The primary objectives of the program are too broadly educate students on the biology of microorganisms and prepare them for positions in the microbial industries and graduate/professional study in life sciences through extensive laboratory and course work and research experience.

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Microorganisms are the smallest living things, of life on earth, ubiquitous in the biosphere and central to the essential life processes on earth. The microbiology curriculum emphasizes the uniqueness of microbial biology, its enormous diversity, and the biochemical basis of microbial life.

The curriculum examines the diverse roles of microorganisms and covers the fundamentals of microbial diversity, physiology and genetics. The focus is on the examination of microorganisms, microbial processes in natural and managed environments and their effects on human, animal, plant and environmental health. The nature and activity of microbial populations in aquatic and terrestrial ecosystems, the interactions within microbial communities, and biogeochemical cycles and energy flows are explored. The curriculum provides students with a fundamental understanding of the applications of microbes in biotechnology, the food industry, agriculture, and medicine. Recent advances in microbial molecular biology and biotechnology have led to an in-depth understanding of the physiology, genetics and taxonomy of microbes. Microbes are central to the food, biotechnology and pharmaceutical industries and are broadly utilized ranging from food fermentations and biosynthetic processes to waste treatment and biodegradation of toxic chemicals. The field of microbiology is a major contributor toward industrial development, human, animal and plant health, environmental integrity and agricultural productivity.

The primary objectives of the curriculum are to broadly educate students regarding the biology of Microorganisms. The curriculum prepares students for positions in industry, government and graduate/professional study in life sciences through extensive course work combined with laboratory and research experience.
Graduation Requirements for the Major
Degree: Bachelor of Science

To enter upper-level microbiology (11:680) courses, students must have completed 01:119:101-102 General Biology and 01:160:161-162 General Chemistry with grades of C or better.

I. College Mission: Interdisciplinary Critical Analysis (3 credits)
11:015:400 Junior/Senior Colloquium (3)
Introductory Life and Physical Sciences
Life Sciences (8 credits)
01:119:101-102 General Biology (4, 4)

B. Physical Science (9 credits)
01:160:161-162 General Chemistry (4, 4)
01:160:171 Introduction to Experimentation (1)

III. Humanities and Arts (6 credits)
See suggested courses in the Degree Requirements chapter.

IV. Multicultural and International Studies (6 credits)
See suggested courses in the Degree Requirements chapter.

V. Human Behavior, Economic Systems, and Political Processes (9 credits)
See suggested courses in the Degree Requirements chapter.

VI. Oral and Written Communication (6 credits)
See suggested courses in the Degree Requirements chapter.
01:355:302 Scientific and Technical Writing (3) is strongly recommended.

VII. Experience-Based Education (0-3 credits) 11:680:497,498 Research in Microbiology (BA, BA) or equivalent independent research project or appropriate cooperative education placement of at least 3 credits or appropriate non-credit bearing internship approved by the curriculum coordinator.

Proficiency in Microbiology (72-73 credits)
REQUIRED COURSES (52-53)

Quantitative skills (8) 01:640:1 ___ CALC1; CALC2(4, 4) OR 01:960:401 Basic Stats for Research (3)
[01:640:151-152 Calculus for Mathematics and Physical Sciences (4,4) is preferred]
**Professional Ethics** (1) 11:680:401 Ethics and Issues in Microbiology (1) or other bioethics course approved by the curriculum coordinator.

**Additional requirements (43-44)**

11:115:403-404 General Biochemistry (4,3) or 01:694:407-408 Molecular Biology and Biochemistry (3,3)  
11:115:413 Experimental Biochemistry (3)  
01:447:380 Genetics (4)  
11:680:390 General Microbiology (4) or 01:447:390 General Microbiology (4)  
11:680:480 Microbial Genetics and Genomics (3) or 11:126:481 Molecular Genetics (3)  
11:680:481 Microbial Physiology (3)  
11:680:491 Microbial Ecology and Diversity (3)  
11:680:494 Applied Microbiology (4)  
11:680:495 Seminar in Microbiology (1)  
01:750:193-194 Physics for the Sciences (4,4) or equivalent *  

*Students intending to apply to medical school should be aware that many schools require laboratories in organic chemistry and physics.*

**ELECTIVES (15)** A minimum of 15 credits of elective courses

11:115:428 Homology Modeling of Proteins (3)  
11:126:407 Comparative Virology (3)  
11:126:405 Microbial Technology (3)  
11:126:427 Methods in Recombinant DNA Technology (4)  
11:126:482 Molecular Genetics Laboratory (3)  
11:126:483 Nucleotide Sequence Analysis (3)  
11:126:485 Bioinformatics (3)  
11:126:486 Analytical Methods in Microbiology (3)  
11:117:414 Unit Processes in Bioenvironmental Engineering II (3)  
01:146:328 Human Parasitology (3)  
01:146:474 Immunology (3)  
01:146:475 Laboratory in Immunology (1)  
11:375:411 Environmental Microbiology (3)  
11:375:453 Soil Ecology (3)  
11:375:312 Environmental Microbiology Laboratory (2)  
11:400:423 Food Microbiology (3)  
11:400:424 Food Microbiology Laboratory (1)  
01:447:392 Pathogenic Microbiology (3)  
01:447:398 Electron Microscopy (3)  
01:447:480 Topics in Molecular Genetics (3)  
11:680:492 Microbial Ecology Laboratory (2)  
11:680:410 Microbiology and Culture of Cheese and Wine (3)  
11:704:405 Evolution of Infectious diseases (3) (taught in Spring)  
11:776:302 General Plant Pathology (3)  
11:776:400 Fungi in the Environment (3)  
11:776:415 Fungi and Human Health (3)
Research in Microbiology (BA): One to three credits of research may be substituted for an equal number of credits of elective courses, with the approval of the curriculum coordinator.

IX. Unspecified Electives (3-7 credits)

Suggested Course Sequence

First Year, Fall Term
01:355:101 Expository Writing (3)
01:119:101 General Biology (4)
01:160:161 General Chemistry (4)
01:640:135 Calculus I (4)*
* Can be delayed to subsequent year
Total Semester Credits: 15 Cumulative Total Credits: 15

First Year, Spring Term
01:119:102 General Biology (4)
01:160:162 General Chemistry (4)
01:160:171 Introduction to Experimentation (1)
01:640:138 Calculus II (4)* OR Basic Stats for Research - 01:960:480 (3)
Course fulfilling Areas III, IV or V (3)
* Can be delayed to subsequent year
Total Semester Credits: 16 Cumulative Total Credits: 31

Second Year, Fall Term
01:160:307 Organic Chemistry (4)
01:447:380 Genetics (4)
01:750:193 Physics for the Sciences (4)
Courses fulfilling Areas III, IV or V (3-6)
Total Semester Credits: 18 Cumulative Total Credits: 49

Second Year, Spring Term
01:160:308 Organic Chemistry (4) *
11:680:390 General Microbiology (4)
01:750:194 Physics for the Sciences (4)
Courses fulfilling Areas III, IV or V (3-6)
Total Semester Credits: 14 Cumulative Total Credits: 63

Third Year, Fall Term
11:115:403 Biochemistry (4)
11:115:413 Experimental Biochemistry (3)
11:680:494 Applied Microbiology (4) or 11:680:491 Microbial Ecology and Diversity (3) *

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01:355:302 Scientific and Technical Writing (3) or equivalent Course fulfilling Areas III, IV or V (3)
Total Semester Credits: 14  Cumulative Total Credits: 77

* 11:680:491 is a pre-requisite for 11:680:492 Microbial Ecology & Diversity Lab offered every other spring (even years)

Third Year, Spring Term

11:115:404 Biochemistry (3)
11:680:492 Microbial Ecol and Diversity Lab (2)
11:680:480 Microbial Genetics & Genomics (3)
Microbiology electives (3-6) and/or Research in Microbiology (3) 11:680:401
Ethics and Issues in Microbiology (1)
Total Semester Credits: 15  Cumulative Total Credits: 92

Fourth Year, Fall Term

11:680:495 Seminar in Microbiology (1)
Microbiology Electives (6-9) and/or Research in Microbiology (3)*
Courses fulfilling Areas III, IV or V (3)
Free elective courses (0-5)
Total Semester Credits: 18  Cumulative Total Credits: 110

Fourth Year, Spring Term

Junior/Senior Colloquium (3)
11:680:481 Microbial Physiology (3)
Microbiology Electives (3-6)
and/or Research in Microbiology (3)*
Courses fulfilling Areas III, IV or V (3)
Free elective courses (3)
Total Semester Credits: 18  Cumulative Total Credits: 128

*An appropriate cooperative education placement, approved by the Program Director or a George H. Cook Scholars project can substitute for Research in Microbiology.

Schedule for Key Courses in Microbiology

Fall Semesters

11:680:491 Microbial Ecology and Diversity
11:680:494 Applied Microbiology
11:680:495 Seminar in Microbiology
11:680:497 Research in Microbiology
11:115:403 General Biochemistry
2015
11:115:413 Experimental Biochemistry 
11:126:405 Microbial Technology 
11:126:407 Comparative Virology (taught every other year) 
11:126:481 Molecular Genetics 
11:126:483 Nucleotide Sequence Analysis 
11:126:484 Biotechnology Robotics 
11:127:414 Unit Processes in Bioenvironmental Engineering II 
01:146:328 Human Parasitology 
11:375:411 Environmental Microbiology 
11:375:312 Environmental Microbiology Laboratory 
11:375:453 Soil Ecology 
01:447:380 Genetics 
11:628:404 Fungi and Ecosystems (3) or 11:770:403 Fungi in the Environment 
11:770:301 General Plant Pathology 

**Spring Semester**

11:680:401 Ethics and Issues in Microbiology 
11:680:480 Microbial Genetics and Genomics 
11:680:481 Microbial Physiology 
11:680:492 Microbial Ecology & Diversity Lab 
11:680:498 Research in Microbiology 
11:115:403 General Biochemistry 
11:126:412 Process Biotechnology (taught every other year) 
11:126:427 Methods in Recombinant DNA Technology 
11:126:482 Molecular Genetics Laboratory 
11:126:483 Nucleotide Sequence Analysis 
11:126:485 Bioinformatics 
11:126:486 Analytical Methods in Microbiology 
01:146:328 Human Parasitology 
01:146:474 Immunology 
01:146:475 Laboratory in Immunology 
11:400:423 Food Microbiology 
11:400:424 Food Microbiology Laboratory 
11:704:405 Evolution of Infectious diseases (3) (taught every other spring) 
01:447:380 Genetics 
01:447:392 Pathogenic Microbiology 
01:447:398 Electron Microscopy 
01:447:480 Topics in Molecular Genetics 

**Summer Session**

11:680:390 General Microbiology 
01:146:474 Immunology 
01:146:475 Laboratory in Immunology 
01:447:392 Pathogenic Microbiology 
01:447:380 Genetics 

2015
Residency requirements for the major in Microbiology: A minimum of 20 credits of course work from among the required and elective courses VIII. Proficiency in Microbiology, not including Quantitative skills (8) must be completed in residence. Of these 20 credits, at least 12 credits must be completed from 680 courses.

This rule is intended to assure that students receiving degrees from Rutgers - New Brunswick have taken a minimum number of courses in their major with New Brunswick faculty. Please keep in mind that although a course may transfer from another institution into one of the Rutgers-New Brunswick schools, it will not necessarily be accepted toward the major in Microbiology. Therefore, transfer courses must be evaluated and accepted by the Program Director in order to count toward the major.
Requirements for Minor in Microbiology (19-21 credits)

Prerequisites: Students must have completed 01:119:101-102 General Biology and 01:160:161-162 General Chemistry with grades of C or better.


One of the following:

- Microbial Ecology and Diversity 11:680:491 (3)
- Microbial Genetics and Genomics 11:680:480 (3)
- Applied Microbiology 11:680:394 (4)

At least 9 credits from the following (in addition to the courses listed above):

- Microbial Ecology and Diversity 11:680:491 (3)
- Microbial Genetics and Genomics 11:680:480 (3)
- Applied Microbiology 11:680:394 (4)
- Microbial Physiology 11:680:481 (3)
- Environmental Microbiology 11:375:411 (3)
- Food Microbiology 11:400:423 (3)
- Pathogenic Microbiology 01:447:392 (3)
- Microbial Ecology & Diversity Laboratory 11:680:492 (2)
- Fungi and Ecosystems 11:628:404 (3)
- Comparative Virology 11:126:407 (3)

Other microbiology courses must be approved by the Program Director: Dr. Vetriani