

Biotechnology

Department Information

- **Department Web Site:**
www.ndsu.edu/agriculture/academics/academic-units/microbiological-sciences (<http://www.ndsu.edu/agriculture/academics/academic-units/microbiological-sciences/>)
- **Credential Offered:**
B.S.; Minor
- **Official Program Curriculum:**
catalog.ndsu.edu/undergraduate/program-curriculum/biotechnology/ (<http://catalog.ndsu.edu/undergraduate/program-curriculum/biotechnology/>)

Biotechnology is an interdisciplinary field that uses a combination of biology and technology to design and produce new molecules, plants, animals and microorganisms with improved characteristics. Biotechnology offers seemingly unlimited opportunities to combine genes from related or unrelated species to produce useful organisms with desirable properties that were not previously found in nature.

Background

Biotechnology may be thought of as a collection of technologies using animal and/or plant cells, biological molecules, molecular biology processes and genetic engineering for applications in medicine, agriculture and the pharmaceutical industry. The technologies include the use of recombinant DNA for gene cloning and gene transfers between organisms; culture of plant and animal cells and tissues; fusion of animal cells or plant protoplast; the regeneration of whole plants from single cells and the large-scale fermentation processes that use some of these novel organisms for the production of pharmaceuticals, diagnostic tests for diseases, feed additives, enzymes and hormones.

Examples of successful biotechnology include the development of crop plants that are resistant to herbicides or insects, the production of human growth hormone and insulin by genetically engineered bacteria and the development of unique vaccines.

The Program and Curriculum

The recommended course of study includes courses to develop special skills that are needed to enter the rapidly expanding and changing field of biotechnology. In addition to the required courses, students may select from a variety of specialized elective science courses to help develop a particular area of interest. Students majoring in biotechnology are required to either complete an internship or perform a research project in the laboratory of a faculty advisor. The biotechnology program leads to a Bachelor of Science degree.

The Faculty and Facilities

The faculty who advise, teach and serve as research mentors for the biotechnology program are spread among several academic departments. The departments include plant sciences; biological sciences, biology, chemistry, biochemistry and molecular biology; animal and range sciences; plant pathology; veterinary and microbiological sciences; and pharmaceutical sciences. Several scientists at the North Dakota State University Center for Nanoscale Science and Engineering and at the on-campus USDA facilities also serve as research mentors.

Laboratory facilities and specialized equipment are used for instruction and research. These include animal and plant tissue culture facilities, small animal housing, electron and confocal microscopes, automated DNA sequencing equipment, equipment for performing microarray experiments, and NDSU Core Labs. The Core Labs are shared cutting-edge research facilities and include the Advanced Imaging and Microscopy Core, Core Biology Facility, Core Synthesis and Analytical Services, μ Core (pronounced "micro"-core), and the Electron Microscopy Core Laboratory, among many other state-of-the-art facilities and equipment.

Career Opportunities

Biotechnology continues to rapidly develop into new research areas. Surveys indicate there will be a continuing high demand for well-educated personnel. Job opportunities are found in life science departments in colleges and universities; private and government research institutes; food production, pharmaceutical and agri-chemical industries; and in the biotechnology industries. Graduates of this program have the educational background and laboratory experience to take advantage of any of these job opportunities. Graduates of the biotechnology program are now successful and productive scientists at pharmaceutical, agri-chemical and biotechnology companies, and at government and private research institutions throughout the country.

The majority (approximately 60 percent) of graduates from the biotechnology program choose to continue their education in graduate or professional schools. Graduates of the biotechnology program have earned master's and doctoral degrees in many diverse areas, including cellular and molecular biology, biology, microbiology, plant sciences, animal physiology, cancer biology and virology at many of the most respected universities in the United States. Graduates of our program are now established and productive professors, physicians and veterinarians.

High School Preparation

Students entering the biotechnology program should have a strong background in mathematics, including trigonometry, biology, chemistry, physics, writing and computer courses. A composite ACT score of 26 or higher is recommended.

TRANSFER STUDENT PREPARATION

Transfer students are strongly advised to take transferable general education courses and intro biology and intro chemistry courses in preparation for upper-level science courses at NDSU.

Sample Program Guide

IMPORTANT DISCLAIMER: A Sample Program Guide provides an unofficial guide of program requirements and should be used by prospective students who are considering attending NDSU in the future. It is NOT an official curriculum and should NOT be used by current NDSU students for official degree planning purposes. Note that the official curriculum used by current NDSU students can vary from the Sample Program Guide due to a variety of factors such as, but not limited to, start year, education goals, transfer credit, and course availability.

To ensure proper program completion, enrolled students should utilize Degree Map (<https://www.ndsu.edu/registrar/degreemap/>) and Schedule Planner (<https://www.ndsu.edu/onestop/degree-map-and-planning/>) in Campus Connection and consult regularly with their academic advisor to ensure requirements are being met.

First Year			
Fall	Credits	Spring	Credits
MICR 189*		1 Humanities/Fine Arts Gen Ed	3
ENGL 110		3 ENGL 120	3
MATH 165		4 BIOL 151	3
BIOL 150		3 BIOL 151L	1
BIOL 150L		1 CHEM 122	3
CHEM 121		3 CHEM 122L	1
CHEM 121L		1	
		16	14
Second Year			
Fall	Credits	Spring	Credits
COMM 110		3 Wellness Gen Ed	2
STAT 330		3 Humanities/Fine Arts & Global Perspectives Gen Ed	3
MICR 350		3 CHEM 342	3
MICR 350L		2 PLSC 315	3
CHEM 341		3 PLSC 315L	1
CHEM 341L		1 Biotech Technique Elective	3
		15	15
Third Year			
Fall	Credits	Spring	Credits
Social/Behavioral Sciences Gen Ed		3 Social/Behavioral Sciences & Cultural Diversity Gen Ed	3
PHYS 211		3 Upper Division Writing Gen Ed	3
PHYS 211L		1 PHYS 212	3
BIOC 460		3 PHYS 212L	1
MICR 470		3 BIOC 461	3
MICR 471		2 MICR 480, PLSC 380, or BIOL 460 (select one)	3
		15	16

Fourth Year			
Fall	Credits	Spring	Credits
MICR 482		3 CSCI 114 or 122	3
Biotechnology Technique Elective		3 BIOC 474	3
Biotechnology Technique Elective		3 MICR 491 or BIOC 491	1-2
MICR 493 & MICR 494 (or student may do MICR 497 FE/Coop Ed/Internship) ¹		3 Free Elective	6
Free Elective		4	
		16	13-14

Total Credits: 120-121

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Only required for first-time, first-year students.

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2-4 credits of 493 Research and 1 credit of 494 Thesis