# **BIOLOGY, B.S. (SCIENCE)**

Begin Campus: Any Penn State Campus

End Campus: University Park

# **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/policies-andrules-for-undergraduate-students/82-00-and-83-00-degree-requirements/ #82-44).

### **Common Requirements for the Major (All Options)**

Code	Title C	redits
Prescribed Cours	es	
CHEM 111	Experimental Chemistry I	1
CHEM 113	Experimental Chemistry II	1
MATH 141	Calculus with Analytic Geometry II	4
Prescribed Course	es: 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 Cours	es	
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	r 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 Cours	es		
BIOL 463	General Ecology	3	
Additional Course	25		
STAT 462	Applied Regression Analysis	3	
or STAT 464	Applied Nonparametric Statistics		
Select one of the following:			
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			

### 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.

### Ecology Group:

Symbiosis
Ecology of Infectious Diseases
Ecotoxicology
Invertebrate Zoology
Ecological and Environmental Problem Solving
Biology of Fungi
Animal Behavior
Ecology of Lakes and Streams
Population Ecology and Global Climate Change
Theoretical Population Ecology
Field Ecology
Physiological Ecology
Experimental Field Biology
Sociobiology
Astrobiology
Coastal Biology
Tropical Field Ecology
Molecular Evolution
Symbiosis
Medical Embryology
Taxonomy of Seed Plants
Invertebrate Zoology
Paleobotany
Comparative Anatomy of Vertebrates
Advanced Genetics
Biology of Fungi
Evolution
Population Genetics

BIOL 429	Animal Behavior		CHEM 202	Fundamentals of Organic Chemistry I	
BIOL 432	Developmental Genetics		& CHEM 203	and Fundamentals of Organic Chemistry II	
BIOL 433	Evolution of Vertebrates		CHEM 210	Organic Chemistry I	
BIOL 434	Pathobiology of Emerging Infectious Disease		& CHEM 212	and Organic Chemistry II	
BIOL 436	Population Ecology and Global Climate Change	9	& CHEM 213	and Laboratory in Organic Chemistry	
BIOL 438	Theoretical Population Ecology		Groups		
BIOL 439	Practical Bioinformatics			m of 18 credits of 400-level biology courses, with	1
BIOL 443	Evo-devo: Evolution of Developmental Mechan	isms		from each of the following groups (each course satisfy a requirement in only one group). Moreover,	
BIOL 446	Physiological Ecology			credits of BIOL 400, 494, 495, 496 and SC 295, 395,	
BIOL 451	Biology of RNA			I to fulfill the 18 credit minimum in the 400-level	
BIOL 460	Human Genetics		biology course re	equirements.	
BIOL 463	General Ecology		Plant and Fungi	Group:	
BIOL 464	Sociobiology		BIOL 406	Symbiosis	
BIOL 474	Astrobiology		BIOL 407	Plant Developmental Anatomy	
BIOL 478	COMPARATIVE NEUROANATOMY		BIOL 414	Taxonomy of Seed Plants	
Practicum Grou			BIOL 420	Paleobotany	
BIOL 400	Teaching in Biology		BIOL 424	Seeds of Change: The Uses of Plants	
	Biological Experimental Design		<b>BIOL/PPEM</b>	Biology of Fungi	
BIOL 402W BIOL 407			425	5, 5	
BIOL 407 BIOL 414	Plant Developmental Anatomy		BIOL 431	Reproductive Biology	
	Taxonomy of Seed Plants		BIOL 441	Plant Physiology	
BIOL 417	Invertebrate Zoology		BIOL 444	Field Ecology	
BIOL 419	Ecological and Environmental Problem Solving	1	BIOL 446	Physiological Ecology	
BIOL 421	Comparative Anatomy of Vertebrates		BIOL 448	Ecology of Plant Reproduction	
BIOL 422	Advanced Genetics		BIOL 451	Biology of RNA	
BIOL/PPEM	Biology of Fungi		BIOL 482	Coastal Biology	
425	Further of Vertebrates		BIOL 499A	Tropical Field Ecology	
BIOL 433	Evolution of Vertebrates		PPEM 427	Mycotoxins: Effects of Fungal Toxins on Human	
BIOL 437	Histology			and Animal Health	
BIOL 439	Practical Bioinformatics		Evolution Group:		
BIOL 444	Field Ecology		BIOL 405	Molecular Evolution	
BIOL 450W	Experimental Field Biology		BIOL 406	Symbiosis	
BIOL 461	Contemporary Issues in Science and Medicine		BIOL 411	Medical Embryology	
BIOL 473	Laboratory in Mammalian Physiology		BIOL 414	Taxonomy of Seed Plants	
BIOL 475N			BIOL 417	Invertebrate Zoology	
BIOL 478	COMPARATIVE NEUROANATOMY		BIOL 420	Paleobotany	
BIOL 482	Coastal Biology		BIOL 421	Comparative Anatomy of Vertebrates	
BIOL 494	Research Project		BIOL 422	Advanced Genetics	
BIOL 495	Internship in Biology		BIOL/PPEM	Biology of Fungi	
BIOL 496	Independent Studies		425	blology of rungi	
BIOL 499A	Tropical Field Ecology		BIOL 427	Evolution	
BIOTC 459	Plant Tissue Culture and Biotechnology		BIOL 428	Population Genetics	
SC 295	Science Co-op Work Experience I		BIOL 429	Animal Behavior	
SC 395	Science Co-op Work Experience II		BIOL 432	Developmental Genetics	
SC 495	Science Co-op Work Experience III		BIOL 433	Evolution of Vertebrates	
Supporting Cou	rses and Related Areas		BIOL 434	Pathobiology of Emerging Infectious Disease	
Select 17-24 cre	edits from department list	17-24	BIOL 434	Population Ecology and Global Climate Change	
Conorol Diology	Option (16 El oradita)		BIOL 438	Theoretical Population Ecology	
	Option (46-51 credits) following campuses: Abington, Altoona, Beaver, Berk	s.	BIOL 438	Practical Bioinformatics	
	risburg, Schuylkill, Scranton, University Park, York	-1			
-			BIOL 443	Evo-devo: Evolution of Developmental Mechanism	5
Code	Title	Credits	BIOL 446	Physiological Ecology	
Additional Cour			BIOL 451	Biology of RNA	
Select one of th	e following:	6-8	BIOL 460	Human Genetics	

BIOL 463	General Ecology	BIOL 415	Ecotoxicology	
BIOL 464	Sociobiology	BIOL 416	Biology of Cancer	
BIOL 474	Astrobiology	BIOL 421	Comparative Anatomy of Vertebrates	
BIOL 478	COMPARATIVE NEUROANATOMY	BIOL 424	Seeds of Change: The Uses of Plants	
Genetics and De	velopmental Biology Group:	BIOL 426	Developmental Neurobiology	
BIOL 404	Cellular Mechanisms in Vertebrate Physiology	BIOL 430	Developmental Biology	
BIOL 405	Molecular Evolution	BIOL 431	Reproductive Biology	
BIOL 407	Plant Developmental Anatomy	BIOL 432	Developmental Genetics	
BIOL 411	Medical Embryology	BIOL 437	Histology	
BIOL 413	Cell Signaling and Regulation	BIOL 443	Evo-devo: Evolution of Developmental Mechani	sms
BIOL 416	Biology of Cancer	BIOL 446	Physiological Ecology	
BIOL 422	Advanced Genetics	BIOL 460	Human Genetics	
BIOL 426	Developmental Neurobiology	BIOL 469	Neurobiology	
BIOL 428	Population Genetics	BIOL 470	Functional and Integrative Neuroscience	
BIOL 430	Developmental Biology	BIOL 472	Human Physiology	
BIOL 431	Reproductive Biology	BIOL 478	COMPARATIVE NEUROANATOMY	
BIOL 432	Developmental Genetics	BIOL 479	General Endocrinology	
BIOL 439	Practical Bioinformatics	BIOL 482	Coastal Biology	
BIOL 443	Evo-devo: Evolution of Developmental Mechanisms	Practicum Group		
BIOL 448	Ecology of Plant Reproduction	BIOL 400	Teaching in Biology	
BIOL 448	Biology of RNA	BIOL 402W	Biological Experimental Design	
BIOL 451 BIOL 460	Human Genetics	BIOL 402W	Plant Developmental Anatomy	
BIOL 467		BIOL 414		
BIOL 469	Molecular Basis of Neurological Diseases		Taxonomy of Seed Plants	
MICRB 410	Neurobiology	BIOL 417 BIOL 419	Invertebrate Zoology Ecological and Environmental Problem Solving	
	Principles of Immunology			
Ecology Group:	Oursehiania	BIOL 421	Comparative Anatomy of Vertebrates	
BIOL 406	Symbiosis	BIOL 422	Advanced Genetics	
BIOL 412	Ecology of Infectious Diseases	BIOL/PPEM 425	Biology of Fungi	
BIOL 415 BIOL 417	Ecotoxicology Invertebrate Zoology	BIOL 433	Evolution of Vertebrates	
	5,	BIOL 437	Histology	
BIOL 419	Ecological and Environmental Problem Solving	BIOL 439	Practical Bioinformatics	
BIOL/PPEM 425	Biology of Fungi	BIOL 444	Field Ecology	
BIOL 429	Animal Behavior	BIOL 450W	Experimental Field Biology	
BIOL 425	Ecology of Lakes and Streams	BIOL 461	Contemporary Issues in Science and Medicine	
BIOL 435	Population Ecology and Global Climate Change	BIOL 401 BIOL 473	Laboratory in Mammalian Physiology	
BIOL 430	Theoretical Population Ecology	BIOL 475N		
BIOL 438	Field Ecology	BIOL 4751	Advanced Human Anatomy - cadaver based	
BIOL 444 BIOL 446			COMPARATIVE NEUROANATOMY	
BIOL 446 BIOL 450W	Physiological Ecology	BIOL 478 BIOL 482	COMPARATIVE NEUROANATOMY Coastal Biology	
	Experimental Field Biology		57	
BIOL 463 BIOL 464	General Ecology	BIOL 494	Research Project	
	Sociobiology	BIOL 495	Internship in Biology	
BIOL 474	Astrobiology	BIOL 496	Independent Studies	
BIOL 482	Coastal Biology	BIOL 499A	Tropical Field Ecology	
BIOL 499A	Tropical Field Ecology	BIOTC 459	Plant Tissue Culture and Biotechnology	
Physiology Grou		SC 295	Science Co-op Work Experience I	
BIOL 404	Cellular Mechanisms in Vertebrate Physiology	SC 395	Science Co-op Work Experience II	
BIOL 406	Symbiosis	SC 495	Science Co-op Work Experience III	
BIOL 409	Biology of Aging		ses and Related Areas	
BIOL 411	Medical Embryology	Select 20-27 cred	lits from department list	20-2
BIOL 412	Ecology of Infectious Diseases			
BIOL 413	Cell Signaling and Regulation			

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 Cours	ses				
Select 2-5 credit	s from the following:	2-5			
MATH 220	Matrices				
MATH 231	Calculus of Several Variables				
MICRB 201	Introductory Microbiology				
MICRB 202	Introductory Microbiology Laboratory				
Groups					

Groups

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

	1 35 1
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	Bacterial 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	Biology of Fungi
425	Exclusion.
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 BIOL 446	Evo-devo: Evolution of Developmental Mechanisms
	Physiological Ecology
BIOL 451 BIOL 460	Biology of RNA Human Genetics
	General Ecology
BIOL 463 BIOL 464	55
BIOL 464 BIOL 474	Sociobiology
BIOL 474 BIOL 478	Astrobiology COMPARATIVE NEUROANATOMY
Practicum Group: BIOL 400	Teaching in Biology
BIOL 400	Biological Experimental Design
BIOL 402W	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	Biology of Fungi
425	biology of rulig.
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		BIOL 417	Invertebrate Zoology
Supporting Courses and Related Areas		BIOL 420	Paleobotany	
		9-17	BIOL 421	Comparative Anatomy of Vertebrates
			BIOL 422	Advanced Genetics
	on (46-51 credits) lowing campuses: University Park		BIOL/PPEM 425	Biology of Fungi
Code	Title	Credits	BIOL 427	Evolution
Prescribed Course	25		BIOL 428	Population Genetics
BIOL 469	Neurobiology	3	BIOL 429	Animal Behavior
BMB 401	General Biochemistry	3	BIOL 432	Developmental Genetics
BMB 402	General Biochemistry	3	BIOL 433	Evolution of Vertebrates
CHEM 210	Organic Chemistry I	3	BIOL 434	Pathobiology of Emerging Infectious Disease
CHEM 212	Organic Chemistry II	3	BIOL 436	Population Ecology and Global Climate Change
CHEM 213	Laboratory in Organic Chemistry	2	BIOL 438	Theoretical Population Ecology
Additional Course			BIOL 439	Practical Bioinformatics
Select 3 credits fr	om the followina:	3	BIOL 443	Evo-devo: Evolution of Developmental Mechanisms
BIOL 426	Developmental Neurobiology	-	BIOL 446	Physiological Ecology
BIOL 470	Functional and Integrative Neuroscience		BIOL 451	Biology of RNA
BIOL 478	COMPARATIVE NEUROANATOMY		BIOL 460	Human Genetics
Groups			BIOL 463	General Ecology
•	of 12 credits of 400-level biology courses, with	12	BIOL 463	Sociobiology
	from the Neuroscience group, 3 credits from the	12	BIOL 474	Astrobiology
	nd 3 credits from the Practicum Group. A maxim	um	BIOL 474 BIOL 478	COMPARATIVE NEUROANATOMY
	L 400, 494, 495, 496 and SC 295, 395, 495 may be		Practicum Group	
	2 credit minimum in the 400-level biology course	è		
requirements.		BIOL 400	Teaching in Biology	
Neuroscience Gro	up:		BIOL 402W	Biological Experimental Design
BIOL 404	Cellular Mechanisms in Vertebrate Physiology		BIOL 407	Plant Developmental Anatomy
BIOL 413	Cell Signaling and Regulation		BIOL 414	Taxonomy of Seed Plants
BIOL 424	Seeds of Change: The Uses of Plants		BIOL 417	Invertebrate Zoology
BIOL 426	Developmental Neurobiology		BIOL 419	Ecological and Environmental Problem Solving
BIOL 430	Developmental Biology		BIOL 421	Comparative Anatomy of Vertebrates
BIOL 437	Histology		BIOL 422	Advanced Genetics
BIOL 467	Molecular Basis of Neurological Diseases		BIOL/PPEM	Biology of Fungi
BIOL 470	Functional and Integrative Neuroscience		425	For half on a f Martalana ta
BIOL 472	Human Physiology		BIOL 433	Evolution of Vertebrates
BIOL 473	Laboratory in Mammalian Physiology		BIOL 437	Histology
BIOL 478	COMPARATIVE NEUROANATOMY		BIOL 439	Practical Bioinformatics
BIOL 479	General Endocrinology		BIOL 444	Field Ecology
BBH 432	Biobehavioral Aspects of Stress		BIOL 450W	Experimental Field Biology
or BBH 451	Pharmacological Influences on Health		BIOL 461	Contemporary Issues in Science and Medicine
or BBH 468	Neuroanatomical Bases for Disorders of Behavio	or and	BIOL 473	Laboratory in Mammalian Physiology
	Health		BIOL 475N	
or HDFS 468		BIOL 478	COMPARATIVE NEUROANATOMY	
or NUTR 445	Energy and Macronutrient Metabolism		BIOL 482	Coastal Biology
or PSYCH 45Learning and Memory		BIOL 494	Research Project	
or PSYCH 46Physiological Psychology		BIOL 495	Internship in Biology	
or PSYCH 47	Clinical Neuropsychology		BIOL 496	Independent Studies
Evolution Group:			BIOL 499A	Tropical Field Ecology
BIOL 405	Molecular Evolution		BIOTC 459	Plant Tissue Culture and Biotechnology
BIOL 406	Symbiosis		SC 295	Science Co-op Work Experience I
BIOL 411	Medical Embryology		SC 395	Science Co-op Work Experience II
	, .,			

Supporting Cou	urses and Related Areas			
Select 14-19 cr	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 Cou	irses			
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 12 at least 6 credits from the Plant and Fungi group, 3 credits from the Evolution group, and 3 credits from the Practicum group. A maximum of 3 credits of BIOL 400, 494, 495, 496 and SC 295, 395, 495 may be used to fulfill the 12 credit minimum in the 400-level biology course requirements.

Plant and Fungi Group:

 ant and i ungi o	ioup.			
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 Mechanis	ms	
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		
	ses and Related Areas		
Select 14-19 cred	lits 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 Course	25	
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	BIOL 427	Evolution	
CHEM 213	Laboratory in Organic Chemistry	2	BIOL 428	Population Genetics	
Additional Courses			BIOL 429	Animal Behavior	
Groups			BIOL 432	Developmental Genetics	
credits from the Physiology group, 3 credits from the Evolution group, and 3 credits from the Practicum group. A maximum of 3 credits of		12	BIOL 433	Evolution of Vertebrates	
			BIOL 434	Pathobiology of Emerging Infectious Disease	
			BIOL 436	Population Ecology and Global Climate Change	
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.			BIOL 438	Theoretical Population Ecology	
Physiology Group:			BIOL 439	Practical Bioinformatics	
BIOL 404	Cellular Mechanisms in Vertebrate Physiology		BIOL 443	Evo-devo: Evolution of Developmental Mechanisms	
BIOL 404 BIOL 406	Symbiosis		BIOL 446	Physiological Ecology	
BIOL 400 BIOL 409	•		BIOL 451	Biology of RNA	
	Biology of Aging		BIOL 460	Human Genetics	
	BIOL 411 Medical Embryology		BIOL 463	General Ecology	
	BIOL 412 Ecology of Infectious Diseases		BIOL 464	Sociobiology	
BIOL 413 Cell Signaling and Regulation			BIOL 474	Astrobiology	
BIOL 415	Ecotoxicology		BIOL 478	COMPARATIVE NEUROANATOMY	
BIOL 416 Biology of Cancer			Practicum Group		
BIOL 421	Comparative Anatomy of Vertebrates		BIOL 400	Teaching in Biology	
BIOL 424	Seeds of Change: The Uses of Plants		BIOL 402W	Biological Experimental Design	
BIOL 426	Developmental Neurobiology		BIOL 40211	Plant Developmental Anatomy	
BIOL 430	BIOL 430 Developmental Biology		BIOL 407 BIOL 414	Taxonomy of Seed Plants	
BIOL 431	Reproductive Biology		BIOL 414 BIOL 417	Invertebrate Zoology	
BIOL 432					
BIOL 437			BIOL 419	Ecological and Environmental Problem Solving	
BIOL 443	Evo-devo: Evolution of Developmental Mechanisms		BIOL 421	Comparative Anatomy of Vertebrates	
BIOL 446	Physiological Ecology		BIOL 422	Advanced Genetics	
BIOL 460	Human Genetics		BIOL/PPEM 425	Biology of Fungi	
BIOL 469	Neurobiology		BIOL 433	Evolution of Vertebrates	
BIOL 470	Functional and Integrative Neuroscience		BIOL 433 BIOL 437	Histology	
BIOL 478	COMPARATIVE NEUROANATOMY		BIOL 437 BIOL 439	Practical Bioinformatics	
BIOL 479	General Endocrinology		BIOL 439 BIOL 444		
BIOL 482	Coastal Biology			Field Ecology	
ANSC 431	Physiology of Animal Reproduction		BIOL 448	Ecology of Plant Reproduction	
or ANTH 4	66The Skull		BIOL 450W	Experimental Field Biology	
or BMB 48	34 Functional Genomics		BIOL 461	Contemporary Issues in Science and Medicine	
or ENT 40	2WBiology of Animal Parasites		BIOL 473	Laboratory in Mammalian Physiology	
	40 Microbial Physiology and Structure		BIOL 475N		
	41 Principles of Immunology		BIOL 476	Advanced Human Anatomy - cadaver based	
	41 Medical Microbiology		BIOL 478	COMPARATIVE NEUROANATOMY	
	43 Viral Pathogensis		BIOL 482	Coastal Biology	
	-		BIOL 494	Research Project	
or PSYCH 46Physiological Psychology Evolution Group:			BIOL 495	Internship in Biology	
BIOL 405	Molecular Evolution		BIOL 496	Independent Studies	
BIOL 405 BIOL 406	Symbiosis		BIOL 499A	Tropical Field Ecology	
	•		BIOTC 459	Plant Tissue Culture and Biotechnology	
BIOL 411	Medical Embryology		SC 295	Science Co-op Work Experience I	
BIOL 414	Taxonomy of Seed Plants		SC 395	Science Co-op Work Experience II	
BIOL 417	Invertebrate Zoology		SC 495	Science Co-op Work Experience III	
BIOL 420	Paleobotany		Supporting Cour	ses and Related Areas	
BIOL 421	1 Comparative Anatomy of Vertebrates Select 15-20 credits from department list				
BIOL 422	Advanced Genetics			dits from department list 15	
BIOL/PPEM	Biology of Fungi				

## **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/generaleducation/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-degreerequirements/#83-80)). For more information, check the Suggested Academic Plan for your intended program.