

Bioprocessing Science (BS)

The B.S Bioprocessing Science degree prepares students for technical careers in biomanufacturing through formal training in fundamental sciences, as well as preparing students for careers in industries whose products are based on biological systems, including biopharmaceutical and biotechnology companies.

Plan Requirements

Code	Title	Hours
Orientation		
ALS 103 or ALS 303	First-year Success in Agriculture and Life Sciences Transfer Success in Agriculture and Life Sciences	1
Communication		
COM 110 or COM 112	Public Speaking Interpersonal Communication	3
Mathematical Sciences		
MA 131	Calculus for Life and Management Sciences A	3
MA 231	Calculus for Life and Management Sciences B	3
ST 311	Introduction to Statistics	3
Natural and Physical Sciences		
BIO 183	Introductory Biology: Cellular and Molecular Biology	4
CH 101 & CH 102	Chemistry - A Molecular Science and General Chemistry Laboratory	4
CH 201 & CH 202	Chemistry - A Quantitative Science and Quantitative Chemistry Laboratory	4
CH 221 & CH 222	Organic Chemistry I and Organic Chemistry I Lab	4
CH 223 & CH 224	Organic Chemistry II and Organic Chemistry II Lab	4
BCH 351 or BCH 451	General Biochemistry Principles of Biochemistry	3
MB 351 & MB 352	General Microbiology and General Microbiology Laboratory	4
PY 211	College Physics I	4
PY 212	College Physics II	4
Major Requirements		
BBS 201	Introduction to Biopharmaceutical Science	3
FS 231	Principles of Food and Bioprocess Engineering	4
BEC 330	Principles and Applications of Bioseparations	2
FS 290 or BEC 220	Careers in Food and Bioprocessing Sciences Introduction to Drug Development and Careers in Biomanufacturing	1
BBS 301	Process Validation Science	3
FS 403	Analytical Techniques in Food & Bioprocessing Science	4
FS 416	Quality Control in Food and Bioprocessing	3
BBS 426	Upstream Biomanufacturing Laboratory	2
FS 475	Problems and Design in Food and Bioprocessing Science	3

BIT 410 or BEC 425 & BEC 445	Manipulation of Recombinant DNA Molecular Biology for Biomanufacturing and Cell Line Development for Biomanufacturing	4
BIT Elective or BEC Elective or BBS Elective (p. 1)		4
GN 311 or ZO 250	Principles of Genetics Animal Anatomy and Physiology	4

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/)		5
GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)		
World Language Proficiency (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/world-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.

BIT Elective or BEC Electives or BBS Electives

Code	Title	Hours
BEC 436	Introduction to Downstream Process Development	2
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		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
BEC 536	Introduction to Downstream Process Development	2
BEC 562	Fundamentals of Bio-Nanotechnology	3
BEC 563	Fermentation of Recombinant Microorganisms	2
BEC 575	Global Regulatory Affairs for Medical Products	3
BEC 580	cGMP Fermentation Operations	2
BEC 583		2
BEC 585	cGMP Downstream Operations	2
BIO 572	Proteomics	3

BIT 402	Biotechnology Networking and Professional Development	1
BIT 410	Manipulation of Recombinant DNA	4
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 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 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
BIT 501	Ethical Issues in Biotechnology	1
BIT 502	Biotechnology Networking and Professional Development	1
BIT 510	Core Technologies in Molecular and Cellular Biology	4
BIT 564	Protein Purification	2
BIT 565	Real-time PCR Techniques	2
BIT 566	Animal Cell Culture Techniques	2
BIT 567	PCR and DNA Fingerprinting	2
BIT 571	RNA Interference and Model Organisms	2
BIT 572	Proteomics	3
BIT 573	Protein Interactions	2
BIT 574	Plant Genetic Engineering	2
BIT 577	Metagenomics	2
BIT 579	High-Throughput Discovery	2
BIT 580	Yeast Metabolic Engineering	2
BIT 581	Plant Transformation	2
BIT 590	Independent Study in Biotechnology	1-3
BIT 595	Special Topics	1-6
BME 583	Tissue Engineering Technologies	2
CH 572	Proteomics	3
PB 481	Plant Tissue Culture and Transformation	2
PO 466	Animal Cell Culture Techniques	2
PO 566	Animal Cell Culture Techniques	2
BBS 325	Introduction to Brewing Science and Technology	3
BBS 326	Brewing Practices and Analyses	3
BBS 427	Brewing Equipment, Controls and Operations	3

Semester Sequence

This is a sample.

First Year

Fall Semester		Hours
ALS 103	First-year Success in Agriculture and Life Sciences	1
BIO 183 or BIO 181	Introductory Biology: Cellular and Molecular Biology or Introductory Biology: Ecology, Evolution, and Biodiversity	4
ENG 101	Academic Writing and Research	4
COM 110 or COM 112	Public Speaking or Interpersonal Communication	3
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
Hours		16

Spring Semester

CH 101	Chemistry - A Molecular Science	3
CH 102	General Chemistry Laboratory	1
BBS 201	Introduction to Biopharmaceutical Science	3
MA 131	Calculus for Life and Management Sciences A	3
Free Elective ¹		3
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		3
Hours		16

Second Year

Fall Semester		
CH 221	Organic Chemistry I	3
CH 222	Organic Chemistry I Lab	1
MA 231	Calculus for Life and Management Sciences B	3
PY 211	College Physics I	4
BEC 220 or FS 290	Introduction to Drug Development and Careers in Biomanufacturing or Careers in Food and Bioprocessing Sciences	1
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		3
Hours		15

Spring Semester

CH 223	Organic Chemistry II	3
CH 224	Organic Chemistry II Lab	1
FS 231	Principles of Food and Bioprocess Engineering	4
PY 212	College Physics II	4
Free Elective ¹		3
Hours		15

Third Year

Fall Semester		
CH 201	Chemistry - A Quantitative Science	3
CH 202	Quantitative Chemistry Laboratory	1
MB 351	General Microbiology	3

MB 352	General Microbiology Laboratory	1
Free Elective ¹		3
Anatomy/Physiology Elective (p. 1)		4
Hours		15
Spring Semester		
BCH 351	General Biochemistry	3
BIT Electives or BEC Electives or BBS Electives (p. 1)		4
GEP US Diversity, Equity, and Inclusion (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-usdei/)		3
BIT 410 or BEC 425 and BEC 445	Manipulation of Recombinant DNA or Molecular Biology for Biomanufacturing and Cell Line Development for Biomanufacturing	4
Hours		14
Fourth Year		
Fall Semester		
ST 311	Introduction to Statistics	3
BBS 301	Process Validation Science	3
BBS 426	Upstream Biomufacturing Laboratory	2
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
BEC 330	Principles and Applications of Bioseparations	2
Hours		14
Spring Semester		
FS 475	Problems and Design in Food and Bioprocessing Science	3
FS 416	Quality Control in Food and Bioprocessing	3
FS 403	Analytical Techniques in Food & Bioprocessing Science	4
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		2
Hours		15
Total Hours		120

¹ Students are strongly encouraged to complete a minor in a closely related field, and should consult with an advisor in the minor department for the most current requirements. A list of can be viewed online at <http://oucc.ncsu.edu/minors> (<http://oucc.ncsu.edu/minors/>). Free elective courses taken as credit only may not apply toward a minor.

Career Opportunities

Consumer demand for safe, high quality, nutritious foods and biopharmaceutical products, as well as for educational programs designed to promote healthy eating, creates a variety of career opportunities in the food, pharmaceutical and the allied health industries. Industrial opportunities include management, research and development, process supervision, quality control and assurance, procurement,

distribution, and sales. Public health opportunities include educational program development, delivery, and assessment. In addition, graduates hold positions with government agencies and many with advanced degrees have teaching and/or research positions in colleges and universities.

Bioprocessing Science

The Bioprocessing Science degree is a unique program designed to provide graduates with a special skill set specific to bioprocessing and biomanufacturing. Graduates from this degree program will have exciting opportunities to biomanufacture medicines, vaccines, enzymes and other products that improve the quality of life.

Scholarships

The department provides both merit and financial need scholarships to encourage and assist students preparing for careers in Food, Bioprocessing, or Nutrition Science.

Career Titles

Learn More About Careers

NCcareers.org (<https://nccareers.org/>)

Explore North Carolina's central online resource for students, parents, educators, job seekers and career counselors looking for high quality job and career information.

Occupational Outlook Handbook (<https://www.bls.gov/ooh/>)

Browse the Occupational Outlook Handbook published by the Bureau of Labor Statistics to view state and area employment and wage statistics. You can also identify and compare similar occupations based on your interests.

Career One Stop Videos (<https://www.careeronestop.org/>)

View videos that provide career details and information on wages, employment trends, skills needed, and more for any occupation. Sponsored by the U.S. Department of Labor.

Focus 2 Career Assessment (<https://careers.dasa.ncsu.edu/explore-careers/career-assessments/>) (NC State student email address required)
This career, major and education planning system is available to current NC State students to learn about how your values, interests, competencies, and personality fit into the NC State majors and your future career. An NC State email address is required to create an account. Make an appointment with your career counselor (<https://careers.dasa.ncsu.edu/about/hours-appointments/>) to discuss the results.

Focus 2 Apply Assessment (<https://www.focus2career.com/Portal/Register.cfm?SID=1929>) (Available to prospective students)

A career assessment tool designed to support prospective students in exploring and choosing the right major and career path based on your unique personality, interests, skills and values. Get started with Focus 2 Apply and see how it can guide your journey at NC State.

NC Biotech Center (<https://careers.ncbiotech.org/>)