

# BIOLOGY MAJOR, B.S.— QUANTITATIVE BIOLOGY TRACK

Biology is the study of life from both basic and applied perspectives across a broad range of analytical levels, from the molecule and cell to the organism and ecosystem.

This program is designed for students with a strong interest in a multidisciplinary approach that incorporates computational approaches to study biological problems, in preparation for graduate study in biological or health sciences.

## Student Learning Outcomes

Upon completion of the biology (B.A., B.S.) program, students should be able to:





- **Knowledge Base:** Demonstrate knowledge of major concepts, theoretical perspectives, empirical findings, and historical trends in the broad field of Biology
- **Research Methods:** Apply basic research methods in the biological sciences, including research design, data analysis, and data interpretation
- **Critical Thinking Skills:** Demonstrate the use of critical and creative thinking skills in upper-level biology courses and in their approach to undergraduate research
- **Application of Knowledge, Research Methods, and Critical Thinking:** Apply knowledge of the field of biology, research skills, and critical thinking skills to undertake a course-based, field, or laboratory research project








## Requirements

In addition to the program requirements, students must

- earn a minimum final cumulative GPA of 2.000
- complete a minimum of 45 academic credit hours earned from UNC–Chapel Hill courses
- take at least half of their major core requirements (courses and credit hours) at UNC–Chapel Hill
- earn a minimum cumulative GPA of 2.000 in the major core requirements. Some programs may require higher standards for major or specific courses.

For more information, please consult the degree requirements section of the catalog (<https://catalog.unc.edu/undergraduate/degree-requirements/>).

Code	Title	Hours
<b>Gateway Course</b>		
BIOL 101 & 101L	 Principles of Biology and  Introductory Biology Laboratory <sup>1, H, F</sup>	4
<b>Core Requirements</b>		
<b>Fundamentals courses</b>		
BIOL 103	 How Cells Function <sup>2, F</sup>	3
BIOL 104	 Biodiversity <sup>2, F</sup>	3

BIOL 105L	Biological Research Skills	1
<b>Intermediate Level Core Courses</b>		
One of the following five options: <sup>3</sup>		4
BIOL 220	 Molecular Genetics <sup>H</sup>	
BIOL 240	Cell Biology <sup>H</sup>	
BIOL 250	Evolutionary Biology	
BIOL 260	Introduction to Ecology	
An organismal diversity course (see list below)		
Two laboratory courses, one of which must be a quantitative biology lab course <sup>4</sup>		8
A choice of three biology electives over BIOL 200 (each of three or more credits, not including BIOL 213, BIOL 222, BIOL 253, BIOL 291, BIOL 292, BIOL 293, BIOL 294, BIOL 295, BIOL 296, BIOL 353, a second semester of BIOL 395, and BIOL 495), of which at least two quantitative electives must be chosen from: <sup>5</sup>		9-12
BIOL 214H	 Mathematics of Evolutionary Processes	
BIOL 224H	The Mathematics of Life <sup>5</sup>	
BIOL 226	Mathematical Methods for Quantitative Biology <sup>5</sup>	
BIOL 431	Biological Physics	
BIOL 451	Comparative Physiology	
BIOL 454	Evolutionary Genetics	
BIOL 465	Global Biodiversity and Macroecology	
BIOL 525	Analysis and Interpretation of Sequence-Based Functional Genomics Experiments <sup>5</sup>	
BIOL 526	Computational Genetics <sup>5, H</sup>	
BIOL 527	Seminar in Quantitative Biology <sup>5</sup>	
BIOL 528	Quantitative Personalized Genomics <sup>5</sup>	
BIOL 534	Mathematical Modeling in the Life Sciences	
BIOL 542	 Light Microscopy for the Biological Sciences	
BIOL 551	Comparative Biomechanics	
BIOL 553	Mathematical and Computational Models in Biology <sup>5</sup>	
BIOL 554	Introduction to Computational Neuroscience	
BIOL 562	Statistics for Environmental Scientists <sup>5</sup>	
BIOL 563	Statistical Analysis in Ecology and Evolution	
BIOL 564	Population Ecology	
BIOL 642	Advanced Studies of Cell Division <sup>5</sup>	
COMP 555	Bioalgorithms	
MATH 553 & 553L	Mathematical and Computational Models in Biology and Mathematical and Computational Models in Biology Laboratory	
MATH 564	Mathematical Modeling in the Life Sciences	
PHYS 405	Biological Physics	
PHYS 461	Introduction to Medical Physics	
<b>Additional Requirements</b>		
BIOS 600	Principles of Statistical Inference	3
or STOR 155	 Introduction to Data Models and Inference	
or STOR 151	 Introduction to Data Analysis	
or STOR 120	 Foundations of Statistics and Data Science	
CHEM 101 & 101L	 General Descriptive Chemistry I and  Quantitative Chemistry Laboratory I <sup>H, F</sup>	4

CHEM 102 & 102L	General Descriptive Chemistry II and Quantitative Chemistry Laboratory II <sup>H, F</sup>	4
CHEM 261	Introduction to Organic Chemistry I <sup>H</sup>	3
Select one of the following: 3		
BIOL 222	Introduction to Programming with Biological Data	
COMP 110	Introduction to Programming and Data Science <sup>H</sup>	
COMP 116	Introduction to Scientific Programming	
COMP 401	Foundation of Programming <sup>H</sup>	
MATH 231	Calculus of Functions of One Variable I <sup>H, F</sup>	4
MATH 232	Calculus of Functions of One Variable II <sup>H, F</sup>	4
MATH 233 or MATH 210	Calculus of Functions of Several Variables <sup>H, F</sup> / Mathematical Tools for Data Science	3-4
One of the following: 4		
PHYS 114	General Physics I: For Students of the Life Sciences <sup>F</sup>	
PHYS 118	Introductory Calculus-based Mechanics and Relativity <sup>H, F</sup>	
One of the following: 4		
PHYS 115	General Physics II: For Students of the Life Sciences <sup>F</sup>	
PHYS 119	Introductory Calculus-based Electromagnetism and Quanta <sup>H, F</sup>	
A choice of two additional allied sciences electives selected from the course list below (some courses are more than 3 credits) <sup>6</sup> 6		
Enough general education and free electives to accumulate 125 academic hours varies		
<b>Total Hours</b>		<b>125-126</b>

<sup>H</sup> Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

<sup>F</sup> FY-Launch class sections may be available. A FY-Launch section fulfills the same requirements as a standard section of that course, but also fulfills the FY-SEMINAR/FY-LAUNCH First-Year Foundations requirement. Students can search for FY-Launch sections in ConnectCarolina using the FY-LAUNCH attribute.

<sup>1</sup> With a C grade or better in BIOL 101

<sup>2</sup> Both BIOL 103 and BIOL 104 need to be completed before taking a 400-level BIOL class in the major.

<sup>3</sup> Core courses taken beyond the required one may be used as electives.

<sup>4</sup> One must be a quantitative laboratory chosen from BIOL 224H/BIOL 224L, BIOL 226/BIOL 226L, BIOL 451/BIOL 451L, BIOL 525/BIOL 525L, BIOL 526, BIOL 527/BIOL 527L, BIOL 528/BIOL 528L, BIOL 553/BIOL 553L, BIOL 562, or BIOL 563. BIOL 395 counts as a laboratory course for students entering in Fall 2022 or later. Other non-Q-Bio laboratory courses include all of the Organismal Structure and Diversity courses listed below, any course with an "L" designation (except BIOL 253/L, which does not count as an elective in the major), and the following courses: BIOL 255H, BIOL 256, BIOL 459, BIOL 461, BIOL 463, BIOL 535, BIOL 562, and BIOL 563.

<sup>5</sup> Quantitative biology laboratory courses can be used as quantitative biology electives if the quantitative biology laboratory course requirement is satisfied by another course. One elective may consist of a total of three hours of BIOL courses numbered above 600 (not including BIOL 692H).

<sup>6</sup> Premedical students are encouraged to take CHEM 241/CHEM 241L and CHEM 262/CHEM 262L.

Code	Title	Hours
<b>Organismal Diversity Course List</b>		
BIOL 271 & 271L	Plant Biology and Plant Biology Laboratory	4
BIOL 272 & 272L	Local Flora and Local Flora Lab	4
BIOL 273	Horticulture	4
BIOL 274 & 274L	Plant Diversity and Plant Diversity Laboratory	4
BIOL 277 & 277L	Vertebrate Field Zoology and Vertebrate Field Zoology Laboratory	4
BIOL 278 & 278L	Animal Behavior and Animal Behavior Laboratory	4
BIOL 279 & 279L	Seminar in Organismal Biology and Topics in Organismal Biology Laboratory	3-4
BIOL 422 & BIOL 421L or BIOL 422 & 422L	Microbiology and Microbiology Laboratory with Research / Microbiology and Microbiology Laboratory	4-5
BIOL 441 & 441L	Vertebrate Embryology and Vertebrate Embryology Laboratory	4
BIOL 451 & 451L	Comparative Physiology and Comparative Physiology Laboratory	4
BIOL 471 & 471L	Evolutionary Mechanisms and Evolutionary Mechanisms Laboratory	4
BIOL 472	Introduction to Plant Taxonomy	4
BIOL 473 & 473L	Mammalian Morphology and Development and Mammalian Morphology Laboratory	4
BIOL 474 & 474L	Evolution of Vertebrate Life and Vertebrate Structure and Evolution Laboratory <sup>H</sup>	4
BIOL 475 & 475L	Biology of Marine Animals and Biology of Marine Animals Laboratory	4
BIOL 476 & 476L	Avian Biology and Avian Biology Laboratory	4
BIOL 479 & 479L	Topics in Organismal Biology at an Advanced Level and Laboratory in Organismal Biology: Advanced Topics	4
BIOL 579	Organismal Structure and Diversity in the Southern Appalachian Mountains	4

<sup>H</sup> Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

## Allied Science Electives

All allied science elective courses need to have a minimum of three credit hours.

Code	Title	Hours
ANTH 143	Human Evolution and Adaptation	3
ANTH 148	Human Origins	3
ANTH 298	Biological Anthropology Theory and Practice	3
ANTH 315	Human Genetics and Evolution	3
ANTH 318	Human Growth and Development	3
ANTH 412	Paleoanthropology	3
ANTH 414	Laboratory Methods: Human Osteology	3
ANTH 415	Laboratory Methods: Zooarchaeology	3
ANTH 416	Bioarchaeology	3
ANTH 470	Medicine and Anthropology	3
ANTH 623	Human Disease Ecology	3
ASTR ---	Any ASTR course above 99	3
BIOC 107	Introduction to Biochemistry	4
BIOC 108	Introduction to Biochemistry	4
BIOL ---	Any BIOL course above 101, except BIOL 213, BIOL 291, BIOL 292, BIOL 294, BIOL 295, BIOL 296, and BIOL 495	3
BIOS ---	Any BIOS course	3
BMME 335	Biomaterials	3
CHEM ---	Any CHEM course above 101	3
COMP ---	Any COMP course above 100, except COMP 380	3
EMES ---	Any EMES course above 100	3
ENEC 202	Introduction to the Environmental Sciences	4
ENEC 256	Mountain Biodiversity	4
ENEC 324	Water in Our World: Introduction to Hydrologic Science and Environmental Problems	3
ENEC 403	Environmental Chemistry Processes	3
ENEC 406	Atmospheric Processes II	4
ENEC 410	Earth Processes in Environmental Systems	4
ENEC 411	Oceanic Processes in Environmental Systems	4
ENEC 415	Environmental Systems Modeling	3
ENEC 471	Human Impacts on Estuarine Ecosystems	4
ENEC 489	Ecological Processes in Environmental Systems	4
EPID 600	Principles of Epidemiology for Public Health	3
EXSS 175	Human Anatomy <sup>F</sup>	3
EXSS 276	Human Physiology	3
GEOG 110	The Blue Planet: An Introduction to Earth's Environmental Systems <sup>H</sup>	3
GEOG 111	Weather and Climate	3
GEOG 212	Environmental Conservation and Global Change	3
GEOG 222	Health and Medical Geography	3
GEOG 253	Introduction to Atmospheric Processes	4
GEOL ---	Any GEOL course above 100	3
MASC ---	Any MASC course above 100	3
MATH ---	Any MATH course above 110, except MATH 129P	3
MCRO 251	Introductory Medical Microbiology	4
NSCI 175	Introduction to Neuroscience	3
NSCI 222	Learning <sup>H</sup>	3
NSCI 225	Sensation and Perception <sup>H</sup>	3

NUTR 240	Introduction to Human Nutrition	3
PHIL 155	Truth and Proof: Introduction to Mathematical Logic <sup>H</sup>	3
PHYS ---	Any PHYS course above 99, except PHYS 132	
PSYC 101	General Psychology <sup>F</sup>	3
PSYC 210	Statistical Principles of Psychological Research <sup>H</sup>	3
PSYC 220	Biopsychology <sup>H</sup>	3
PSYC 230	Cognitive Psychology <sup>H</sup>	3
STOR 120	Foundations of Statistics and Data Science <sup>F</sup>	4
STOR ---	Any STOR course above 151	3
SPHS 570	Anatomy and Physiology of the Speech, Language, and Hearing Mechanisms	3

<sup>H</sup> Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.












<sup>F</sup> FY-Launch class sections may be available. A FY-Launch section fulfills the same requirements as a standard section of that course, but also fulfills the FY-SEMINAR/FY-LAUNCH First-Year Foundations requirement. Students can search for FY-Launch sections in ConnectCarolina using the FY-LAUNCH attribute.

## Sample Plan of Study

Sample plans can be used as a guide to identify the courses required to complete the major and other requirements needed for degree completion within the expected eight semesters. The actual degree plan may differ depending on the course of study selected (second major, minor, etc.). Students should meet with their academic advisor to create a degree plan that is specific and unique to their interests. The sample plans represented in this catalog are intended for first-year students entering UNC–Chapel Hill in the fall term. Some courses may not be offered every term.

## Suggested Program of Study for the Quantitative Track

First Year	Hours
<b>First-Year Foundation Courses</b>	
IDST 101  College Thriving	1
ENGL 105  English Composition and Rhetoric or ENGL 105I  English Composition and Rhetoric (Interdisciplinary)	3
First-Year Seminar or First-Year Launch ( <a href="https://catalog.unc.edu/undergraduate/ideas-in-action/first-year-seminars-launches/">https://catalog.unc.edu/undergraduate/ideas-in-action/first-year-seminars-launches/</a> ) <sup>F</sup>	3
Triple-I and Data Literacy ( <a href="https://catalog.unc.edu/undergraduate/ideas-in-action/triple-i/">https://catalog.unc.edu/undergraduate/ideas-in-action/triple-i/</a> )	4
Global Language through level 3 ( <a href="https://catalog.unc.edu/undergraduate/ideas-in-action/global-language/">https://catalog.unc.edu/undergraduate/ideas-in-action/global-language/</a> )	varies
<b>Major Courses</b>	
BIOL 101  Principles of Biology & 101L  and  Introductory Biology Laboratory <sup>H, F</sup>	4
CHEM 101  General Descriptive Chemistry I & 101L  and  Quantitative Chemistry Laboratory I <sup>H, F</sup>	4

A fundamentals course BIOL 103 or BIOL 104	3
BIOL 105L Biological Research Skills	1
MATH 231  Calculus of Functions of One Variable I <sup>H, F</sup>	4
MATH 232  Calculus of Functions of One Variable II <sup>H, F</sup>	4
<b>Hours</b>	<b>31</b>
<b>Sophomore Year</b>	
A fundamentals course BIOL 103 or BIOL 104	3
A core BIOL class	3
CHEM 102  General Descriptive Chemistry II and Quantitative Chemistry Laboratory II <sup>H, F</sup>	4
CHEM 261 Introduction to Organic Chemistry I <sup>H</sup>	3
BIOS 600 Principles of Statistical Inference	3
or  Introduction to Data Models and Inference	
or STOR 155  Introduction to Data Analysis	
or STOR 151  Foundations of Statistics and Data Science	
or STOR 120	
MATH 233  Calculus of Functions of Several Variables <sup>H, F</sup>	4
Gen Ed and elective courses	12
<b>Hours</b>	<b>32</b>
<b>Junior Year</b>	
Two Biology electives including one quantitative laboratory	7
PHYS 114  General Physics I: For Students of the Life Sciences <sup>F</sup>	4
or PHYS 118  Introductory Calculus-based Mechanics and Relativity	
PHYS 115  General Physics II: For Students of the Life Sciences <sup>F</sup>	4
or PHYS 119  Introductory Calculus-based Electromagnetism and Quanta	
A programming class	3
Gen Ed and elective courses	12
<b>Hours</b>	<b>30</b>
<b>Senior Year</b>	
Three Biology electives	10-11
Allied sciences electives (CHEM 241/CHEM 241L if premed)	6
Electives to accumulate 125 academic hours	16
<b>Hours</b>	<b>32-33</b>
<b>Total Hours</b>	<b>125-126</b>

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## Biology Major, NUS Joint Degree

Biology B.S. majors may wish to consider applying for the Joint Degree Program, an innovative joint undergraduate degree program between the

University of North Carolina at Chapel Hill and the National University of Singapore. UNC–Chapel Hill undergraduates spend anywhere from two to four semesters at the National University of Singapore and receive a joint bachelor of science degree from both institutions. For further information, contact the Study Abroad Office.

## Special Opportunities in Biology

Students are encouraged to speak with their advisor about opportunities to serve as peer advisors in the Health Professions Advising Office, or to join Tri-Beta, the National Biological Sciences Honor Society.

## Honors in Biology

Candidates for honors or highest honors must secure approval from the departmental honors advisor. They must have three hours of BIOL 395, take BIOL 692H, and maintain a grade point average of 3.3, both overall and in biology courses (exclusive of BIOL 692H and including only one semester of BIOL 395), calculated at the end of the semester preceding the semester in which they graduate. Other requirements are detailed on the department website (<http://bio.unc.edu/undergraduate/honors-info/>).

## High-Impact/Experiential Education

After completing BIOL 201 or BIOL 202 (or a 200-level core course under the new curriculum), students are encouraged to pursue high-impact/experiential education opportunities. The department offers several courses that meet the High-Impact/Experiential Education requirement and the Research and Discovery requirement from the General Education curriculum.

## Laboratory Teaching Apprenticeships and Assistantships

Opportunities exist to assist graduate instructors in lecture or undergraduate laboratory courses. Interested students should contact the instructor of the course, and will need to submit a form to obtain approval from the departmental director of undergraduate studies.

## Undergraduate Awards

All awards include a personal plaque, a monetary gift, and a place on Coker Hall's list of department honorees. The awards include

- The Stephen G. Brantley Award in honor of Henry Van Peters Wilson, given annually to a senior biology major for excellence in research in molecular and cellular biology.
- The Robert Ervin Coker Award, given annually to a senior biology major for excellence in research in organismal biology and ecology.
- The John N. Couch Award, given annually to a senior biology major with interests in plant biology who has demonstrated the highest ideals of scholarship and research.
- The Irvine R. Hagadorn Award, given annually to the junior biology major based on academic and research excellence. This award is also recognized by the UNC–Chapel Hill chancellor at the Annual Chancellor's Awards Ceremony.
- The Francis J. LeClair Award, given annually to a senior biology major for academic excellence in biology with an emphasis in plant sciences.

## Undergraduate Research

An undergraduate research experience can be extremely valuable to explore career choices and to prepare for postgraduate work in the biological sciences. Undergraduates may take a CURE course, and/or participate directly in the research of faculty in the Department of

Biology or other departments (with Biology sponsorship). This research opportunity allows students to put their knowledge of biology into practice through participation in cutting-edge research. Students' participation in research can begin as early as their second year by registration in BIOL 395.

Undergraduates with a 2.0 grade point average or higher in biology courses are encouraged to enroll in BIOL 395. Information concerning the procedure for enrolling in a research course can be obtained from the chair of the department's undergraduate honors research program. Additional information can be found on the department's website (<http://bio.unc.edu/undergraduate/research/>).

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## Department Programs

### Majors

- Biology Major, B.S. (<https://catalog.unc.edu/undergraduate/programs-study/biology-major-bs/>)
- Biology Major, B.S.–Quantitative Biology Track (p. 1)
- Biology Major, B.A. (<https://catalog.unc.edu/undergraduate/programs-study/biology-major-ba/>)

### Minor

- Biology Minor (<https://catalog.unc.edu/undergraduate/programs-study/biology-minor/>)

### Graduate Programs

- M.A. in Biology (<https://catalog.unc.edu/graduate/schools-departments/biology/>)
- M.S. in Biology (<https://catalog.unc.edu/graduate/schools-departments/biology/>)
- Ph.D. in Biology (<https://catalog.unc.edu/graduate/schools-departments/biology/>)

## Contact Information

### Department of Biology

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