

Academic Degree Programs Assessment

College of Liberal Arts and Sciences

Department of Biological Sciences

PhD in Biological Sciences

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Submitted to the University Assessment Panel by

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Academic Degree Programs Assessment

Part I: Assessment Plan

1. Introduction

A Ph.D. in the Biological Sciences allows graduates to pursue professional careers in the public or private sector. Training focuses on the process, skills and critical thinking necessary to design and execute scientific research. Training through research and study of the primary literature endows graduates of the program with enhanced content knowledge, applied skills and a fundamental understanding of the process of science and the scientific method. The overall goal of the program is to develop effective scientists capable of designing and conducting significant independent research.

2. Student Learning Outcomes (SLOs)

Graduates of the Biological Sciences Ph.D. program will demonstrate:

1. Fundamental understanding of the principles, major research findings and current unresolved problems in their area of emphasis
2. Effective scientific communication skills
3. Effective laboratory and field research skills
4. Proficiency in critical thinking,
5. Appropriate use of the scientific method.
6. Technical writing proficiency
7. Original scholarship and the ability to conduct independent research

3. Program-by-PhD Student Learning Outcomes Matrix (Outcome-by-Methods)

Student learning outcomes	Summative Assessment		Formative Assessment	
	Candidacy Exam	Ph.D. Dissertation	Research Committee Meetings	Dissertation Research (BIOS 799)
1. Principles/Problems	S	S	S	S
2. Communication	S	S	S	S
3. Lab/Field Skills		S	S	S
4. Critical Thinking	S	S	S	S
5. Scientific Method	S	S	S	S
6. Technical Writing	S	S	S	
7. Original Independent Research		S	S	S
Program outcome strongly supports (S), moderately supports (M), not support (blank)				

4. Curriculum Map

The curriculum map for PhD students depends on students' research interest (area of focus) and career goal. In our department, we currently have 8 different areas of focus: Anatomy; Biomedical Science; Bioinformatics; Biology Education; Cellular/Molecular Biology; Ecology, Evolution, Behavior & Conservation Program; Microbiology; and Plant Science. Students and their graduate committee will select the best curriculum map from the following graduate courses.

Course	Program Student Learning Outcomes					
	Principles/ problem solving	Communica tion	Lab/field Research skills	Critical thinking	Scientific methods	Technical writing
BIOS 506 - Conservation Biology	P		P	P	P	
BIOS 509X - Water Quality	P		P	P	P	
BIOS 511 - Plant Physiology	P		P	P	P	
BIOS 512 - Mycology	P		P	P	P	
BIOS 513 - Microbial Physiology	P		P	P	P	
BIOS 517 - Pathogenic Microbiology	P		P	P	P	
BIOS 522X - Plant- Soil Interactions	P		P	P	P	
BIOS 523 - Principles of Virology	P		P	P	P	

Course	Program Student Learning Outcomes					
	Principles/ problem solving	Communica tion	Lab/field Research skills	Critical thinking	Scientific methods	Technical writing
BIOS 530 - Plant Systematics	P		P	P	P	
BIOS 533 - Behavioral Ecology	P	P	P	P	P	P
BIOS 535X - Primate Evolution	P		P	P	P	
BIOS 537X - Primate Anatomy	P		P	P	P	
BIOS 539 - Molecular Evolution	P		P	P	P	
BIOS 540 - Immunobiology	P		P	P	P	
BIOS 542 - Evolution and the Creationist Challenge	P		P	P	P	
BIOS 544 - Cell and Tissue Culture	P		P	P	P	
BIOS 545 - Human Histology	P		P	P	P	
BIOS 546 - Gross Human Anatomy	P		P	P	P	
BIOS 547 - Comparative Vertebrate Anatomy	P		P	P	P	

Course	Program Student Learning Outcomes					
	Principles/ problem solving	Communica tion	Lab/field Research skills	Critical thinking	Scientific methods	Technical writing
BIOS 550 - Molecular Biology of Cancer	P		P	P	P	
BIOS 553 - Entomology	P		P	P	P	
BIOS 554 - Developmental Biology	P		P	P	P	
BIOS 555 - Comparative Physiology	P		P	P	P	
BIOS 556 - Biology of Fishes, Amphibians, and Reptiles	P		P	P	P	
BIOS 557 - Biology of Birds and Mammals	P		P	P	P	
BIOS 558 - Vertebrate Paleontology	P		P	P	P	
BIOS 561 - Endocrinology	P		P	P	P	
BIOS 564 - Cell Signaling	P		P	P	P	
BIOS 565 - Cellular Physiology	P		p	P	P	

Course	Program Student Learning Outcomes					
	Principles/ problem solving	Communica tion	Lab/field Research skills	Critical thinking	Scientific methods	Technical writing
BIOS 567 - Advanced Molecular Biology	P		P	P	P	
BIOS 568X - Geomicrobiology	P		P	P	P	
BIOS 569X - Invertebrate Paleontology	P		P	P	P	
BIOS 570X - General Biological Chemistry	P		P	P	P	
BIOS 571X - Biological Chemistry Laboratory	P	P	P	P	P	P
BIOS 572X - Biological Chemistry I	P		P	P	P	
BIOS 573X - Biological Chemistry II	P		P	P	P	
BIOS 576 - Plant Genetics	P		P	P	P	
BIOS 577 - Human Genetics	P		P	P	P	

Course	Program Student Learning Outcomes					
	Principles/ problem solving	Communica tion	Lab/field Research skills	Critical thinking	Scientific methods	Technical writing
BIOS 582 - Biology of Forensic Analysis	P		P	P	P	
BIOS 587 - Conservation Genetics	P		P	P	P	
BIOS 588 - Applied Microbial Biotechnology	P		P	P	P	
BIOS 589 - Madagascar Field Biology	P		P	P	P	
BIOS 605 - Institute for Science Teachers in Biology	P	P	P	P	P	P
BIOS 610 - Food and Industrial Microbiology	P		P	P	P	
BIOS 619 - Microbial Systematics and Diversity	P		P	P	P	
BIOS 623 - Graduate Teaching and Research Orientation	P	P		P		

Course	Program Student Learning Outcomes					
	Principles/ problem solving	Communica tion	Lab/field Research skills	Critical thinking	Scientific methods	Technical writing
BIOS 626 - Methods of Teaching Human Anatomy	P		P	P	P	
BIOS 627X - Neuroanatomical Bases of Behavior	P		P	P	P	
BIOS 628X - Neuroanatomical Bases of Behavior: Laboratory	P		P	P	P	P
BIOS 629 - Human Embryology	P		P	P	P	
BIOS 630X - Neurochemical Bases of Behavior	P		P	P	P	
BIOS 632 - Radiation Biology	P		P	P	P	
BIOS 638 - Molecular Genetics of Prokaryotes	P		P	P	P	
BIOS 640 - Advanced Immunology	P		P	P	P	
BIOS 641 - Practical Bioinformatics for Biologists	P		P	P	P	

Course	Program Student Learning Outcomes					
	Principles/ problem solving	Communica tion	Lab/field Research skills	Critical thinking	Scientific methods	Technical writing
BIOS 643 - Bioinformatics	P		P	P	P	
BIOS 646 - Programming for Bioinformatics	P		P	P	P	
BIOS 670 - Biostatistical Analysis	P		P	P	P	
BIOS 684 - The Process and Practices of Science	P		P	P	P	
BIOS 690 - Topics in Molecular and Cellular Control Mechanisms	P		P	P	P	
BIOS 699 - Master's Thesis	P	P	P	P	P	P
BIOS 700 - Special Topics in Biology	P	P	P	P	P	P
BIOS 761 - Seminar	P	P	P	P	P	P
BIOS 770 - Independent Study	P	P	P	P	P	P
BIOS 790 - Cooperative Education	P	P		P		

Note. Course supports the outcome at the B=beginning, D=developing, or P=proficient level.

5. Assessment Methods

Method	Description	Target	Timeline	Person Responsible	SLO Assessed
Ph.D. Candidacy Examination	Students must pass a candidacy exam for the Ph.D. that consists of both written and oral portions. The candidacy exam tests the depth and breadth of the student's knowledge in their area of research, and assesses the student's ability to design and present a coherent, logical and appropriate research plan. Students are also expected to be able to present a coherent, logical and appropriate research plan describing specific experimental approaches that will be carried out to investigate current problems in biological sciences in their area of concentration.	Over 90% of Ph.D. students initially admitted to the program are expected to successfully pass this qualifying exam.	Sometime in years 2 to 3 in the Ph.D. program (after accrual of ≥ 28 and ≤ 60 credit hours)	Dissertation Research Committee (Graduate faculty members)	1,2,4,5,6
Written Research Dissertation	Students must write a Ph.D. dissertation that exhibits original research. Students will defend the Ph.D. dissertation in a public seminar and in a comprehensive examination conducted by the student's advisory committee.	100% of students receiving the Ph.D. degree are expected to meet this requirement.	Final Semester of the students' Ph.D. program	Dissertation Research Committee (Graduate faculty members)	1,2,3,4,5,6,7

Committee Meetings	This is a tool of <i>formative</i> assessment. Ph.D. students establish and meet with their advisory committees during their second year, and every 6-12 months thereafter. Students present their project data, progress and proposed plan of research. The committee asks questions, provides feedback and constructive criticism and frames the expectations for the student's final dissertation content.	100% of the students passing into candidacy will go on to produce a successful dissertation research project.	Every 6-9 months	Dissertation Research Committee (Graduate faculty members)	1,2,3,4,5,6,7
Doctoral Dissertation Research (BIOS 799)	All post-candidacy Ph.D. students must take at least 12 hours of BIOS 799. During their execution of their research projects, students typically meet with and present their research to the principal investigator/dissertation research advisor in lab meetings or individual meetings. The advisor provides advice and direction, and assesses progress by the student successfully complete 12 hours of BIOS 799.	100% of post-candidacy Ph.D. students will need at least 12 hours of Bios 799	Every semester after successful completion of the qualifying examination	Dissertation Research Advisor	1,2,3,4,5,6,7