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

Begin Campus: Any Penn State Campus

End Campus: Altoona

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

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

Code	Title	redits	
<b>Prescribed Cours</b>	es		
CHEM 111	Experimental Chemistry I	1	
CHEM 113	Experimental Chemistry II	1	
MATH 141	Calculus with Analytic Geometry II	4	
Prescribed Course	s: 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	s 4	
CHEM 110	Chemical Principles I	3	
CHEM 112	Chemical Principles II	3	
MATH 140	Calculus With Analytic Geometry I	4	
<b>Additional Course</b>	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 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	ses	
BIOL 463	General Ecology	3
<b>Additional Cours</b>	es	
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

**BIOL 428** 

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:	
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

**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 Mechanisa	ms
BIOL 446	Physiological Ecology	1110
BIOL 451	Biology of RNA	
BIOL 460	Human Genetics	
BIOL 463	General Ecology	
BIOL 464	Sociobiology	
BIOL 474	Astrobiology	
BIOL 474	COMPARATIVE NEUROANATOMY	
racticum Group:		
BIOL 400	Teaching in Biology	
BIOL 400	Biological Experimental Design	
BIOL 402VV	Plant Developmental Anatomy	
BIOL 414	Taxonomy of Seed Plants	
BIOL 417	Invertebrate Zoology	
BIOL 417	Ecological and Environmental Problem Solving	
BIOL 421	Comparative Anatomy of Vertebrates	
BIOL 422	Advanced Genetics	
BIOL/PPEM	Biology of Fungi	
425	biology of Fullyi	
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	
upporting Cours	es and Related Areas	
-	its from department list	17-24

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

Code	Title	Credits
Additional Cour	ses	
Select one of th	e following:	6-8

CHEM 202	Fundamentals of Organic Chemistry I
& CHEM 203	and Fundamentals of Organic Chemistry II
CHEM 210	Organic Chemistry I
& CHEM 212	and Organic Chemistry II
& CHEM 213	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:

3	•
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

BIOL 460

**Human Genetics** 

	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
<b>BIOL 427</b>	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 463	General Ecology	BIOL 415	Ecotoxicology
BIOL 464	Sociobiology	BIOL 416	Biology of Cand
BIOL 474	Astrobiology	BIOL 421	Comparative A
BIOL 478	COMPARATIVE NEUROANATOMY	BIOL 424	Seeds of Chang
Genetics and De	evelopmental Biology Group:	BIOL 426	Developmental
BIOL 404	Cellular Mechanisms in Vertebrate Physiology	BIOL 430	Developmental
BIOL 405	Molecular Evolution	BIOL 431	Reproductive B
BIOL 407	Plant Developmental Anatomy	BIOL 432	Developmental
BIOL 411	Medical Embryology	BIOL 437	Histology
BIOL 413	Cell Signaling and Regulation	BIOL 443	Evo-devo: Evolu
BIOL 416	Biology of Cancer	BIOL 446	Physiological E
BIOL 422	Advanced Genetics	BIOL 460	Human Genetic
BIOL 426	Developmental Neurobiology	BIOL 469	Neurobiology
BIOL 428	Population Genetics	BIOL 470	Functional and
BIOL 430	Developmental Biology	BIOL 472	Human Physiol
BIOL 431	Reproductive Biology	BIOL 478	COMPARATIVE
BIOL 432	Developmental Genetics	BIOL 479	General Endoc
BIOL 439	Practical Bioinformatics	BIOL 482	Coastal Biology
BIOL 443	Evo-devo: Evolution of Developmental Mechanisms	Practicum Group	<b>)</b> :
BIOL 448	Ecology of Plant Reproduction	BIOL 400	Teaching in Bio
BIOL 451	Biology of RNA	BIOL 402W	Biological Expe
BIOL 460	Human Genetics	BIOL 407	Plant Developm
BIOL 467	Molecular Basis of Neurological Diseases	BIOL 414	Taxonomy of S
BIOL 469	Neurobiology	BIOL 417	Invertebrate Zo
MICRB 410	Principles of Immunology	BIOL 419	Ecological and
Ecology Group:		BIOL 421	Comparative A
BIOL 406	Symbiosis	BIOL 422	Advanced Gene
BIOL 412	Ecology of Infectious Diseases	BIOL/PPEM	Biology of Fund
BIOL 415	Ecotoxicology	425	
BIOL 417	Invertebrate Zoology	BIOL 433	Evolution of Ve
BIOL 419	Ecological and Environmental Problem Solving	BIOL 437	Histology
BIOL/PPEM	Biology of Fungi	BIOL 439	Practical Bioin
425	3,7	BIOL 444	Field Ecology
BIOL 429	Animal Behavior	BIOL 450W	Experimental F
BIOL 435	Ecology of Lakes and Streams	BIOL 461	Contemporary
BIOL 436	Population Ecology and Global Climate Change	BIOL 473	Laboratory in N
BIOL 438	Theoretical Population Ecology	BIOL 475N	
BIOL 444	Field Ecology	BIOL 476	Advanced Hum
BIOL 446	Physiological Ecology	BIOL 478	COMPARATIVE
BIOL 450W	Experimental Field Biology	BIOL 482	Coastal Biology
BIOL 463	General Ecology	BIOL 494	Research Proje
BIOL 464	Sociobiology	BIOL 495	Internship in Bi
BIOL 474	Astrobiology	BIOL 496	Independent St
BIOL 482	Coastal Biology	BIOL 499A	Tropical Field E
BIOL 499A	Tropical Field Ecology	BIOTC 459	Plant Tissue Co
Physiology Grou		SC 295	Science Co-op
BIOL 404	Cellular Mechanisms in Vertebrate Physiology	SC 395	Science Co-op
BIOL 406	Symbiosis	SC 495	Science Co-op
BIOL 409	Biology of Aging		ses and Related
BIOL 411	Medical Embryology		dits from departn
BIOL 411	Ecology of Infectious Diseases	Select 20-27 CIE	uits iroin departif
BIOL 412	Cell Signaling and Regulation		
DIUL 413	Gen Signaling and Regulation		

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 Mechanism	ms
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/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 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 Course	es and Related Areas	
Select 20-27 credi	ts 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 Cr	edits
Prescribed Course	es	
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 Course	s	
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	, 3, ,	
credits from the G from Evolution, an of 3 credits of BIO	of 12 credits of 400-level courses, with at least 6 enetics and Developmental Biology group, 3 credit d 3 credits from the Practicum group. A maximum L 400, 494, 495, 496 and SC 295, 395, 495 may be 12 credit minimum in the 400-level biology course	12 s
	elopmental 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 Mechanism	c
BIOL 448	Ecology of Plant Reproduction	9
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	
	Bacterial Genetics	
	Molecular Medicine	
	Functional Genomics	
0	Plant Breeding	
	Principles of Immunology	
Evolution Group:	Timospies of infinatiology	
BIOL 405	Molecular Evolution	
BIOL 406	Symbiosis	
DIOL 400	Cymbicala	

	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
Pr	acticum 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		BIOL 417	Invertebrate Zoology
<b>Supporting Cours</b>	es and Related Areas		BIOL 420	Paleobotany
Select 9-17 credit	s from department list	9-17	BIOL 421	Comparative Anatomy of Vertebrates
	(46 F1 F1)		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 Cours	es		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		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	OOMI AHATIVE NEOTICANATOMI		BIOL 463	General Ecology
	of 12 credits of 400-level biology courses, with	າ 12	BIOL 464	Sociobiology
	from the Neuroscience group, 3 credits from the		BIOL 474	Astrobiology
	and 3 credits from the Practicum Group. A maxi		BIOL 474	COMPARATIVE NEUROANATOMY
	DL 400, 494, 495, 496 and SC 295, 395, 495 may		Practicum Group	
	12 credit minimum in the 400-level biology cou	rse	BIOL 400	
requirements.				Teaching in Biology
Neuroscience Gro	•		BIOL 402W	Biological Experimental Design
BIOL 404	Cellular Mechanisms in Vertebrate Physiology	1	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  Ecological and Environmental Problem Solving
BIOL 426	Developmental Neurobiology		BIOL 419	
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 425	Biology of Fungi
BIOL 470	Functional and Integrative Neuroscience		BIOL 433	Evolution of Vertebrates
BIOL 472	Human Physiology		BIOL 433	Histology
BIOL 473	Laboratory in Mammalian Physiology		BIOL 439	Practical Bioinformatics
BIOL 478	COMPARATIVE NEUROANATOMY		BIOL 444	Field Ecology
BIOL 479	General Endocrinology		BIOL 450W	Experimental Field Biology
BBH 432	Biobehavioral Aspects of Stress		BIOL 461	Contemporary Issues in Science and Medicine
	Pharmacological Influences on Health		BIOL 473	Laboratory in Mammalian Physiology
or BBH 468	Neuroanatomical Bases for Disorders of Beha	vior and	BIOL 475	Laboratory in Maininalian Fifysiology
	Health		BIOL 478	COMPARATIVE NEUROANATOMY
or HDFS 468			BIOL 478	Coastal Biology
	5 Energy and Macronutrient Metabolism		BIOL 494	Research Project
	5Learning and Memory		BIOL 494	Internship in Biology
	6Physiological Psychology			
	7Clinical 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
BIOL 414	Taxonomy of Seed Plants		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**

Plant and Fungi Group:

**BIOL 433** 

BIOL 434

#### 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.

	-	•			
	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 Grou	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			

**Evolution of Vertebrates** 

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	Biology of Fungi				
425	3, 3, 3				
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				
<b>Supporting Cours</b>	Supporting Courses 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 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	

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CHEM 212	Organic Chemistry II	3	BIOL 427	Evolution	
CHEM 213	Laboratory in Organic Chemistry	2	BIOL 428	Population Genetics	
Additional Cours			BIOL 429	Animal Behavior	
Groups			BIOL 432	Developmental Genetics	
,	m of 12 credits of 400-level courses, with at least 6	12	BIOL 433	Evolution of Vertebrates	
	Physiology group, 3 credits from the Evolution group,		BIOL 434	Pathobiology of Emerging Infectious Disease	
	m the Practicum group. A maximum of 3 credits of		BIOL 436	Population Ecology and Global Climate Change	e
	95, 496 and SC 295, 395, 495 may be used to fulfill		BIOL 438	Theoretical Population Ecology	
	nimum in the 400-level biology course requirements.		BIOL 439	Practical Bioinformatics	
Physiology Grou			BIOL 443	Evo-devo: Evolution of Developmental Mechan	isms
BIOL 404	Cellular Mechanisms in Vertebrate Physiology		BIOL 446	Physiological Ecology	
BIOL 406	Symbiosis		BIOL 451	Biology of RNA	
BIOL 409	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 474	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 402W	Plant Developmental Anatomy	
BIOL 430	Developmental Biology		BIOL 414	Taxonomy of Seed Plants	
BIOL 431	Reproductive Biology		BIOL 417		
BIOL 432	Developmental Genetics			Invertebrate Zoology	_
BIOL 437	Histology		BIOL 419	Ecological and Environmental Problem Solving	J
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 437	Histology	
BIOL 478	COMPARATIVE NEUROANATOMY		BIOL 439	Practical Bioinformatics	
BIOL 479	General Endocrinology		BIOL 444	Field Ecology	
BIOL 482	Coastal Biology		BIOL 448	Ecology of Plant Reproduction	
ANSC 431	Physiology of Animal Reproduction		BIOL 450W	Experimental Field Biology	
or ANTH 4	66The Skull		BIOL 461	Contemporary Issues in Science and Medicine	,
or BMB 48	4 Functional Genomics		BIOL 473	Laboratory in Mammalian Physiology	
or ENT 402	2WBiology of Animal Parasites		BIOL 475N	Laboratory in Mariinalian i hysiology	
or MICRB 4	40 Microbial Physiology and Structure		BIOL 475N	Advanced Human Anatomy - cadaver based	
or MICRB 4	41 Principles of Immunology		BIOL 478	COMPARATIVE NEUROANATOMY	
or MICRB 4	41 Medical Microbiology		BIOL 478		
or MICRB 4	43 Viral Pathogensis		BIOL 494	Coastal Biology Research Project	
or PSYCH	46Physiological Psychology		BIOL 494	Internship in Biology	
<b>Evolution Group</b>			BIOL 495	Independent Studies	
BIOL 405	Molecular Evolution		BIOL 499A	Tropical Field Ecology	
BIOL 406	Symbiosis			. 37	
BIOL 411	Medical Embryology		BIOTC 459 SC 295	Plant Tissue Culture and Biotechnology	
BIOL 414	Taxonomy of Seed Plants			Science Co-op Work Experience I	
BIOL 417	Invertebrate Zoology		SC 395	Science Co-op Work Experience II	
BIOL 420	Paleobotany		SC 495	Science Co-op Work Experience III	
BIOL 421	Comparative Anatomy of Vertebrates			ses and Related Areas	15.
BIOL 422	Select 15-20 credits from department list		uits irom department list	15-2	
BIOL/PPEM 425	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/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.