-level Course	3	Biology 400-level Selection (consult with an academic adviser for options)	3
Biology 400-level Selection (consult with an academic adviser for options)	3	Biology 400-level Selection (consult with an academic adviser for options)	3
ENGL 202C‡	3	General Education Course	3
Elective Course or Supporting Course	3	Elective Course or Supporting Course	3-4
Elective Course or Supporting Course	3-4	Elective Course or Supporting Course	3
	15-16		**15-16**

Total Credits 123-129

* 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 Cultural Diversity 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.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

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 (https://science.psu.edu/bio/undergrad/after-graduation/)

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (https://science.psu.edu/bio/grad/)

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