

ANIMAL BEHAVIOR (ANBE)

Faculty

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The program in animal behavior offers an interdisciplinary major that includes subject matter in biology, chemistry, mathematics, physics, and psychology. The focus is directed toward understanding behavior and providing the student with a background uniting ecological, ethological, environmental, evolutionary, experimental, and physiological approaches to the study of animal life.

During the 50 years that Bucknell University has offered this major, animal behavior has been chosen by students seeking a broad background in the natural and social sciences; by those who become researchers; as a background for medical or veterinary science; and, because of the breadth of requirements, by persons filling a variety of positions in commerce, law, and public service.

The major may be pursued under either the Bachelor of Arts or the Bachelor of Science programs. The programs differ chiefly in the number of advanced science courses and laboratories. All students are encouraged to seek laboratory and field experiences in addition to required course work. The Bucknell laboratories, as well as opportunities abroad, are well suited to complement the student's education. Research culminating in an honors thesis is especially recommended.

Animal behavior majors will fulfill the Culminating Experience requirement by taking ANBE 320 Advanced Topics in Animal Behavior in their senior year. The course is open only to senior animal behavior majors and is designed to explore diverse areas and concepts in animal behavior particularly relevant to a student graduating with a degree in animal behavior. The course encourages majors to reflect on what they learned over the years and to look to the future for emerging ideas within the field.

Information literacy, formal presentation, and writing goals within the major will be fulfilled when students take ANBE 296 Research Methods in Animal Behavior/PSYC 296 Research Methods in Animal Behavior and ANBE 320 Advanced Topics in Animal Behavior. In ANBE 296 Research Methods in Animal Behavior/PSYC 296 Research Methods in Animal Behavior, students conduct experimental research, present their work to the class in a conference-style session and write their research as a journal-style publication. In so doing, they search the literature to find sources that provide a theoretical basis for their study, develop the hypotheses tested, and instruct the design of their study. In ANBE 320 Advanced Topics in Animal Behavior, students will develop more theoretical and conceptual writing skills by conducting literature searches on topics in animal behavior and synthesizing the material into a review-style paper. Students will present the results of their literature reviews to class and lead class discussions on selected topics, also enhancing their presentation skills. Although information literacy, formal presentation, and writing goals within the major will be specifically addressed in ANBE 296 Research Methods in Animal Behavior/PSYC 296 Research Methods in Animal Behavior and ANBE 320 Advanced Topics in Animal Behavior, majors will receive similar training in these skills in many other courses they take as electives and requirements within the major.

Bachelor of Arts

The **Bachelor of Arts major** consists of the following 13 required courses.

Animal Behavior core course

ANBE/BIOL/PSYC 266	Animal Behavior	1
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Applied Research Methods in Animal Behavior

ANBE/PSYC 296	Research Methods in Animal Behavior	1
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Biology core courses¹

Select three of the following:		3
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BIOL 205	Introduction to Molecules and Cells (strongly recommended)	
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BIOL 206	Organismal Biology	
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BIOL 207	Genetics	
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BIOL 208	Principles of Ecology and Evolution (strongly recommended)	
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Psychology core requirements

PSYC 203	Learning	1
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PSYC 250	Biopsychology	1
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Statistics requirement

PSYC 215	Psychological Statistics	1
or MATH 216	Statistics I	

Chemistry requirement

CHEM 205	Principles of Chemistry	1
CHEM 211	Organic Chemistry I	1
Upper-level animal behavior electives ²		
Select two of the following:		
ANBE/BIOL 314	Amphibian Biology and Conservation	
ANBE 319	Topics in Animal Behavior	
ANBE/BIOL 321	Behavioral Ecology	
ANBE/BIOL 341	Evolution	
ANBE/BIOL 342	Neuroethology	
ANBE/BIOL 354	Tropical Ecology	
ANBE/BIOL 355	Social Insects	
ANBE/BIOL 357	Ornithology	
ANBE/BIOL/PSYC 370	Primate Behavior and Ecology	
ANBE/PSYC 371	Primate Cognition	
ANBE 372	Comparative Cognition	
BIOL 309	Wildlife and Emerging Diseases	
BIOL 312	Comparative Vertebrate Anatomy	
BIOL 313	Mammalogy	
BIOL 318	Principles of Physiology	
BIOL 324	Neurophysiology	
BIOL 328	Endocrinology	
BIOL 353	Ecosystem Ecology	
BIOL 358	Invertebrate Zoology	
BIOL 359	General Entomology	
BIOL 361	Systematic Biology	
PSYC 324	Advanced Psychological Statistics	
Culminating Experience requirement		
ANBE 320	Advanced Topics in Animal Behavior	1

¹ Students should consult with an academic adviser in animal behavior to determine the most appropriate biology course selections given their academic goals.

² Cross-listed courses are indicated. With special permission, other upper-level PSYC/BIOL courses may be considered as electives.

Bachelor of Science

The **Bachelor of Science major** consists of the following 19 required courses:

Animal Behavior core course

ANBE/BIOL/PSYC 266	Animal Behavior	1
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Applied Research Methods in Animal Behavior

ANBE/PSYC 296	Research Methods in Animal Behavior	1
PSYC 290	Research Methods in Biopsychology	1
or PSYC 293	Research Methods in Learning	

Calculus requirement

MATH 201	Calculus I	1
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Quantitative requirements¹

Select two of the following:

PHYS 211	Classical and Modern Physics I	
PHYS 212	Classical and Modern Physics II	
MATH 202	Calculus II	
MATH 211	Calculus III	
MATH 217	Statistics II	
CSCI 203	Introduction to Computer Science I	
CSCI 204	Introduction to Computer Science II	

PSYC 324	Advanced Psychological Statistics	
Biology core courses		
BIOL 205	Introduction to Molecules and Cells	1
BIOL 206	Organismal Biology	1
BIOL 207	Genetics	1
BIOL 208	Principles of Ecology and Evolution	1
Psychology core requirements		
PSYC 203	Learning	1
PSYC 250	Biopsychology	1
Statistics requirement		
MATH 216 or PSYC 215	Statistics I Psychological Statistics	1
Chemistry requirement		
CHEM 205	Principles of Chemistry	1
CHEM 211	Organic Chemistry I	1
Upper-level animal behavior electives ²		
Select three of the following:		3
ANBE/BIOL 314	Amphibian Biology and Conservation	
ANBE 319	Topics in Animal Behavior	
ANBE/BIOL 321	Behavioral Ecology	
ANBE/BIOL 341	Evolution	
ANBE/BIOL 342	Neuroethology	
ANBE/BIOL 354	Tropical Ecology	
ANBE/BIOL 355	Social Insects	
ANBE/BIOL 357	Ornithology	
ANBE/BIOL/PSYC 370	Primate Behavior and Ecology	
ANBE/PSYC 371	Primate Cognition	
ANBE 372	Comparative Cognition	
BIOL 309	Wildlife and Emerging Diseases	
BIOL 312	Comparative Vertebrate Anatomy	
BIOL 313	Mammalogy	
BIOL 318	Principles of Physiology	
BIOL 324	Neurophysiology	
BIOL 328	Endocrinology	
BIOL 353	Ecosystem Ecology	
BIOL 358	Invertebrate Zoology	
BIOL 359	General Entomology	
BIOL 361	Systematic Biology	
PSYC 324	Advanced Psychological Statistics ³	
Culminating Experience requirement		
ANBE 320	Advanced Topics in Animal Behavior	1
Total Credits		19

¹ Other quantitative-based courses may be approved with special permission.

² Cross-listed courses are indicated. With special permission, other upper-level PSYC/BIOL courses may be considered as electives.

³ PSYC 324 cannot be counted as a 300-level elective if it is used to satisfy the Quantitative Requirement.

The recommended sequence for the Bachelor of Science major is as follows:

First Year

First Semester	Credits	Second Semester	Credits
ANBE 266	1	BIOL 206	1
BIOL 205	1	PSYC 215 or MATH 216	1

MATH 201	1		
	3		2
Sophomore			
First Semester		Credits Second Semester	Credits
BIOL 207	1	BIOL 208	1
CHEM 205	1	CHEM 211	1
PSYC 296 or 250	1	PSYC 296 or 203	1
	3		3
Junior			
First Semester		Credits Second Semester	Credits
Select one of the following:	1	Select one of the following:	1
PSYC 290 or 293		PSYC 290 or 293	
Animal behavior elective	1	Animal behavior elective	1
Quantitative elective	1	Quantitative elective	1
	3		3
Senior			
First Semester		Credits Second Semester	Credits
Animal behavior elective	1	Animal behavior elective	
ANBE 320	1		
	2		0

Total Credits: 19

All students are advised to take the biology core courses in sequence, starting with BIOL 205 Introduction to Molecules and Cells. BIOL 208 Principles of Ecology and Evolution serves as the prerequisite for most of the elective courses. Note that one semester of independent research (ANBE 391 Research) or honors credit (ANBE 399 Senior Thesis) may count toward the upper-level electives for the BA or BS.

Off-campus study and research are encouraged. Recent students have studied in Africa, Australia, New Zealand and Ecuador. Other programs in Europe, Asia, South and Central America are also appropriate. Students are advised to explore opportunities through The Office of Global and Off-campus Education (OGOE) and to coordinate off-campus coursework in consultation with a faculty adviser. Many minors complement studies in animal behavior and students are encouraged to explore options within the humanities and social sciences in consultation with a faculty adviser.

Majors in Animal Behavior will:

1. Understand evolutionary theory as a unifying construct that brings together teachings of many diverse disciplines.
2. Understand the proximate and ultimate bases for behavior (how and why animals behave as they do).
3. Understand the process through which scientific information is derived, evaluated, and communicated.

Courses

ANBE 266. Animal Behavior. 1 Credit.

Offered Both Fall and Spring; Lecture hours:3

A survey of important theories, issues, and empirical techniques in the interdisciplinary field of animal behavior emphasizing both proximate and ultimate mechanisms and explanations for behavior. Crosslisted as BIOL 266 and PSYC 266.

ANBE 296. Research Methods in Animal Behavior. 1 Credit.

Offered Either Fall or Spring; Lecture hours:Varies,Other:3; May require dissection or live animal experimentation

Laboratory and/or field research to accompany ANBE 266, BIOL 266, or PSYC 266. Prerequisites: PSYC 215 or MATH 216, PSYC 216 or BIOL 205 and prerequisite or corequisite ANBE 266, BIOL 266, or PSYC 266. Crosslisted as PSYC 296.

ANBE 2NT. Animal Behavior Non-traditional Study. .5-4 Credits.

Offered Fall, Spring, Summer; Lecture hours:Varies; Repeatable

Non-traditional course in Animal Behavior. Prerequisite: permission of the instructor.

ANBE 307. Conservation Genetics. 1 Credit.

Offered Either Fall or Spring; Lecture hours:3,Other:3

As biodiversity has quickly eroded for the past few centuries, some scientists argue that humans are causing the 6th mass extinction event. This course emphasizes the application of population genetics, molecular phylogenetics, and reproductive genetics to answering biological questions in wildlife conservation. Crosslisted as ANBE 607 and BIOL 307 and BIOL 607.

ANBE 314. Amphibian Biology and Conservation. 1 Credit.**Offered Fall Semester Only; Lecture hours:3,Other:3**

The biology of amphibians, including classification, physiology, reproduction, ecology, evolution, and conservation. Laboratory section will include identification of amphibians and field work to identify conservation issues surrounding local amphibian populations. Prerequisites: BIOL 206, BIOL 208 and permission of the instructor. Crosslisted as BIOL 314 and BIOL 614 and ANBE 614.

ANBE 319. Topics in Animal Behavior. .5-1 Credits.**Offered Both Fall and Spring; Lecture hours:3; Repeatable**

Occasional seminars on selected topics of current interest in animal behavior. Prerequisites: ANBE 266, BIOL 266, or PSYC 266, junior or senior status and permission of the instructor. Crosslisted as ANBE 619.

ANBE 320. Advanced Topics in Animal Behavior. 1 Credit.**Offered Fall Semester Only; Lecture hours:3**

Culminating Experience seminar for senior animal behavior majors covering selected topics of current interest in animal behavior. Crosslisted as ANBE 620. Prerequisites: senior animal behavior major status and permission of the instructor.

ANBE 321. Behavioral Ecology. 1 Credit.**Offered Fall Semester Only; Lecture hours:3**

The consideration of behavioral adaptations to various ecological situations. Topics include habitat choice, foraging behavior, defenses against predation, mate choice, and brood care. Prerequisites: BIOL 208 and permission of the instructor. Crosslisted as BIOL 321 and BIOL 621 and ANBE 621.

ANBE 341. Evolution. 1 Credit.**Offered Either Fall or Spring; Lecture hours:3**

Survey of evolutionary processes, phenomena, and mechanisms. Topics covered may include natural selection, sexual selection, adaptation, evolutionary constraints, speciation, evolution and development, coevolution, behavioral evolution, and macroevolution. Prerequisites: BIOL 208 and permission of the instructor. Crosslisted as ANBE 641 and BIOL 341 and BIOL 641.

ANBE 342. Neuroethology. 1 Credit.**Offered Either Fall or Spring; Lecture hours:3**

A course that integrates neurobiology and behavior in natural contexts. Emphasis on signal detection, recognition, discrimination, localization, orientation, and the control of complex acts. Neuronal and hormonal mechanisms, ontogeny and evolution of behavior will be considered. Prerequisites: BIOL 206 or BIOL 208 and permission of the instructor. Crosslisted as ANBE 342 and ANBE 642 and BIOL 642.

ANBE 354. Tropical Ecology. 1 Credit.**Offered Spring Semester Only; Lecture hours:3**

Introduction to tropical ecology including life history strategies of vertebrates and invertebrates, biodiversity management and conservation. Emphasis on class and individual projects, data collection, and journal keeping. Prerequisites: BIOL 208 and permission of the instructor. Crosslisted as ANBE 654 and BIOL 354 and BIOL 654.

ANBE 355. Social Insects. 1 Credit.**Offered Fall Semester Only; Lecture hours:3,Recitation:2; May require dissection or live animal experimentation**

Evolution and genetics of social behavior, caste, communication in foraging and colony defense, queen and worker control over reproduction, social homeostasis, and population dynamics. Occasionally may be taught as a laboratory science. Prerequisites: BIOL 208 and permission of the instructor. Crosslisted as BIOL 355. Juniors and seniors only.

ANBE 356. Plant-Animal Interactions. 1 Credit.**Offered Either Fall or Spring; Lecture hours:3,Other:3**

The ecological and evolutionary interactions among plants and animals, covering pollination, herbivory, seed dispersal, human applications, and effects of global change. Crosslisted as BIOL 356, ANBE 656 and BIOL 656.

ANBE 357. Ornithology. 1 Credit.**Offered Occasionally; Lecture hours:3,Other:3**

The biology of birds, including evolution, behavior, anatomy, physiology, ecology, and conservation; lab trips focus on identification of birds in the field. Prerequisites: BIOL 206, BIOL 208 and permission of the instructor. Crosslisted as ANBE 657 and BIOL 357 and BIOL 657.

ANBE 370. Primate Behavior and Ecology. 1 Credit.**Offered Fall Semester Only; Lecture hours:3; May require dissection or live animal experimentation**

Introduction to research on prosimians, monkeys, and apes with emphasis on the evolutionary origin of diversity, habitat use, social structure, social behavior, and cognitive abilities. Prerequisites: BIOL 122 or BIOL 208 or ANBE 266 or BIOL 266 or PSYC 266 and permission of the instructor. Crosslisted as ANBE 670 and BIOL 370 and BIOL 670 and PSYC 370 and PSYC 670.

ANBE 371. Primate Cognition. 1 Credit.**Offered Alternate Fall or Spring; Lecture hours:3; May require dissection or live animal experimentation**

An investigation into the cognitive abilities and capacities of nonhuman primates emphasizing a comparative perspective. Prerequisites: ANBE 266 or BIOL 266 or PSYC 266 and permission of the instructor. Crosslisted as ANBE 671 and PSYC 371 and PSYC 671.

ANBE 372. Comparative Cognition. 1 Credit.

Offered Both Fall and Spring; Lecture hours:3

Advanced seminar exploring cognition and behavior from evolutionary and comparative perspectives. Topics will include social behavior, memory, communication, spatial cognition, learning, and meta-cognition. Prerequisites: PSYC 266 or ANBE 266, and permission of the instructor. Crosslisted as PSYC 372 and PSYC 672 and ANBE 672.

ANBE 391. Research. .5-1 Credits.

Offered Fall, Spring, Summer; Lecture hours:Varies,Other:Varies; Repeatable; May require dissection or live animal experimentation

Independent research, with faculty supervision, in the study of animal behavior. Crosslisted as ANBE 691. Prerequisite: permission of the instructor.

ANBE 399. Senior Thesis. 1 Credit.

Offered Fall, Spring, Summer; Lecture hours:2,Other:10; Repeatable; May require dissection or live animal experimentation

Original research leading to a thesis presentation on a topic related to the study of animal behavior. Prerequisite: permission of the instructor.

ANBE 3NT. Animal Behavior Non-traditional Study. 1-2 Credits.

Offered Fall, Spring, Summer; Lecture hours:Varies,Other:Varies

Non-traditional study in Animal Behavior. Prerequisite: permission of the instructor.