Biotechnology

Biotechnology

Biotechnology is an interdisciplinary field based on a combination of biology and technology. It includes the application of science and technology to the design of new plants, animals, and microorganisms that have improved characteristics. The methodologies 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 protoplasts, and the regeneration of whole plants from single cells.

Biotechnology also is concerned with the large-scale fermentation processes that utilize some of these novel organisms for the production of pharmaceuticals, diagnostic tests for diseases, feed additives, enzymes, and hormones.

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. 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 are all examples of successful biotechnology.

The Biotechnology program is offered in either the College of Agriculture, Food Systems, and Natural Resources (http://www.ag.ndsu.edu/academics) or the College of Science and Mathematics (https://www.ndsu.edu/scimath) and leads to the Bachelor of Science degree or Bachelor of Arts degree (College of Science and Mathematics only). The curriculum is designed to provide students with knowledge and experience in both basic and applied sciences. Students have an opportunity to work with scientists in various areas including, animal science, biochemistry, biology, botany, chemistry, horticulture, microbiology, pharmaceutical sciences, plant pathology, plant science, and zoology. Faculty in each of the cooperating life-science departments has been identified to serve as advisers and research mentors for students who select the biotechnology major. Graduates of this program have excellent opportunities for employment in the biotechnology industry or for graduate education.

Students majoring in biotechnology are required to perform a research project in the laboratory of a faculty member/scientist, and to prepare a senior thesis describing their research project. A 2.50 institutional grade-point average is required to graduate from the program.

Biotechnology Minor

A minor in biotechnology requires satisfactory completion of 21 credits in the following courses. A minimum of eight credits must be taken at NDSU.

Major Requirements

Major: Biotechnology

Degree Type: B.S.
Required Degree Credits to Graduate: 128

General Education Requirements

Code	Title	Credits
First Year Experience (F)		
AGRI/UNIV 189	Skills for Academic Success (Students transferring in 24 or more credits do not need to take AGRI 189.)	1
Communication (C)		
ENGL 110	College Composition I	3
ENGL 120	College Composition II	3
Upper Division Writing: Select one from the following:		3
ENGL 320	Business and Professional Writing	
ENGL 321	Writing in the Technical Professions	
ENGL 324	Writing in the Sciences	
ENGL 325	Writing in the Health Professions	
ENGL 459	Researching and Writing Grants and Proposal	
MICR 354	Scientific Writing	
COMM 110	Fundamentals of Public Speaking	3
Quantitative Reasong (R):		
STAT 330	Introductory Statistics	3
Science & Technology (S)		
CHEM 121 & 121L	General Chemistry I and General Chemistry I Laboratory	4

CHEM 122 & 122L	General Chemistry II and General Chemistry II Laboratory	4
Select one sequence from the following:		4
PHYS 211 & 211L	College Physics I and College Physics I Laboratory	
PHYS 251 & 251L	University Physics I and University Physics I Laboratory	
Humanities & Fine Arts (A): Select from current general education list		6
Social & Behavioral Sciences (B): Select from the current general education list		6
Wellness (W): Select from the current general education list		2
Cultural Diversity (D): Select from the current general education list		
Global Perspectives (G): Select from the current general education list		
Total Credits		**42**

Major requirements

Code	Title	Credits
General Education Requirements		40
Biotechnology Requirements		
BIOC 460 & 460L	Foundations of Biochemistry and Molecular Biology I and Foundations of Biochemistry I Laboratory	4
BIOC 461	Foundations of Biochemistry and Molecular Biology II	3
BIOC 465	Principles of Physical Chemistry and Biophysics	4
BIOC 474	Methods of Recombinant DNA Technology	3
MICR 350 & 350L	General Microbiology and General Microbiology Lab	5
MICR 470	Basic Immunology	3
MICR 471	Immunology and Serology Laboratory	2
MICR 482	Bacterial Genetics & Phage	3
MICR 491	Seminar (Biotechnology)	1-5
MICR 494	Individual Study (Senior Research)	2-4
MICR 494	Individual Study (Senior Thesis)	1
Supporting Requirements		
AGRI 150	Agriculture Orientation (Applies to students earning the degree from the CoAFSNR only; Students transferring in 24 or more credits do not need to take AGRI 150)	1
BIOL 150 & 150L	General Biology I and General Biology I Laboratory	4
BIOL 151 & 151L	General Biology II and General Biology II Laboratory	4
CHEM 341 & 341L	Organic Chemistry I and Organic Chemistry I Laboratory	4
CHEM 342	Organic Chemistry II	3
CSCI 114	Microcomputer Packages	3
or CSCI 122	Visual BASIC	
Select one from the following:		8
MATH 146 & MATH 147	Applied Calculus I and Applied Calculus II	
MATH 165 & MATH 166	Calculus I and Calculus II	
Select one from the following:		4
PHYS 212 & 212L	College Physics II and College Physics II Laboratory	
PHYS 252 & 252L	University Physics II and University Physics II Laboratory	

PLSC 315 & 315L	Genetics and Genetics Laboratory	4
Major Elective in Physiology: Select 3 credits from the following:		3
BOT 380	Plant Physiology	
ZOO 460	Animal Physiology	
MICR 480	Bacterial Physiology	
Major Elective in Biotechnology Technique: Select 4-6 credits from the following:		4-6
BIOC 473	Methods of Biochemical Research	
BIOC 487	Molecular Biology of Gene Expression	
MICR 445	Animal Cell Culture Techniques	
PLSC 411	Genomics	
PLSC 484	Plant Tissue Culture and Biotechnology	
Additional Humanities & Fine Arts or Social & Behavioral Sciences Credits		6
An additional 6 credits from these General Education categories is required for earning a B.S. degree from either the College of Agriculture, Food Systems, and Natural Resources or the College of Science and Mathematics.		
Degree Requirements: Potential of 7 credits to reach 128		7
Total Credits		**128-136**

Degree Notes:

- The Bachelors of Science degree is the default degree type for this program of study. However, a Bachelor of Arts degree is available if the degree is being earned from the College of Science & Mathematics.
- Bachelor of Arts (B.A.) Degree Requirements: An additional 12 credits of Humanities and/or Social Sciences courses and proficiency of a modern foreign language at the second year level (example: SPAN 201 & 202). Courses for the Humanities and/or Social Sciences may be fulfilled by any course having the following prefix: ADHM, ANTH, ARCH, ART, CJ, CLAS, COMM, ECON, ENGL, FREN GEOG, GERM, HDFS, HIST, LA, LANG, MUSC, PHIL, POLS, PSYC, RELS, SOC, SPAN, THEA, WGS, or any course from the current Humanities & Fine Arts (A) and/or Social & Behavioral Sciences (B) General Education list.

Minor Requirements

Biotechnology Minor

Required Credits: 21

Code	Title	Credits
BIOC 460 & 460L	Foundations of Biochemistry and Molecular Biology I and Foundations of Biochemistry I Laboratory	4
BIOC 461	Foundations of Biochemistry and Molecular Biology II	3
PLSC 315 & 315L	Genetics and Genetics Laboratory	4
Biotechnology Technique Electives: Select 4 credits from the following:		4
BIOC 473	Methods of Biochemical Research	
BIOC 474	Methods of Recombinant DNA Technology	
MICR 445	Animal Cell Culture Techniques	
PLSC 484	Plant Tissue Culture and Biotechnology	
Specialized Electives: Select 6 credits form the following:		6
BOT 380	Plant Physiology	
MICR 470	Basic Immunology	
MICR 471	Immunology and Serology Laboratory	
MICR 482	Bacterial Genetics & Phage	
PPTH 324	Introductory Plant Pathology	
ZOO 370	Cell Biology	
ZOO 460	Animal Physiology	
Total Credits		**21**

Minor Requirements and Notes

- A minimum of 8 credits must be taken at NDSU.