**Microbiology (BS): Microbial Biotechnology Concentration**

To see more about what you will learn in this program, visit the Learning Outcomes website ([https://apps.orp.ncsu.edu/pgas/](https://apps.orp.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**

**Microbiology (BS): Microbial Biotechnology**: 120 Total Units

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**Major Requirements**

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<td>Principles of Human Anatomy &amp; Physiology (A): Nervous, Skeletal, Muscular, &amp; Digestive Systems</td>
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**Microbiota**

**Microbiology (BS): Microbial Biotechnology Concentration**

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| BCH 553 | Biochemistry of Gene Expression                     | 1     |
| GN 421 | Molecular Genetics                                  | 1     |
| GN 521 | Molecular Genetics                                  | 1     |
| BIO 240 | Principles of Human Anatomy & Physiology (A): Nervous, Skeletal, Muscular, & Digestive Systems | 1     |
| BIO 245 | Principles of Human Anatomy & Physiology (B): Endocrine, Cardiovascular, Respiratory & Renal Systems | 1     |
| BIO 414 | Cell Biology                                       | 1     |
| PB 421 | Plant Physiology                                   | 1     |

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| GN 521 | Molecular Genetics                                  | 1     |
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| BIO 245 | Principles of Human Anatomy & Physiology (B): Endocrine, Cardiovascular, Respiratory & Renal Systems | 1     |
| BIO 414 | Cell Biology                                       | 1     |
| PB 421 | Plant Physiology                                   | 1     |

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| BIO 245 | Principles of Human Anatomy & Physiology (B): Endocrine, Cardiovascular, Respiratory & Renal Systems | 1     |
| BIO 414 | Cell Biology                                       | 1     |
| PB 421 | Plant Physiology                                   | 1     |
Microbial Biotech Electives

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<td>BEC 463</td>
<td>Fermentation of Recombinant Microorganisms</td>
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<td>BEC 480</td>
<td>cGMP Fermentation Operations</td>
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<td>BEC 488</td>
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<td>BIT 463</td>
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GEP Additional Breadth (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/) (Humanities/Social Sciences/Visual and Performing Arts)

GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)

GEP U.S. Diversity (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-us-diversity/) (verify requirement)

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

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

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<td>Expression Systems in Biomanufacturing I</td>
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<td>BIT 402</td>
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<td>BIT 410</td>
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<td>Gene Expression Analysis: Microarrays</td>
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<td>BIT 464</td>
<td>Protein Purification</td>
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<td>Real-time PCR Techniques</td>
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<td>BIT 467</td>
<td>PCR and DNA Fingerprinting</td>
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<td>Genome Mapping</td>
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<td>BIT 479</td>
<td>High-Throughput Discovery</td>
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<td>BIT 481</td>
<td>Plant Tissue Culture and Transformation</td>
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<td>BIT 492</td>
<td>External Learning Experience</td>
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<tr>
<td>BIT 493</td>
<td>Special Problems in Biotechnology</td>
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<td>BIT 495</td>
<td>Special Topics in Biotechnology</td>
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<tr>
<td>BIT 502</td>
<td>Biotechnology Networking and Professional</td>
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Development

Special Topics in Biotechnology

Special Problems in Biotechnology

plant Tissue Culture and Transformation

Yeast Metabolic Engineering

High-Throughput Discovery

Applied Bioinformatics

Metagenomics

Mapping the Brain

Yeast Metabolic Engineering

Plant Tissue Culture and Transformation

External Learning Experience

Special Problems in Biotechnology

Biotechnology Networking and Professional Development
Semester Sequence

This is a sample.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
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<td>Introductory Biology: Ecology, Evolution, and Biodiversity ¹</td>
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<td>CH 101</td>
<td>Chemistry - A Molecular Science ¹</td>
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<td>Critical and Creative Thinking in the Life Sciences ¹</td>
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<td>Calculus for Life and Management Sciences A ¹</td>
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<td>General Microbiology ¹</td>
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<td>MB 451</td>
<td>Microbial Diversity ¹</td>
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<td>Microbial Diversity Lab ¹</td>
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Microbiology (BS): Microbial Biotechnology Concentration

Gene Expression Elective 1 3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/) 3
Microbial Biotechnology Elective 1 3
Microbial Biotechnology Elective 1 3

Total 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.