

University of Florida Academic Program Review 2009-2016
Bachelor of Science Degree in Biology CIP 26.0101

Program Contacts and Administration of the Major:

major.biology.ufl.edu/about/administration-of-the-major

The UF Biology Major is administered out of the UF Biology Major Office located in 214 Bartram Hall. The composition of the Biology Major Executive (BMEC) Committee is given in Table 1.

1. Mission and Purpose

The UF Biology Major program comprises the faculty and courses from the Biology Department within the College of Liberal Arts and Sciences (CLAS) and several departments from the College of Agricultural and Life Sciences (CAL S) to prepare undergraduates for careers in the life sciences, advanced study in professional and graduate schools, productive citizenship and leadership, and lifelong learning. The program is comprehensive and flexible, emphasizing the diverse forms, processes, and systems of life. Students in the program complete required and elective courses that promote critical thinking through the investigation and understanding of principles and unifying themes that govern living systems. The program promotes and facilitates broad and diverse student participation in mentored research opportunities by allowing undergraduate research courses from several departments and colleges to apply towards major credit including the departments of Agronomy, Animal Sciences, Anthropology, Biology, Biochemistry and Molecular Biology, Chemistry, Entomology and Nematology, Food Science and Human Nutrition, Horticultural Sciences, Interdisciplinary Studies, Microbiology and Cell Science, Wildlife Ecology and Conservation, and several departments from the Colleges of Engineering, Medicine, Dentistry, and Veterinary Medicine. Students in the program are provided academic, professional and career advising to facilitate timely, successful completion of the degree and placement in their preferred post-graduate education program or career.

The UF Biology Major supports the goals of the Board of Governors' Strategic Plan by 1) increasing the number of STEM degrees awarded, 2) increasing the number of STEM degrees awarded to underrepresented minorities, and 3) strengthening the quality and reputation of the undergraduate program.

Goal 1: Increasing the Number of Biology Degrees Awarded

The total number of biology degrees awarded increased from 55 in 2009 to 455 in 2015 (Figure 1).

Goal 2: Increasing the Number of Degrees Awarded to Underrepresented Minorities

The total number of biology degrees awarded to underrepresented minorities increased from 11 in 2009 to 132 in 2015 (Figure 2).

Goal 3: Strengthening the Quality and Reputation of the Undergraduate Program

The average national ranking of UF Biology Major total scores from the national Biology Major Test increased from the top 43% in 2010 to the top 18% in 2015 (Figure 3).

2. Description of the Program

The UF Biology Major offers three specializations in CLAS and four in CALS (Table 2). The major does not offer a minor.

CLAS offers two Bachelor of Science in Biology specializations. Integrative Biology is designed for students preparing for graduate studies in biology or specialized areas such as ecology, evolution, genetics, molecular biology, physiology and systematics. Pre-professional Biology is designed for students preparing for admission to medical, dental, optometry, veterinary or other professional schools. CLAS also offers a Bachelor of Arts in Biology specialization that is a flexible program best suited for students interested in a career in education, the allied health professions, and interdisciplinary fields such as environmental or biotechnology law, science journalism, and bioscience management. This specialization is not recommended for students seeking admission into professional medical schools or students seeking careers in research.

CALS offers four Bachelor of Science in Biology specializations. Applied Biology is designed for students interested in learning how fundamental biology is applied to solving problems. This specialization provides exposure to the major issues facing sustainability of human populations and natural resources. Biotechnology is designed for students seeking careers where knowledge of molecular biology and genetic engineering are important. Students learn specialized techniques and scientific procedures in molecular biology, virology, bioengineering, cell and tissue culture, and bioinformatics. Natural Science is designed for students interested in descriptive and interpretive biology, with an emphasis on field biology. The specialization provides exposure to the major forms of flora and fauna, and integrates some of the major environmental factors that influence the distribution of flora and fauna, such as soil/water relations and human activities. The CALS Pre-professional specialization is almost identical to that in CLAS and is designed for students preparing for admission to medical, dental, optometry, veterinary or other professional schools. The UF Biology Major is unique in that it provides students access to over 100 life-science courses from over 15 departments in three colleges: Liberal Arts and Sciences; Agricultural and Life Sciences; and Medicine.

The main differences between the colleges in addition to the different specializations offered are that CLAS requires proficiency in a foreign language while CALS does not; and CALS requires technical writing, public speaking, and economics courses while CLAS does not.

Required Foundation Coursework for the Major

All of the Bachelor of Science specializations require BSC 2010+L & 2011+L, CHM 2045+L & 2046+L, at least one course in organic chemistry, two courses with labs in physics, and MAC

2311 and MAC 2312 or STA 2023. The Bachelor of Arts specialization requires BSC 2010+L & 2011+L, CHM 1030 & 1031, PHY 2004+L & 2005+L, and MAC 1147 & STA 2023. (Tables 3 and 4).

Required Core Coursework for the Major

Although there are major differences among the specializations regarding core coursework, all require the senior capstone course, BSC 4936 Critical Analysis of Biological Research. All Bachelor of Science specializations require a course in genetics. Both Pre-professional specializations require MCB 3020+L, PCB 4723C, BCH 4024, and 12 credits from the list of approved life science electives (Tables 5 - 11).

3. Program Goals for Teaching

The UF Biology Major provides excellence in teaching with a diversity of courses from CLAS and CALS, and a diversity of faculty for mentoring in authentic life science research from CLAS, CALS, College of Medicine, College of Dentistry, College of Health and Human Performance, and the College of Veterinary Medicine.

Program Goal 1: Promote biology knowledge, critical thinking, and communication skills.

Program Goal 2: Promote graduation in a timely manner.

Program Goal 3: Increase opportunities for students in life science research.

4. Criteria for Knowing When the Goals and Objectives are Achieved

Scores from 1) a national standardized biology test, 2) a PowerPoint presentation, and 3) pre- and post quizzes on ethics in research are used to assess Program Goal 1. Informal communication with advisors in the Academic Advising Center concerning bottleneck courses and time to graduation are used to assess Program Goal 2. Number of students in undergraduate research courses is used to assess Program Goal 3.

5. Student Learning Objectives

The student learning objectives include content knowledge of the discipline, critical thinking, ethics in research, and communication. The objectives were designed for quantitative evaluation.

Student Learning Objective 1: Content Knowledge

Student Learning Objective 2: Critical Thinking, Solutions to Problems and Scientific Inquiry

Student Learning Objective 3: Critical Thinking, Ethics in Scientific Research

Student Learning Objective 4: Communication

6. Assessment of How Well Students are Achieving Learning Objectives.

The major conducts a summative assessment of student performance in the senior capstone course, BSC 4936 Critical Analysis of Biological Research. Students take the standardized Biology Major Field Test, produce a PowerPoint presentation with audio, and take an ethics in research quiz after participating in an interactive role-play module (*The Lab: Avoiding Research Misconduct*, U.S. Department of Health and Human Services, Office of Research Integrity, <https://ori.hhs.gov/thelab>).

The Biology Major Executive Committee has set a goal of UF being in the top 30% in the nation for Total Score, five life science topic Sub-Scores, and the assessment indicator Analytical Skills from the Biology Major Field Test. The goals for the ethics in research quiz and PowerPoint presentation were percentage scores of 70% or greater.

Results for Total and Sub-Scores

Total and Sub-Scores were above the minimum for academic years 2011-2012 through 2013-2014, but declined below the minimum in 2014-2015, and then climbed above the minimum in Fall 2015, the last semester for which data are available (Figure 3). The Biology Major Field Test was administered in the senior capstone course BSC 4936 which was not required for graduation until 2014-2015. Prior to this time the course was taken as an elective; therefore, only motivated students enrolled in the course. In 2014-2015, enrollment in the course and participation in the Biology Major Field Test was required of all graduating seniors regardless of motivation and scores declined. In 2014-2015 the Biology Major Field test was worth only 9% of the final grade in BSC 4936 and all students earned a minimum of 16 out of 20 points. It was observed that students were attending the test, but not taking it seriously with some leaving very early. In the Fall of 2015 it was decided to make the Biology Major Field Test worth 14% of the final grade in BSC 4936 and points awarded were scaled, so that students were awarded points commensurate with their performance on the test. The hope was to encourage students to make a greater effort at performing well on the test. This approach apparently worked as the scores increased above the minimum for Fall 2015 (Figure 3).

A similar pattern was observed for the Analytical Skills portion of the Biology Major Field Test (Figure 4.) Although Figure 4 includes data for all the Assessment Indicators only Analytical Skills was designated by BMEC to be included in the evaluation.

An ethics in research quiz was administered in BSC 4936 beginning 2012-2013 academic year (Figure 5). The Biology Major Executive Committee set a goal of 70% (14 correct out of 20 questions) on the post-quiz. This goal was met for each academic year.

A PowerPoint with audio assignment was included in BSC 4936 beginning 2012-2013 academic year (Figure 6). The Biology Major Executive Committee set a goal of 70% (7 points out of 10 total) for this assessment. The goal was met for each academic year.

7. Review of Lower-Level Prerequisite Courses

The UF Biology Major is not a limited access major. Lower-level prerequisites are in compliance with state standards.

8. Date of the Last Review

This is a new major and there has not been a previous review.

9. Summary of the Findings

Strengths

The UF Biology Major, with a total of 2,046 students in Fall 2015 (Figure 7), is UF's largest undergraduate major. The CLAS portion of the major is the largest major in its college. The major awarded 445 degrees in 2014-2015 (Figure 1) and has greatly increased enrollment since its inception. The major increased the number of degrees awarded to underrepresented minorities from 20% in 2008-2009 to 30% in 2014-2015 (Figure 2). The major continues to attract some of the best students from Florida and across the nation. Its strengths include a vigorous undergraduate program that offers students access to six specializations, over 100 courses from 15 departments in two colleges, and mentoring in research from faculty from five colleges. The major increased access of its students to research opportunities by allowing credit for life science research from several academic departments to count towards major credit. The major responded to a need for attracting majors interested in teaching by creating a Bachelor of Arts specialization that allowed students to obtain a biology degree without the more advanced math, chemistry, and physics required for students seeking admission into medical school. The major responded to the state and university call for online degree programs by the creation of the online Bachelor of Arts specialization in Biology, which expands the educational opportunities of non-traditional students. The major facilitated the success of non-traditional transfer students in the online Biology Bachelor of Arts specialization by evaluating the syllabuses of life science courses taken at other institutions for use as upper-level credit at UF. Many students have been helped along to graduation by this process.

The major maintains an organized and consistent assessment program incorporated into the senior capstone course BSC 4936. Assessment results placed its students in the top 18% of national scores on the Biology Major Field Test administered to 468 U.S. institutions, and the top 14% of Florida institutions who participated in the assessment. The major acquired professional-quality banners and brochures for advertisement and recruitment (Figures 8-11).

Weaknesses

Anecdotal data indicate that the demand for undergraduate research opportunities exceeds the supply. The major is responding to the need by creating a mechanism whereby students can obtain research credit by internships with scientists in professional research labs in the private and public sectors. Not enough underrepresented minorities receive STEM degrees in the U.S. The Communications Office of the College of Liberal Arts and Sciences recently produced new banners and brochures with photographs of underrepresented students participating in life science research activities. The Assistant Director of the UF Biology Major is a co-PI on an NSF-funded grant that awards financial support to low-income and often first generation college students to pursue a 5-year combined bachelor and master's degree in biotechnology. There are currently four women in the program, two of which are minorities. Not enough online upper-level life science courses exist for the Biology Bachelor of Arts specialization. There is a need for many residential upper-level biology courses to be converted into an online format, which requires continued support from the Colleges and University.

Opportunities

Collaboration with the UF Career Resource Center and incorporation of externships and internships into the curriculum will expand research opportunities for undergraduates. Incorporation of future employment and/or educational goals into the senior capstone course will provide data needed to track the post-graduation status of our students. Creation of additional online upper-level life science courses for the online Biology Bachelor of Arts specialization will increase UF's capacity to extend STEM education to an increasing number of non-traditional students across the state and nation.

Threats

The success of the major is a result of the collegial cooperation among faculty and administrators from CLAS and CALS that serve on the BMEC. There is a remote threat that this cooperation could become competitive if not nurtured and supported by the University. A record number of students are selecting Biology as their academic major; however, the ability of the Biology Department to offer additional sections of teaching laboratories for BSC 2010 and 2011 has reached a limit. There is a threat that the major will not be able to continue expanding STEM educational opportunities without increasing the capacity to offer additional sections of teaching laboratories. The popularity of the new online Biology Bachelor of Arts specialization is increasing, but there is a threat that interest in the online program will decline if current and new students do not perceive that sufficient online upper-level courses are being made available.

10. Top Fives

Achievements

1. Increased total enrollment to become largest major on campus. Total enrollment for Fall 2015 was 2,046 students. This represents a 34% increase compared to Fall 2009.
2. Increased degrees awarded to underrepresented minorities. Total enrollment of underrepresented minorities was 445 for Fall 2015. This represents a 39% increase compared to Fall 2009.
3. Creation of an online Biology Bachelor of Arts specialization. This has increased access to a biology education to non-traditional students from Florida and across the nation. There are currently 27 students registered for courses in the University of Florida Online Biology Bachelor of Arts specialization.
4. Approximately 100 courses from 15 departments offered to students. This provides a wide diversity of courses that cover all of modern biology allowing for student exploration of diverse interests and goals.
5. Students participating in research sponsored by five UF Colleges. This diversity of research venues provides almost an endless array of topics for our students to pursue their research interests.

Impediments

1. Lack of upper-level online biology courses. The residential Biology Bachelor of Arts specialization offers 85 elective courses in life science, while the online venue offers only 14 online elective courses.
2. Lack of placement of undergraduates into research opportunities. Students often contact four or more faculty before getting an interview, and even then some never get an offer.
3. Not knowing the location and disposition of students upon graduation. It is difficult to obtain comprehensive placement data without a formal tracking procedure.
4. Not having a thorough external review of the major. Cornell University and the University of Wisconsin both have similar programs that are associated with two colleges. Not knowing how we compare to peer schools makes it difficult for the BMEC to make administrative adjustments and plan for continued improvement.

11. Data on Program's Enrollment SCH and FTE

The major produced 9,873 SCH, and 243 FTE in the Spring 2016 semester, which represents a 23% and 22% increase over the Spring 2010 numbers.

12. Academic Culture

The academic culture of the UF Biology Major is student-friendly and supportive of a diversity of students receiving an excellent education in Biology. Renowned faculty routinely invite undergraduates into their labs for mentoring in research. The commitment of faculty towards undergraduate research has transferred to post-docs and graduate students who routinely mentor students under faculty supervision. Academic advisors for Biology students continue to receive national awards for outstanding professional and pre-health advising. Advisors have contributed greatly to making UF the number one provider of black applicants to U.S. medical schools; the number two provider of Hispanic/Latino applicants to U.S. medical schools; and number three in total applicants to U.S. medical schools.

The major has provided funds for undergraduates to travel to several venues for presentation of research. The major provides additional support by guiding students into research and the production of scientific posters in BSC 3911 Entering Research in Biology.

Students from both CLAS and CALS have collaborated to create a new UF Biology Club open to all interested in life science. The club began Fall 2015. Students from both colleges exhibit a high level of cooperation and collegiality. The BMEC Assistant Director also serves as the advisor for Alpha Zeta, which is an honorary, professional society in CALS. Currently students in the CALS Biology Major fill six of 17 leadership roles in Alpha Zeta, which is notable in that CALS has 25 undergraduate academic major programs.

13. Link to Academic Learning Compact

catalog.ufl.edu/ugrad/current/liberalarts/alc/biology.aspx

catalog.ufl.edu/ugrad/current/agriculture/alc/biology.aspx

14. Summary of Recommendations

This "Century of Biology" (Venter and Cohen, 2004; Dwyer, 2008) requires the education of an increasing number of life science students who can apply modern concepts, theories, and approaches to global challenges involving medicine, agriculture and the environment (Aktipis et al., 2011; Carroll et al., 2014; Marin and Weiner, 2014). Florida's population is now third largest in the U. S. (U.S. Census Bureau, 2014), and the UF Biology Major is poised to become one of the nation's premier providers of a modern undergraduate education in the life sciences. The collaboration between the Department of Biology, and the various life science departments within the College of Agricultural and Life Sciences provides a vibrant approach to

undergraduate life science education. However, this inter-college Biology Major will need administrative support to continue to grow and thrive, and thereby, to meet the increasing demands of its undergraduates and the state in this current era of the life sciences.

The Biology Major Executive Committee should consider appointing a committee of faculty, advisors, and students from CALS and CLAS to design and supervise an external review of the Biology Major including its online Bachelor of Arts specialization. Deans from CALS and CLAS should be encouraged to provide additional funds to convert residential biology elective courses into an online format, and to support teaching these new online courses. The senior capstone course should be revised to collect information that would provide data on the placement of Biology students upon graduation. The major should work with the departments to modify existing courses or design new courses that allow its students to participate in external internships at federal, state, and private agencies and laboratories.

15. Provost's signature

References

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Table 1. Administration of the UF Biology Major.	
Director	Michael Miyamoto
Assistant Director and Undergraduate Coordinator	William Spencer
Program Assistant	Cindy Link
Biology Major Executive Committee (BMEC) Members	<p>John Blake*, Professor, Wildlife Ecology & Conservation, CALS Joel Brendemuhl, Assoc. Dean, CALS ex-officio Christine Davis*, Lecturer, Biology, CLAS Alice Harmon*, Professor, Biology, CLAS Patrick Inglett*, Assoc. Professor, Soil and Water Science, CALS Michael Miyamoto*, BMEC Chair, Professor, Biology CLAS Bala Rathinasabapathi* Professor, Horticultural Sciences, CALS Ata Sarajedini, Assoc. Dean, CLAS ex officio William Spencer, Lecturer, Biology, CLAS ex officio</p> <p>* = voting members</p>
Biology Major Website	major.biology.ufl.edu/
CLAS Academic Advisors	Roberta Knickerbocker Christine Richmond Miranda Santos
CALS Academic Advisors	Britta Osborne Brandi Phillips
By-Laws	major.biology.ufl.edu/about/administration-of-the-major/bylaws/
BMEC Minutes	major.biology.ufl.edu/about/administration-of-the-major/bmec-meeting-minutes/
Biology Major Facebook Page	www.facebook.com/pages/UF-Biology-Major/252946434808023

Table 2. Specializations within the UF Biology Major in the College of Liberal Arts and Sciences (CLAS) and the College of Agricultural and Life Sciences (CALs).

College	Major	Specialization	Description
CLAS	BIO	BA	Bachelor of Arts
		INT	Integrative
		PRO	Pre-professional
CALs	BLY	APB	Applied Biology
		BTC	Biotechnology
		NS	Natural Science
		PRO	Pre-professional

Table 3. Foundation courses for the specializations in the UF BIO Major in CLAS.			
Discipline	Foundation Courses		
	Biology B.A.	Integrative Biology	Pre-Professional
General Biology	BSC 2010 & 2011 & labs		
General Chemistry	CHM 1030 and 1031	CHM 2045 and 2046 and labs	
Organic Chemistry	Not required	CHM 2210 and 2211 and lab	CHM 2210 and 2211 and lab
Mathematics	MAC 1147	MAC 2311 and either STA 2023 or MAC2312	
Physics	PHY 2004 and 2005 and labs	PHY 2053 and 2054 and labs	

Table 4. Foundation courses for the specializations in the UF BLY CALS Major.				
Discipline	Foundation Courses			
	Applied Biology	Bio-technology	Natural Science	Pre-Professional
General Biology	BSC 2010 & 2011 & labs	BSC 2010 & 2011 & labs	BSC 2010 & 2011 & labs	BSC 2010 & 2011 & labs
General Chemistry	CHM 2045 & 2046 & labs	CHM 2045 & 2046 & labs	CHM 2045 & 2046 & labs	CHM 2045 & 2046 & labs
Organic Chemistry	CHM 2200 & lab	CHM 2210 & 2211 & lab	CHM 2200 & lab	CHM 2210 & 2211 & lab
Mathematics	MAC 2311 and either STA 2023 or MAC2312			
Physics	PHY 2004 and 2005 and labs			PHY 2053 and 2054 and labs

Table 5. Core courses for the *Biology Bachelor of Arts* specialization in the CLAS Biology Major.

Distribution Group	Core Courses
	Complete one course from three of the four distribution groups.
1. Molecular Biology, Cellular Biology and Genetics	<p>AGR 3303 (Genetics) BCH 3023 (Elementary Organic & Biological Chemistry) PCB 3023 (Essential Cell Biology) PCB 3063 (Genetics) PCB 3134 (Eukaryotic Cell Structure & Function) PCB 4522 (Molecular Genetics) PCB 4553 (Population Genetics)</p>
2. Organismal Biology	<p>BOT 3503+L (Physiology & Molecular Biology of Plants) BSC 3096 (Human Physiology) MCB 2000+L (Microbiology) MCB 3020&L (Basic Biology of Microorganisms) PCB 3134 (Eukaryotic Cell Structure & Function) PCB 3713C (Cellular Systems and Physiology) PCB 4712 (Comparative Biomechanics) PCB 4723C (Physiology & Molecular Biology of Animals) ZOO 3603C (Evolutionary Developmental Biology) ZOO 3713C (Functional Vertebrate Anatomy)</p>
3. Ecology	<p>BSC 3307C (Climate Change Biology) PCB 3601C (Plant Ecology) PCB 4043C (General Ecology)</p>
4. Evolution and Diversity	<p>BOT 2011C (Plant Diversity) BOT 2710C (Practical Plant Taxonomy) BOT 3151C (Local Flora of North Florida) PCB 4674 (Evolution) ZOO 3513C (Animal Behavior) ZOO 4205C (Invertebrate Biodiversity) ZOO 4307C (Vertebrate Biodiversity)</p>
Approved Electives	15 credits (from 84 courses) ¹
Senior Capstone	BSC 4936 (Critical Analysis of Biological Research)

¹ <https://catalog.ufl.edu/ugrad/current/liberalarts/majors/biology.aspx#4>

Table 6. Core courses for the *Integrative Biology* specialization in the CLAS Biology Major.

Discipline	Core Courses
Genetics	One course from: AGR 3303 (Genetics) PCB 3063 (Genetics) PCB 4522 (Molecular Genetics)
Taxonomic Diversity	One course from two of the following groups: <u>Animal Diversity</u> ZOO 4205C (Invertebrate Biodiversity) ZOO 4307C (Vertebrate Biodiversity) <u>Plant and Fungal Diversity</u> BOT 2011C (Plant Diversity) BOT 2710C (Practical Plant Taxonomy) <u>Microorganisms and Microbial Diversity</u> MCB 3020+L (Basic Biology of Microorganisms)
Physiology	PCB 4723C (Physiology and Molecular Biology of Animals)
Evolution	PCB 4674 (Evolution)
Ecology	PCB 4043C (General Ecology)
Structural Biology	One course from: PCB 3134 (Eukaryotic Cell Structure & Function) ZOO 3713C (Functional Vertebrate Anatomy) ZOO 3603C (Evolutionary Developmental Biology)
Senior Capstone	BSC 4936 (Critical Analysis of Biological Research)

Table 7. Core courses for the *Pre-professional* specialization in the CLAS Biology Major.

Discipline	Core Courses
Biochemistry	BCH 4024 (Biochemistry and Molecular Biology)
Microbiology	MCB 3020+L (Basic Biology of Microorganisms) or PCB 3134 (Eukaryotic Cell Structure & Function)
Genetics	PCB 3063 (Genetics)
Physiology	PCB 4723C (Physiology and Molecular Biology of Animals)
Approved Electives	12 credits (from 85 courses) ¹
Senior Capstone	BSC 4936 (Critical Analysis of Biological Research)
¹ https://catalog.ufl.edu/ugrad/current/liberalarts/majors/biology.aspx#5	

Table 8. Core courses for the *Applied Biology* specialization in the CALS Biology Major.

Discipline	Core Courses
Genetics	One course from: AGR 3303 (Genetics) PCB 3063 (Genetics)
Physiology	One Course from: ANS 3319C (Reproductive Physiology and Endocrinology in Domestic Animals) BOT 3503+L (Physiology and Molecular Biology of Plants) HOS 4304 (Horticultural Physiology)
Microbiology	MCB 3020+L (Basic Biology of Microorganisms)
Biochemistry	One course from: BCH 3025 (Fundamentals of Biochemistry) BCH 4024 (Introduction to Biochemistry & Molecular Biology)
Approved Electives	21 credits (one course from each of the following seven groups): <u>Animal Production</u> ANS 3006C (Introduction to Animal Science) ANS 3440 (Principles of Animal Nutrition) ENY4573 (Beekeeping) FAS 4405 (Aquariums, Water and Aquaculture) <u>Plant Production</u> AGR 4214C (Applied Field Crop Production) AGR 4231C (Forage Science and Range Management) AGR 4512 (Physiology and Ecology of Crops) FOR 3004 (Forests, Conservation and People) FRC 3252 (Tropical and Subtropical Fruits) FRC3274 (Tree and Small Fruit Production) HOS 3020 (Principles of Horticulture Crop Production) HOS3222C (Greenhouse and Protected Crop Production) HOS3281C (Organic and Sustainable Crop Production) PLS 3004c (Principles of Plant Science) PLS 3223+L (Plant Propagation and Laboratory) VEC3221C (Commercial Vegetable Production) <u>Food Science and Human Nutrition</u> FOS 3042 (Introductory Food Science) FOS 4202 (Food Safety and Sanitation) FOS 4222 (Food Microbiology) FOS 4321C (Food Analysis) FOS 4731 (Government Regulations & the Food Industry) HUN 2201 (Fundamentals of Human Nutrition) HUN 3403 (Nutrition Through the Life Cycle) <u>Pest Management</u> ENY 3005+L (Principles of Entomology and Laboratory) ENY 3222C (Biology and Identification of Urban Pests) ENY 3225C (Principles of Urban Pest Management) ENY 3228 (Urban Vertebrate Pest Management) ENY3510C (Turf and Ornamental Entomology) IPM 3022 (Fundamentals of Pest Management) PCB 2441 (Biological Invaders) PLS 4601C (Principles of Weed Science) PLP 3002C (Fundamentals of Plant Pathology) PLS 4613 (Aquatic Weed Control) <u>Natural Resource Management</u> ALS3153 (Agricultural Ecology) ALS 3133 (Agricultural and Environmental Quality) EVS 3000 (Environmental Science) EES 3008 (Energy and Environment) FAS 4305C (Introduction to Fishery Science) FOR 4854 (Agroforestry) SWS 3022 Introduction to Soils in the Environment SWS 4233 (Soil and Water Conservation)

	<p>SWS4223 (Environmental Biogeochemistry) WIS3401 (Wildlife Ecology and Management) WIS4427 (Wildlife Habitat Management) <u>Biological Monitoring and Assessment</u> AOM 4434 (Precision Agriculture) FNR 3410C (Natural Resources Sampling) FOR 3430C (Forest Mensuration) FOR 3434C (Forest Resource Info Systems) ORH 4242C (Arboriculture) PMA 4570C (Field Techniques in IPM) SUR 3103C (Geomatics) SWS 4233 (Soil and Water Conservation) <u>Molecular Biology and Genetics</u> AGR 4320 (Plant Breeding) AGR4304 (Plant Chromosomes and Genomes) ANS 3384 (Genetic Improvement of Farm Animals) HOS 3305 (Introduction to Plant Molecular Biology) MCB 4304 (Genetics of Microorganisms) PCB 4522 (Molecular Genetics) PLS 4242C (Micropropagation of Horticultural Crops)</p>
Senior Capstone	BSC 4936 (Critical Analysis of Biological Research)

Table 9. Core courses for the <i>Biotechnology</i> specialization in the CALS Biology Major.	
Discipline	Core Courses
Genetics	One course from: AGR 3303 (Genetics) PCB 3063 (Genetics)
Microbial Genetics	MCB 4304 (Genetics of Microorganisms)
Cell Biology	PCB 3134 (Eukaryotic Cell Structure and Function)
Microbiology	MCB 3020+L (Basic Biology of Microorganisms)
Biochemistry	BCH 4024 (Introduction to Biochemistry and Molecular Biology)
Evolution	PCB 4674 (Evolution)
Analytical Chemistry	CHM 3120+L (Introduction to Analytical Chemistry)
Approved Electives	<p>six credits (from two of the following groups):</p> <p>General Biotechnology ABE 4660 (Applied Microbial Biotechnology) ABE 4662 (Quantification of Biological Processes) CHM 4300L (Laboratory in Biochemistry and Molecular Biology) BSC 4434C (Intro to Bioinformatics) ZOO 3603C (Evolutionary and Developmental Biology)</p> <p>Food Biotechnology FOS 3042 (Introductory Food Science) FOS 4202 (Food Safety and Sanitation) FOS 4222+L (Food Microbiology and Lab) FOS 4311+L (Food Chemistry and Lab)</p> <p>Animal Biotechnology ANS 3319C (Reproductive Physiology & Endocrinology in Domestic Animals) ANS 3383L (Application of Genetic Evaluation to the Livestock Industry) ANS 3384 (Genetic Improvement of Farm Animals) ENY4701 (Forensic Entomology) FAS 4405 (Aquariums, Water and Aquaculture) PCB 4233 (Immunology) ZOO 4232 (Human Parasitology)</p> <p>Plant Biotechnology AGR4304 (Plant Chromosomes and Genomes) BOT 3503+L (Physiology & Molecular Biology of Plants and Laboratory) HOS 3305 (Introduction to Plant Molecular Biology) HOS 4313C (Laboratory Methods in Plant Molecular Biology) PLP 3002C (Fundamentals of Plant Pathology) PLP 4222C (Introductory Plant Virology) PLP 4242C (Introduction to Plant Bacteriology) PLP 4260C (Intro to Plant Pathogenic Fungi) PLP 4290C (Principles of Plant Disease Diagnosis) PLP4653C (Basic Fungal Biology)</p> <p>Microbial Biotechnology MCB 4034L (Advanced Microbiology Laboratory) MCB 4203 (Bacterial and Viral Pathogens) MCB 4320C (Bacterial Genome Sequencing) MCB 4304 (Genetics of Microorganisms) MCB 4503 (General Virology)</p>
Senior Capstone	BSC 4936 (Critical Analysis of Biological Research)

Table 10. Core courses for the *Natural Science* specialization in the CALS Biology Major.

Discipline	Core Courses
Genetics	One course from: AGR 3303 (Genetics) PCB 3063 (Genetics)
Evolution	PCB 4674 (Evolution)
Approved Electives	<p>21 credits (one course from each of the following groups):</p> <p style="text-align: center;"><u>Vertebrate Animal Biology</u></p> <p style="text-align: center;">FAS 4202C (Biology of Fishes) WIS 3401 (Wildlife Ecology and Management) WIS 3402 (Wildlife of Florida) ZOO 4307C (Vertebrate Biodiversity) ZOO 4472C (Avian Biology)</p> <p style="text-align: center;"><u>Invertebrate Animal Biology</u></p> <p style="text-align: center;">ENY 3005+L (Principles of Entomology and Laboratory) ENY4161 (Insect Classification) ENY4455C (Social Insects) ENY4573 (Beekeeping) ENY4590C (Mosquito Identification) ENY4592 (Mosquito Biology) NEM 3002 (Principles of Nematology) ZOO 4205C (Invertebrate Biodiversity)</p> <p style="text-align: center;"><u>Plant Biology</u></p> <p style="text-align: center;">BOT 2011C (Plant Diversity) BOT 2710C (Practical Plant Taxonomy) BOT 3151C (Local Flora of North Florida) FNR 3131C (Dendrology/Forest Plants)</p> <p style="text-align: center;"><u>Geology and Soils</u></p> <p style="text-align: center;">GLY 2010C (Physical Geology) GLY 2030C (Environmental and Engineering Geology) GLY 2038 (Sustainability and the Changing Earth) SWS 3022 (Introduction to Soils in the Environment) SWS4223 (Environmental Biogeochemistry)</p> <p style="text-align: center;"><u>Water and Wetlands</u></p> <p style="text-align: center;">FNR 4343C (Forest Water Resources and Laboratory) GLY 3882C (Hydrology and Human Affairs) SWS4233 (Soil and Water Conservation) SWS 4244 (Wetlands)</p> <p style="text-align: center;"><u>Ecology</u></p> <p style="text-align: center;">ALS 3153 (Agricultural Ecology) FOR 3153C (Forest Ecology) PCB 3601C (Plant Ecology) PCB 4043C (General Ecology)</p> <p style="text-align: center;"><u>Human Ecology</u></p> <p style="text-align: center;">ANT 2410 (Cultural Anthropology) ANT 2700 (Intro to Applied Anthropology) ANT 4114 (Principles of Archeology) WIS 4523 (Human Dimensions of Natural Resource Conservation)</p>
Senior Capstone	BSC 4936 (Critical Analysis of Biological Research)

Table 11. Core courses for the *Pre-professional* specialization in the CALS Biology Major.

Discipline	Core Courses
Biochemistry	BCH 4024 (Biochemistry and Molecular Biology)
Microbiology	MCB 3020+L (Basic Biology of Microorganisms)
Genetics	One course from: AGR 3303 (Genetics) PCB 3063 (Genetics)
Physiology	One course from: PCB 3713C (Cellular and Systems Physiology) PCB 4723C (Physiology and Molecular Biology of Animals)
Approved Electives	12 credits (from 78 courses) ¹
Senior Capstone	BSC 4936 (Critical Analysis of Biological Research)
¹ http://major.biology.ufl.edu/files/2015/03/BLY-PRO-ALS-March-27-2015-Update.pdf	

Figure 1. Total number of Biology degrees awarded per academic year.

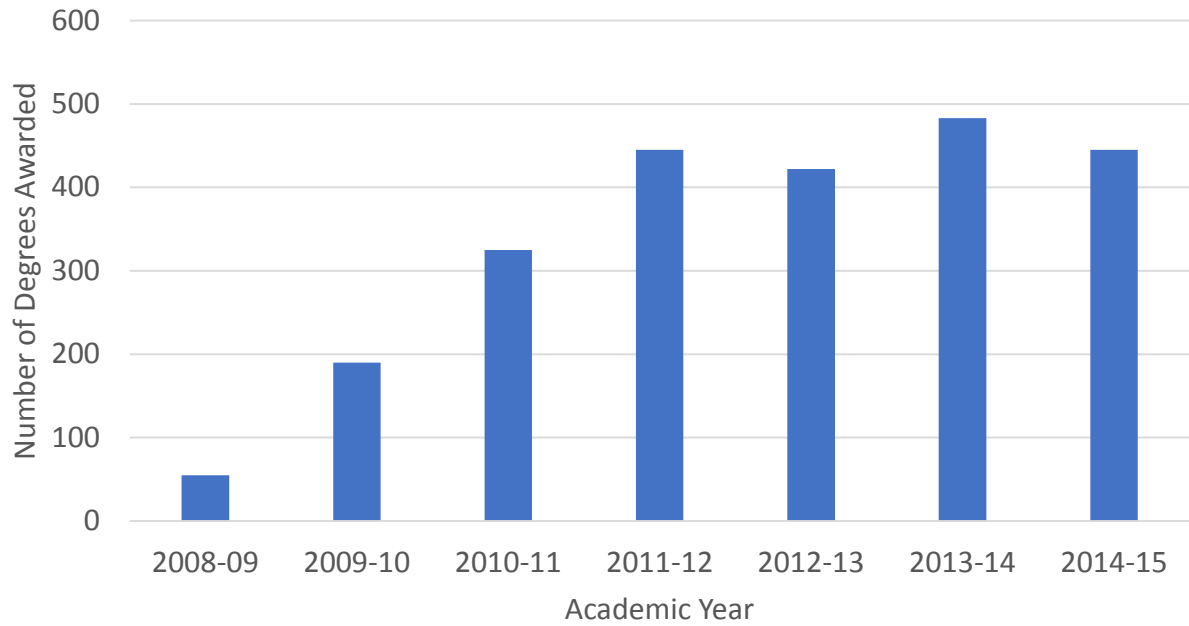


Figure 2. Total number of Biology degrees awarded to underrepresented minorities per academic year.

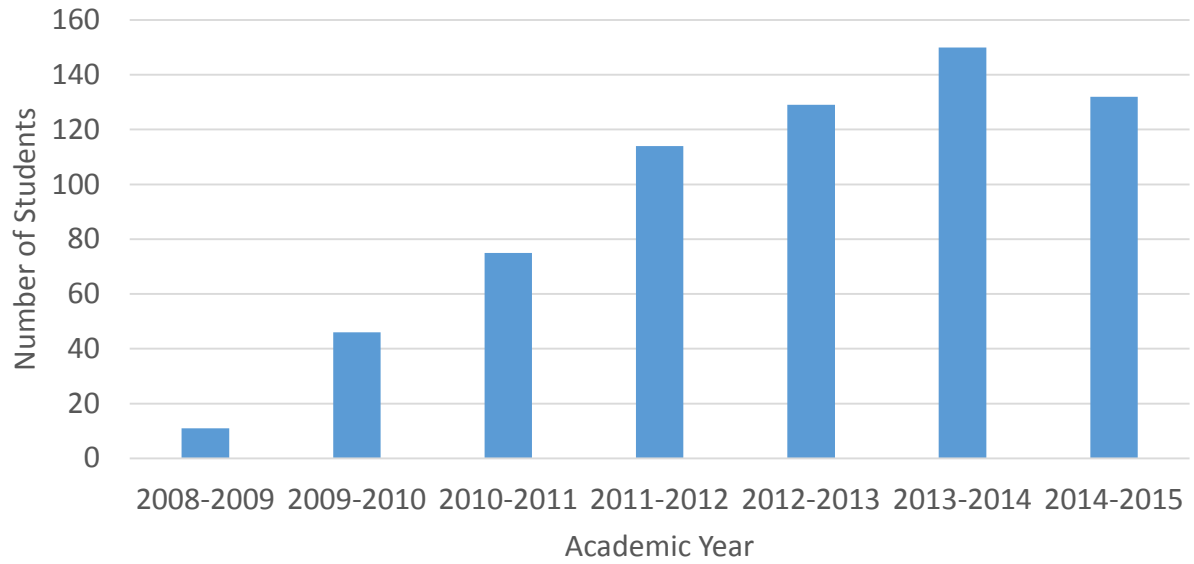
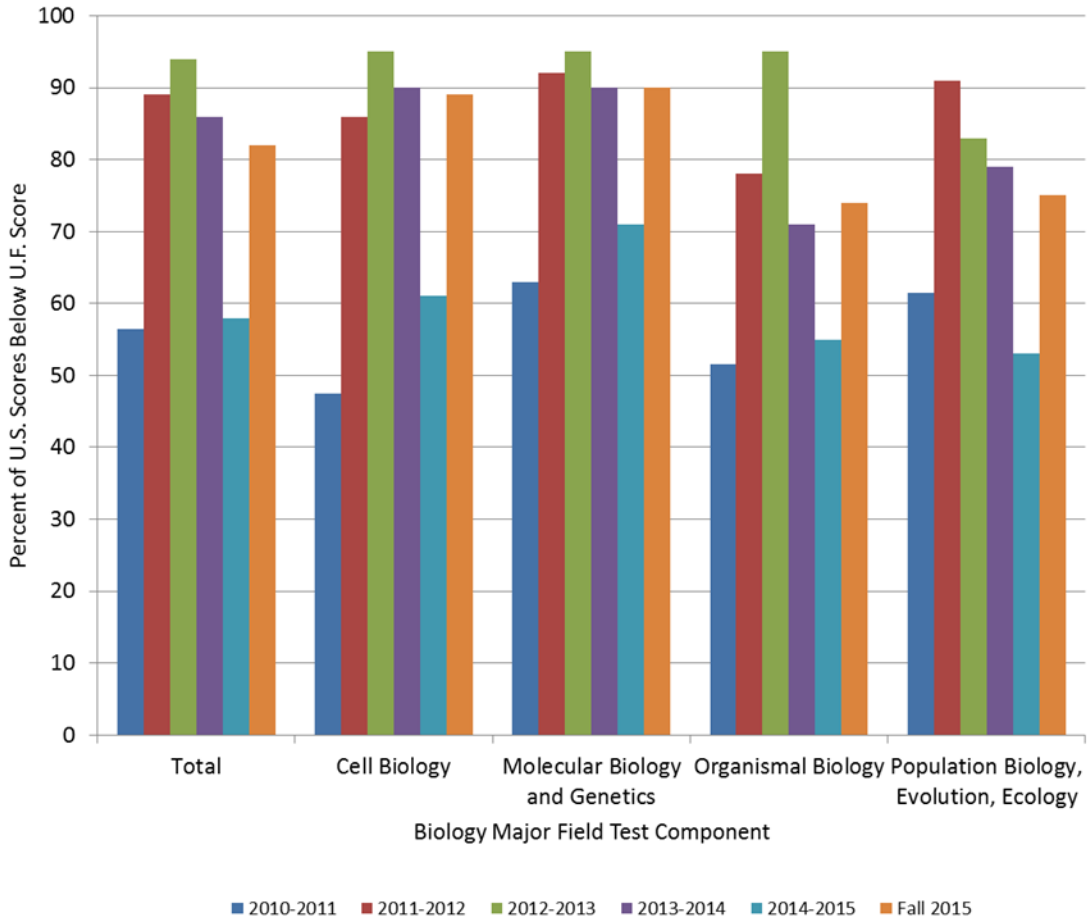
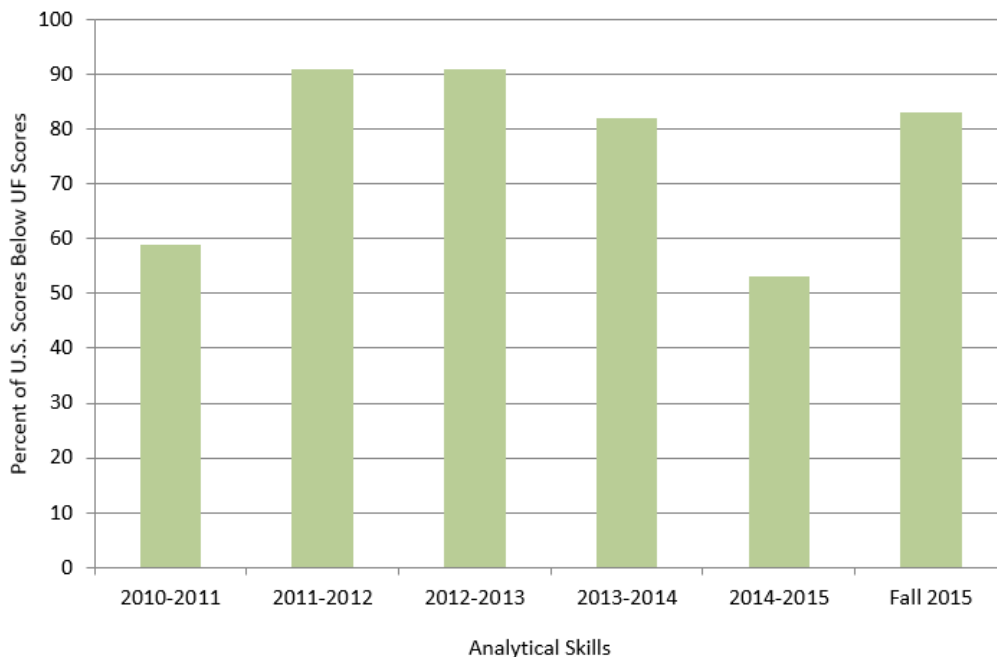


Figure 3. Performance of UF biology majors on the Biology Major Field Test. Performance relative to students at other schools vs. UF students is depicted as the percentage of scores from other schools that are below the scores from UF.*



*Prior to 2014-2015 the test was voluntary and only motivated students participated. Beginning in 2014-2015 the test was required for all graduating seniors and scores declined with several students not completing the test. Beginning Fall 2015 the test was made equal to 14% of the BSC 4936 course grade and scores improved.

Figure 4. Performance of UF biology majors on the *Analytical Skills* portion of the Biology Major Field Test. Performance relative to students at other schools vs. UF students is depicted as the percentage of scores from other schools that are below the scores from UF.*



*Prior to 2014-2015 the test was voluntary and only motivated students participated. Beginning in 2014-2015 the test was required for all graduating seniors and scores declined with several students not completing the test. Beginning Fall 2015 the test was made equal to 14% of the BSC 4936 course grade and scores improved.

**Figure 5. Pre- and post-module scores
(maximum = 20) for the ethics in research quiz.**

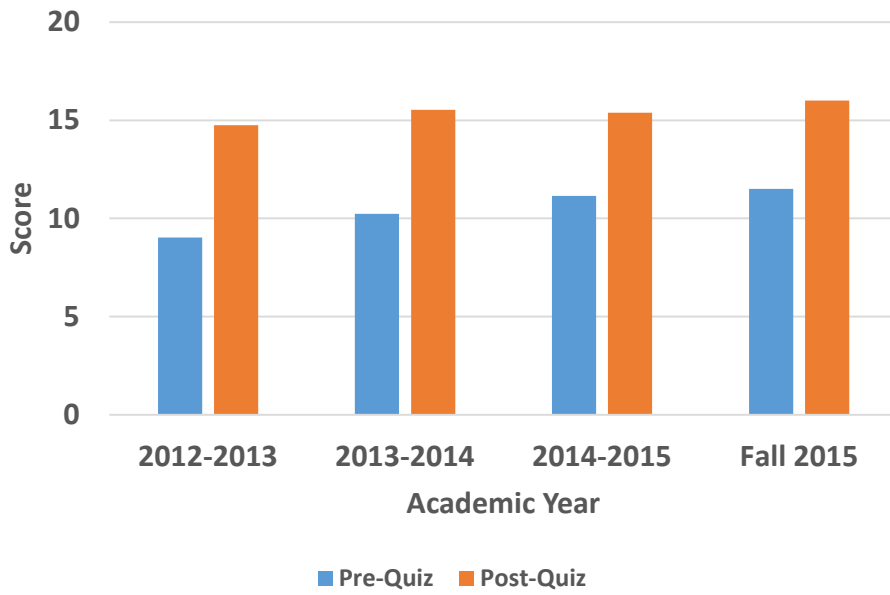


Figure 6. Scores (maximum = 10) for PowerPoint presentation with audio.

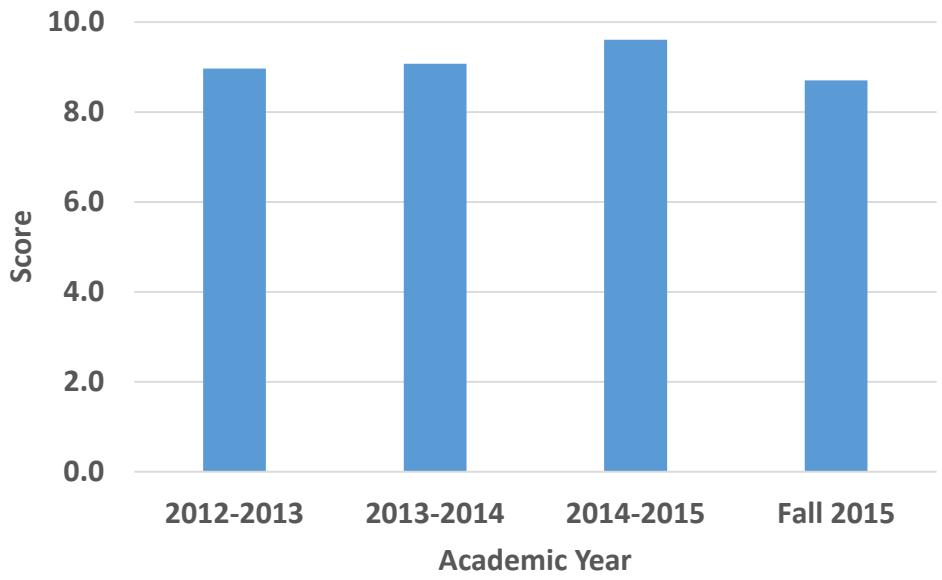


Figure 7. Fall enrollment for the BLY and BIO portions of the UF Biology Major.

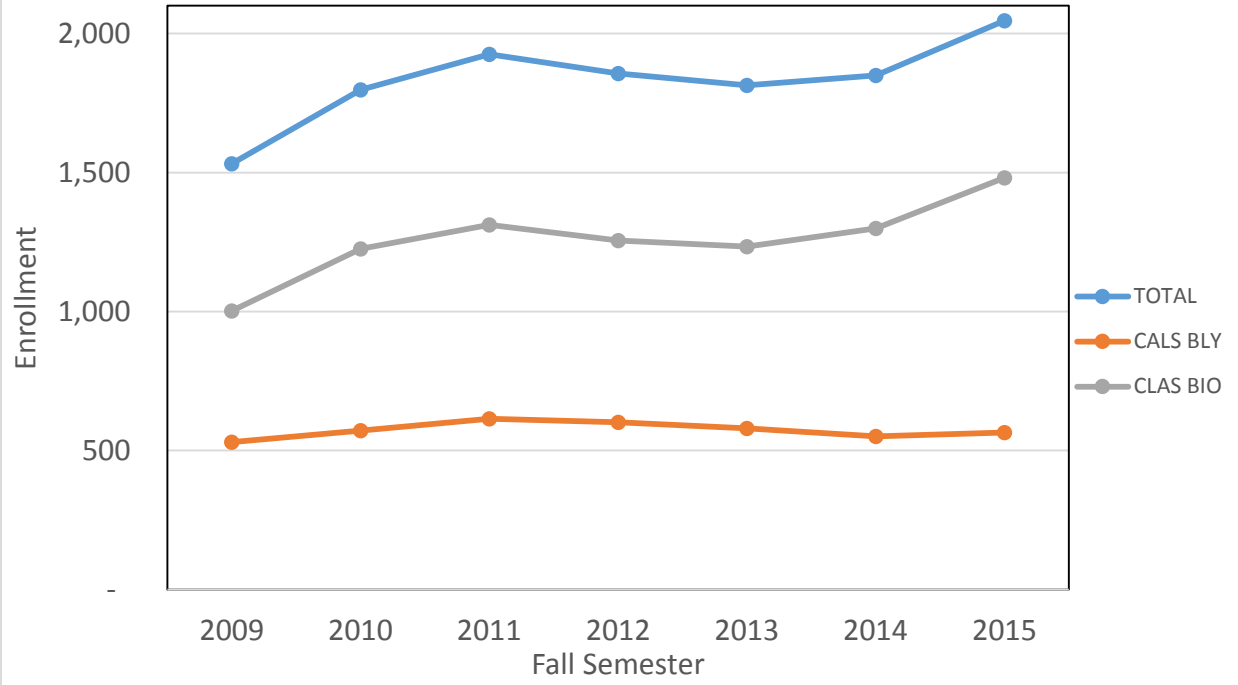


Figure 8. UF Biology Major Brochure, panels 1, 4, and 5.

A Biology Degree Can Take You Places

With a degree in biology, the world is truly your oyster — or rainforest or operating theater or classroom.

- Marine biologist
- Epidemiologist
- Teacher
- Food scientist
- Ecologist
- Zoologist
- Physician assistant
- Biologist
- Nurse
- Conservation scientist
- Laboratory technician
- Forensic scientist
- Microbiologist
- Biochemist
- Medical technician
- Physician
- Audiologist
- Nutritionist
- Zookeeper
- Veterinarian
- Dietician
- Genetic counselor
- Pharmaceutical representative
- Food safety expert
- Medical illustrator
- Agricultural scientist
- Botanist
- Bioterrorism expert
- Environmental lawyer
- Horticulturist
- Dentist
- Forest ranger
- Evolutionary biologist
- Parasitologist
- Science writer
- Virologist
- Crop scientist
- Addiction researcher
- Medical ethicist

For more information on careers, see the Bureau of Labor Standard's Occupational Outlook Handbook: bls.gov/ooh

UNDERGRADUATE RESEARCH

Hands-on, experiential learning is valued and encouraged in the Biology Major. We want all of our students to experience the wonder and awe of scientific discovery, be it in the lab, the field or at the bottom of the ocean. Research experience is valuable on many levels. It diversifies the college experience. It teaches students how scientists apply the knowledge gained in the classroom to real world questions. It provides the opportunity to work with and get to know researchers who are the best in their field. It introduces students to scientific inquiry and the most innovative equipment and techniques. It can enhance students' résumé/CV for graduate or professional school. Here at the University of Florida, you will find enthusiastic faculty members who want to teach you everything they know, in the lab, the field, and the classroom.

Photos are from UF, IFAS, Chris A. Johns and Mike Gil. To learn more, go to chrisajohns.com

UF Biology Major
 College of Liberal Arts and Sciences
 College of Agricultural and Life Sciences
 UNIVERSITY of FLORIDA

Contact:
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 OR
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www.major.biology.ufl.edu

LIBERAL ARTS AND SCIENCES
AGRICULTURAL AND LIFE SCIENCES

BIOLOGY MAJOR

Figure 8 (continued). UF Biology Major Brochure, panels 2, 3 and 6.



Biology is the study of all living things great and small, from vast biomes that cover large swaths of land and sea to the tiniest microorganisms that cannot be observed with the naked eye. At the University of Florida, Biology majors can select one of six areas of specialization, preparing students for working in a lab, teaching in a classroom, becoming a medical doctor, entering graduate school and much more:

- ▶ APPLIED BIOLOGY
- ▶ INTEGRATIVE BIOLOGY
- ▶ BIOTECHNOLOGY
- ▶ NATURAL SCIENCE
- ▶ PRE-PROFESSIONAL BIOLOGY
- ▶ BACHELOR OF ARTS IN BIOLOGY

3 & 5

UF is ranked No. 3 in Kiplinger's and is the fifth largest provider of medical school applicants in the U.S.

ONE MAJOR, TWO COLLEGES

Students majoring in biology at the University of Florida have double the educational opportunities of their peers at other universities. Here, students can become biology majors within the **COLLEGE OF LIBERAL ARTS AND SCIENCES** or in the **COLLEGE OF AGRICULTURAL AND LIFE SCIENCES**. This collaborative program gives students access to a wide range of life science courses and mentors for undergraduate research.

Students specialize in the major by selecting one of six tracks designed to prepare them for careers in professional medicine, life sciences research, private industry, agriculture, government service or education. The Preprofessional track is offered by both colleges. The Applied Biology, Biotechnology, and Natural Science tracks are offered through Agricultural and Life Sciences. The Biology Bachelor of Arts and Integrative Biology tracks are offered through Liberal Arts and Sciences.

For more information about this exciting major, visit major.biology.ufl.edu.





The breadth of the biology major at UF offers remarkable opportunities to explore and solve problems ranging from conservation and for students biodiversity to biomedical and agricultural discovery. At UF, you have access to world-class faculty and the latest technology to study how organisms live together and what makes them tick.

Figure 9. UF Biology Major Table Banner.



Figure 10. UF Biology Major Table Stand-up Banner #1.



Figure 11. UF Biology Major Table Stand-up Banner #2.

