Microbiology (BS)

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

Microbiology is concerned with the growth and development, physiology, classification, ecology, genetics, and other aspects of the life process of an array of microscopic, generally single-celled, organisms and viruses. These organisms frequently serve as model systems for elucidation of fundamental processes that are common to all living cells. Most of the major discoveries that have produced spectacular advances in biology and genomic science during the past decade have resulted from studies of microbial systems. Future developments in biotechnology, production of food and fuel, and human and animal health will rely heavily on understanding microbial processes.

There are 4 avenues to earning a B.S. in Microbiology. Students can opt for a general curriculum (MBIO) or can choose to focus in a particular area by selecting one of three areas of concentration: Microbial Biotechnology (MBIO-MT) or Microbial Research (MBIO-MR) or Microbial Health Sciences (MBIO-HS). These concentrations mirror the three most common career paths of Microbiology majors: work in research laboratories and production facilities, further study in graduate school (at the Masters or Doctoral level), and further study in professional schools such as medical and dental schools.

Plan Requirements

Code	Title	Hours	Counts towards
Orientation			
LSC 103	Exploring Opportunities in the Life Sciences	1	
or MB 103	Introductory Topics in Microbiology		
Communication			
ENG 333	Communication for Science and Research [1]	3	
Mathematical Sciences			
MA 131	Calculus for Life and Management Sciences A [1]	3-4	
or MA 141	Calculus I		
ST 311	Introduction to Statistics [1]	3	
or ST 371	Introduction to Probability and Distribution Theory		
Natural and Physical Sciences			
CH 101 & CH 102	Chemistry - A Molecular Science and General Chemistry Laboratory [1]	4	
CH 201 & CH 202	Chemistry - A Quantitative Science and Quantitative Chemistry Laboratory [1]	4	
CH 221 & CH 222	Organic Chemistry I and Organic Chemistry I Lab [1]	4	
CH 223 & CH 224	Organic Chemistry II and Organic Chemistry II Lab [1]	4	
BIO 181	Introductory Biology: Ecology, Evolution, and Biodiversity [1]	4	
BIO 183	Introductory Biology: Cellular and Molecular Biology [1]	4	
Select one of the following: [1]		4	
PY 201	University Physics I		
PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory		
PY 211	College Physics I		
Select one of the following: [1]		4	
PY 202	University Physics II		
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory		
PY 212	College Physics II		
Major Requirements			
LSC 101	Critical and Creative Thinking in the Life Sciences [1]	2	
MB 351 & MB 354	General Microbiology and Inquiry-Guided Microbiology Lab [1]	4	

MB 411 & MB 412	Medical Microbiology and Medical Microbiology Laboratory [1]	4
MB 414	Microbial Metabolic Regulation [1]	3
MB 451 & MB 452	Microbial Diversity and Microbial Diversity Lab [1]	4
MB 480	Current Issues in Microbiology [1]	1
GN 311	Principles of Genetics [1]	4
BCH 451	Principles of Biochemistry [1]	4
Gene Expression [1]		3
BCH 453/553	Biochemistry of Gene Expression	
GN 421/521	Molecular Genetics	
Cell/Physiology [1]		3
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	
BIO 414	Cell Biology	
PB 421	Plant Physiology	
Laboratory Elective (p. 2) [1]		3
Microbiology Electives (p. 3) [1]		9
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
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.

Laboratory Elective

Code	Title	Hours	Counts towards
BBS 426/526/ BEC 426/526	Upstream Biomanufacturing Laboratory	2	
BCH 452	Introductory Biochemistry Laboratory	2	
BEC 436	Introduction to Downstream Process Development	2	
BEC 440		3	
BEC 441		3	
BEC 462	Fundamentals of Bio-Nanotechnology	3	
BEC 463	Fermentation of Recombinant Microorganisms	2	
BEC 475	Global Regulatory Affairs for Medical Products	3	

BEC 480	cGMP Fermentation Operations	2
BEC 483	Tissue Engineering Technologies	2
BEC 485	cGMP Downstream Operations	2
BEC 488	Animal Cell Culture Engineering	2
BEC 495	Special Topics in Biomanufacturing	1-4
BEC 497	Biomanufacturing Research Projects	1-3
BIT 402	Biotechnology Networking and Professional Development	1
BIT 410	Manipulation of Recombinant DNA	4
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 479	High-Throughput Discovery	2
BIT 480	Yeast Metabolic Engineering	2
BIT 481	Plant Tissue Culture and Transformation	2
BIT 492	External Learning Experience	1-6
BIT 493	Special Problems in Biotechnology	1-6
BIT 495	Special Topics in Biotechnology	1-3
BME 483	Tissue Engineering Technologies	2
CHE 462	Fundamentals of Bio-Nanotechnology	3
CHE 463	Fermentation of Recombinant Microorganisms	2
CHE 488	Animal Cell Culture Engineering	2
FS 426	Upstream Biomanufacturing Laboratory	2
GN 312	Elementary Genetics Laboratory	1
MB 360	Scientific Inquiry in Microbiology: At the Bench	3
MB 420	Fundamentals of Microbial Cell Biotransformations	2
PB 481	Plant Tissue Culture and Transformation	2
PO 466	Animal Cell Culture Techniques	2

Microbiology Electives

Code	Title	Hours	Counts towards
BBS 426	Upstream Biomanufacturing Laboratory	2	
BBS 526	Upstream Biomanufacturing Laboratory	2	
BEC 426	Upstream Biomanufacturing Laboratory	2	
BEC 463	Fermentation of Recombinant Microorganisms	2	
BEC 480	cGMP Fermentation Operations	2	
BEC 526	Upstream Biomanufacturing Laboratory	2	

BEC 563	Fermentation of Recombinant Microorganisms	2
BEC 580	cGMP Fermentation Operations	2
BIT 210	Phage Hunters	3
BIT 211	Phage Genomics	2
BIT 410	Manipulation of Recombinant DNA	4
BIT 463	Fermentation of Recombinant Microorganisms	2
BIT 466	Animal Cell Culture Techniques	2
BIT 563	Fermentation of Recombinant Microorganisms	2
BIT 566	Animal Cell Culture Techniques	2
BSC 493	Research Experience	1-3
CHE 463	Fermentation of Recombinant Microorganisms	2
CHE 563	Fermentation of Recombinant Microorganisms	2
FS 405	Food Microbiology	3
FS 406	Food Microbiology Lab	1
FS 426	Upstream Biomanufacturing Laboratory	2
FS 505	Food Microbiology	3
FS 506	Food Microbiology Lab	1
FS 526	Upstream Biomanufacturing Laboratory	2
MB 210	Phage Hunters	3
MB 211	Phage Genomics	2
MB 405	Food Microbiology	3
MB 406	Food Microbiology Lab	1
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 470	Emerging and Re-emerging Infectious Diseases	3
MB 492	External Learning Experience	1-6
MB 505	Food Microbiology	3
MB 506	Food Microbiology Lab	1
MB 520	Fundamentals of Microbial Cell Biotransformations	2
MB 532	Soil Microbiology	4
MB 535	Bacterial Pathogenesis	3
PO 466	Animal Cell Culture Techniques	2
PO 566	Animal Cell Culture Techniques	2
SSC 532	Soil Microbiology	4

Semester Sequence

This is a sample.

First Year		
Fall Semester		**Hours**
BIO 181	Introductory Biology: Ecology, Evolution, and Biodiversity [1]	4
CH 101 & CH 102	Chemistry - A Molecular Science and General Chemistry Laboratory [1]	4
LSC 101	Critical and Creative Thinking in the Life Sciences [1]	2
MA 131	Calculus for Life and Management Sciences A [1]	3
MB 103	Introductory Topics in Microbiology	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 & CH 222	Organic Chemistry I and Organic Chemistry I Lab [1]	4
ENG 101	Academic Writing and Research	4
Free Elective		3
	Hours	**15**

Second Year		
Fall Semester		
CH 223 & CH 224	Organic Chemistry II and Organic Chemistry II Lab [1]	4
PY 211	College Physics I [1]	4
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3
MB 351	General Microbiology [1]	3
MB 354	Inquiry-Guided Microbiology Lab [1]	1
	Hours	**15**
Spring Semester		
CH 201 & CH 202	Chemistry - A Quantitative Science and Quantitative Chemistry Laboratory [1]	4
PY 212	College Physics II [1]	4
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		3
MB 411 & MB 412	Medical Microbiology and Medical Microbiology Laboratory	4
	Hours	**15**
Third Year		
Fall Semester		
ENG 333	Communication for Science and Research	3
GN 311	Principles of Genetics [1]	4
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3
ST 311	Introduction to Statistics	3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
	Hours	**14**
Spring Semester		
Cell/Physiology Elective (p. 1) [1]		3
BCH 451	Principles of Biochemistry [1]	4
Laboratory Elective (p.) [1]		3
GEP US Diversity, Equity, and Inclusion (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-usdei/)		3
Microbiology Elective (p. 3) [1]		3
	Hours	**16**
Fourth Year		
Fall Semester		
MB 414	Microbial Metabolic Regulation [1]	3
MB 451	Microbial Diversity [1]	3
Microbiology Elective (p. 3) [1]		3
MB 452	Microbial Diversity Lab [1]	2
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		3
MB 480	Current Issues in Microbiology [1]	1
	Hours	**15**
Spring Semester		
Microbiology Elective (p. 3) [1]		3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		3
Free Elective		3
Free Elective		3
Gene Expression Elective (p. 1) [1]		3
	Hours	**15**
	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.