Biological Sciences (BS): Molecular, Cellular, and Developmental Biology Concentration

To see more about what you will learn in this program, visit the Learning Outcomes website (https://apps.oirp.ncsu.edu/pgas/)!

There are five different avenues to earning a B.S. in Biological Sciences at NC State. Students studying for a degree in Biological Sciences can opt for a general curriculum (BLS) or can choose to focus in a particular area by selecting one of four areas of concentration: Molecular, Cellular, and Developmental Biology (MCD), Integrative Physiology and Neurobiology (IPN), Human Biology (HB), or Ecology, Evolution, and Conservation Biology (EEC).

The MCD curriculum offers students in-depth studies of the molecular and cellular basis of life and the development of multicellular organisms. Many students in the MCD concentration focus on lab-based courses in biology, genetics and biotechnology (BIT), in preparation for graduate studies or work in industry.

Plan Requirements

Code	Title	Hours	Counts towards
Exploring the Life Sciences			
LSC 103	Exploring Opportunities in the Life Sciences	1	
Writing			
Advanced Writing Elective (p. 2)	Requirement	3	
Biological Sciences			
LSC 101	Critical and Creative Thinking in the Life Sciences [1]	2	
BIO 181	Introductory Biology: Ecology, Evolution, and Biodiversity [1]	4	
BIO 183	Introductory Biology: Cellular and Molecular Biology [1]	4	
BIO 414	Cell Biology [1]	3	
or BIO 416	Cancer Cell Biology		
BIO 361	Developmental Biology [1]	3	
or GN 434	Genes and Development		
BIT 410	Manipulation of Recombinant DNA [1]	4	
BCH 451	Principles of Biochemistry	4	
GN 311	Principles of Genetics [1]	4	
GN 312	Elementary Genetics Laboratory [1]	1	
Select one of the following: [1]		4	
BIO 240	Principles of Human Anatomy & Physiology (A): Nervous, Skeletal, Muscular, & Digestive Systems		
BIO 245	Principles of Human Anatomy & Physiology (B): Endocrine, Cardiovascular, Respiratory & Renal Systems		
ZO 250	Animal Anatomy and Physiology		
Physical & Mathematical Sciences			
MA 131	Calculus for Life and Management Sciences A [1]	3	
or MA 141	Calculus I		
MA 231	Calculus for Life and Management Sciences B [1]	3	
or MA 241	Calculus II		
CH 101	Chemistry - A Molecular Science [1]	3	
CH 102	General Chemistry Laboratory [1]	1	
CH 201	Chemistry - A Quantitative Science [1]	3	
CH 202	Quantitative Chemistry Laboratory [1]	1	
CH 221	Organic Chemistry I [1]	3	
CH 222	Organic Chemistry I Lab [1]	1	
CH 223	Organic Chemistry II [1]	3	
CH 224	Organic Chemistry II Lab [1]	1	
Select one of the following: [1]		4	
PY 211	College Physics I		

PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory	
Select one of the following: [1]		4
PY 212	College Physics II	
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	
Major Electives		
MCDB Electives (p. 3) [1]		9
Additional Science & Math Electives (p. 4)		8
Learning Experience Elective (p. 5)		3
GEP Courses		
ENG 101	Academic Writing and Research [1]	4
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		6
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		6
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		2
GEP US Diversity, Equity, and Inclusion (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-usdei/)		3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		3
GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)		
Foreign Language Proficiency (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/foreign-language-proficiency/) (verify requirement)		
Free Electives		
Free Electives (12 Hr S/U Lmt) [2]		9
These electives cannot be remedial nor can they be taken at an elementary level after you have taken comparable coursework at a more advanced level. ST 311 is recommended as a Free Elective. Students interested in graduate school or professional school should check the courses required for admission to the programs to which they plan to apply.		
Total Hours		**120**

[1] A grade of C- or higher is required.

[2] Students should consult their academic advisors to determine which courses fill this requirement.

Advanced Writing Requirement Electives

Code	Title	Hours	Counts towards
BIO 267	Research in the Life Sciences I: Research Skills	3	
COM 211	Argumentation and Advocacy	3	
ENG 214	Introduction to Editing	3	
ENG 232	Literature and Medicine	3	
ENG 287	Explorations in Creative Writing	3	
ENG 288	Fiction Writing	3	
ENG 289	Poetry Writing	3	
ENG 292	Writing About Film	3	
ENG 316	Introduction to News and Article Writing	3	
ENG 323	Writing in Rhetorical Traditions	3	
ENG 331	Communication for Engineering and Technology	3	
ENG 332	Communication for Business and Management	3	
ENG 333	Communication for Science and Research	3	
ENG 381	Creative Nonfiction Writing Workshop	3	
ENG 388	Intermediate Fiction Writing Workshop	3	

ENG 389	Intermediate Poetry Writing Workshop	3	
ENG 416	Advanced News and Article Writing	3	
ENG 417	Editorial and Opinion Writing	3	
ENG 422	Writing Theory and the Writing Process	3	
ENG 425	Analysis of Scientific and Technical Writing	3	
ENG 426	Analyzing Style	3	

MCDB Electives

Code	Title	Hours	Counts towards
BCH 452	Introductory Biochemistry Laboratory	2	
BCH 453	Biochemistry of Gene Expression	3	
BCH 455	Proteins and Molecular Mechanisms	3	
BCH 553	Biochemistry of Gene Expression	3	
BCH 555	Proteins and Molecular Mechanisms	3	
BEC 463	Fermentation of Recombinant Microorganisms	2	
BEC 563	Fermentation of Recombinant Microorganisms	2	
BIO 269	Research in the Life Sciences II: Guided Research	3	
BIO 370	Developmental Anatomy of the Vertebrates	3	
BIO 375	Developmental Anatomy Laboratory	2	
BIO 405	Functional Histology	3	
BIO 482	Capstone Course in Molecular, Cellular, and Developmental Biology	3	
BIT 462		2	
BIT 463	Fermentation of Recombinant Microorganisms	2	
BIT 464	Protein Purification	2	
BIT 465	Real-time PCR Techniques	2	
BIT 466	Animal Cell Culture Techniques	2	
BIT 467	PCR and DNA Fingerprinting	2	
BIT 468		2	
BIT 471	RNA Interference and Model Organisms	2	
BIT 473	Protein Interactions	2	
BIT 474	Plant Genetic Engineering	2	
BIT 476	Applied Bioinformatics	2	
BIT 477	Metagenomics	2	
BIT 478		2	
BIT 481	Plant Tissue Culture and Transformation	2	
BIT 562		2	
BIT 563	Fermentation of Recombinant Microorganisms	2	
BIT 564	Protein Purification	2	
BIT 565	Real-time PCR Techniques	2	
BIT 566	Animal Cell Culture Techniques	2	
BIT 567	PCR and DNA Fingerprinting	2	
BIT 568		2	
BIT 571	RNA Interference and Model Organisms	2	
BIT 573	Protein Interactions	2	
BIT 574	Plant Genetic Engineering	2	
BIT 577	Metagenomics	2	
BIT 578		2	
CHE 463	Fermentation of Recombinant Microorganisms	2	
CHE 563	Fermentation of Recombinant Microorganisms	2	
GN 427	Introductory Bioinformatics	3	

GN 441	Human and Biomedical Genetics	3
GN 451	Genome Science	3
GN 456	Epigenetics, Development, and Disease	3
GN 541	Human and Biomedical Genetics	3
MB 351	General Microbiology	3
MB 352	General Microbiology Laboratory	1
MB 354	Inquiry-Guided Microbiology Lab	1
MB 411	Medical Microbiology	3
MB 412	Medical Microbiology Laboratory	1
MB 414	Microbial Metabolic Regulation	3
MB 420	Fundamentals of Microbial Cell Biotransformations	2
MB 435	Bacterial Pathogenesis	3
MB 441	Immunology	3
MB 455	Microbial Biotechnology	3
MB 461	Molecular Virology	3
MB 520	Fundamentals of Microbial Cell Biotransformations	2
MB 535	Bacterial Pathogenesis	3
PB 421	Plant Physiology	3
PB 480	Introduction to Plant Biotechnology	3
PB 481	Plant Tissue Culture and Transformation	2
PB 580	Introduction to Plant Biotechnology	3
PO 466	Animal Cell Culture Techniques	2
PO 566	Animal Cell Culture Techniques	2

Additional Science and Math Electives

Code	Title	Hours	Counts towards
AEC/GN 450	Conservation Genetics	3	
BEC/BIT 463	Fermentation of Recombinant Microorganisms	2	
BIO 230	The Science of Studying Dinosaurs	3	
BIO 240	Principles of Human Anatomy & Physiology (A): Nervous, Skeletal, Muscular, & Digestive Systems	4	
BIO 245	Principles of Human Anatomy & Physiology (B): Endocrine, Cardiovascular, Respiratory & Renal Systems	4	
BIO 310	Quantitative Approaches to Biological Problems	3	
BIO 416	Cancer Cell Biology	3	
BIO 418	Cell Biology Research Lab	2	
BIO 432	Evolutionary Medicine	3	
BIT 477	Metagenomics	2	
GN 428	Introduction to Machine Learning in Biology	3	
GN 453	Personal Genomics	3	
MA 331	Differential Equations for the Life Sciences	3	
MB 470	Emerging and Re-emerging Infectious Diseases	3	
PB 205	Our Green World	3	
ZO 334	Captive Animal Biology Field Laboratory	2	
ZO 486	Capstone Course in Zoology	3	

Learning Experience Electives

Code	Title	Hours	Counts towards
Learning experience in an appropriate area (research, teaching, or other professional experience), with prior approval by faculty adviser, prospective supervisor, and departmental undergraduate coordinator. Contact and arrangements with prospective supervisors is the responsibility of the student. Talk to your advisor about this requirement.			
BIO 269	Research in the Life Sciences II: Guided Research	3	
BIO 499	Honors Project Part 2	3	
BSC 492	Professional Experience	1-3	
BSC 493	Research Experience	1-3	
BSC 498	Biological Sciences Honors Project Part 2	3	

Semester Sequence

This is a sample.

First Year		
Fall Semester		**Hours**
LSC 101	Critical and Creative Thinking in the Life Sciences [1]	2
BIO 181	Introductory Biology: Ecology, Evolution, and Biodiversity [1]	4
CH 101	Chemistry - A Molecular Science [1]	3
CH 102	General Chemistry Laboratory [1]	1
MA 131	Calculus for Life and Management Sciences A [1]	3
LSC 103	Exploring Opportunities in the Life Sciences	1
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
	Hours	**15**
Spring Semester		
BIO 183	Introductory Biology: Cellular and Molecular Biology [1]	4
CH 221	Organic Chemistry I [1]	3
CH 222	Organic Chemistry I Lab [1]	1
ENG 101	Academic Writing and Research [1]	4
MA 231	Calculus for Life and Management Sciences B [1]	3
	Hours	**15**

Second Year		
Fall Semester		
ZO 250	Animal Anatomy and Physiology	4
CH 223	Organic Chemistry II [1]	3
CH 224	Organic Chemistry II Lab [1]	1
Free Elective		3
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
	Hours	**15**
Spring Semester		
GN 311	Principles of Genetics [1]	4
GN 312	Elementary Genetics Laboratory [1]	1
CH 201	Chemistry - A Quantitative Science [1]	3
CH 202	Quantitative Chemistry Laboratory [1]	1
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		3
Learning Experience Elective (p. 5)		3
	Hours	**15**
Third Year		
Fall Semester		
PY 211	College Physics I [1]	4
BIO 361 or GN 434	Developmental Biology [1] or Genes and Development	3
BCH 351 or BCH 451	General Biochemistry [1] or Principles of Biochemistry	4
Advanced Writing Requirement (p. 2)		3
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		3
	Hours	**17**
Spring Semester		
PY 212	College Physics II [1]	4
Cell Biology Requirment (p. 1)		3
BIT 410	Manipulation of Recombinant DNA [1]	4
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		3
	Hours	**14**
Fourth Year		
Fall Semester		
MCD Elective (p. 3)		3
MCD Elective (p.)		3
Science and Math Elective (p. 4)		4
GEP US Diversity, Equity, and Inclusion (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-usdei/)		3
Free Elective		3
	Hours	**16**
Spring Semester		
MCD Elective (p.)		3
Science and Math Elective (p. 4)		4
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3

Free Elective	3
Hours	**13**
Total Hours	**120**

[1] A grade of C- or higher is required.

Career Opportunities

Many students majoring in the Department of Biological Sciences take advantage of scholarship and honors programs available at NC State, including the University Honors Program and the University Scholars Program. In addition, we offer a discipline-based Undergraduate Honors Program in Biological Sciences (DBS Honors Program). The DBS Honors Program requires students to design a challenging program of advanced study, including eight credits of honors coursework in biology and at least two semesters of research or teaching scholarship. Participants write an honors thesis and are required to present their scholarly work at a local, regional, or national meeting. Invitations to join the DBS Honors Program are sent in the first three weeks of the Fall and Spring semesters. Students in any major in the Department of Biological Sciences who have earned an overall GPA of 3.60 after completing 30-65 credit hours at NC State will receive an invitation to join the DBS Honors Program; transfer students in any of our majors who have earned an overall GPA of 3.60 in 15 credit hours at NC State also will receive an invitation.

Students who graduate from the Department of Biological Sciences are well prepared for employment in various government agencies and private industries. Graduates may continue their education with studies leading to advanced degrees in many areas of the biological sciences, including cell biology, ecology, microbiology, genetics, zoology, neurobiology, and biomedical disciplines. Many choose to seek advanced degrees in medicine, dentistry, optometry, veterinary medicine, public health, and other health-related fields. Students who plan to seek certification for pre-college teaching may want to pursue a second major in the Department of Science, Technology, Engineering & Mathematics Education.