

# Biomanufacturing (Certificate)

The Undergraduate Certificate in Biomanufacturing ("BTEC credential") is designed for both NC State students and for persons from outside the University who wish to gain hands-on experience with, and understanding of, the technology and operational protocols of large-scale cGMP biomanufacturing operations. This knowledge base will prepare Certificate recipients to quickly contribute to a cGMP biomanufacturing operation in significant ways and should reduce the time needed for on-the-job training in those operations. The Certificate educational focus includes gene expression technologies, bioreactors, downstream separation and purification processes, and aseptic processing operations.

## Program Coordinator

### Pa Nhia Moore

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## Admissions Requirements

Students enrolled at North Carolina State University who are in good academic standing are eligible for admission to this University Certificate program. In addition, non-degree students with evidence of having completed introductory courses in both biology and organic chemistry, or who have consent of the Certificate Program administrator may enroll in the program. Students who complete the undergraduate Minor in Biomanufacturing or the Post Baccalaureate Certificate in Biomanufacturing are not eligible for the Undergraduate Certificate in Biomanufacturing.

## Plan of Study

Contact the Program Coordinator.

## Registration Information

Contact the Program Coordinator.

## Academic Structure

Term Effective: 8/2012  
Plan Code: 14BTECCTU, 32BTECCTU  
CIP Code: 26.1201  
Description: Undergraduate Certificate in Biomanufacturing  
Offered: On-campus format

## Plan Requirements

Requirements for the Undergraduate Certificate in Biomanufacturing include a minimum of 12 credit hours as specified below. **All courses must be completed with a grade of 'C-' or better.**

**Prerequisites:** All students must complete CH 101 Chemistry - A Molecular Science, BIO 183 Introductory Biology: Cellular and Molecular Biology, and CH 221 Organic Chemistry I, or have departmental approval

of like courses completed. Additional prerequisite courses may be required. Courses must be completed with a grade of C- or better.

Code	Title	Hours	Counts towards
<b>Required Courses:</b>			<b>3</b>
BEC 220	Introduction to Drug Development and Careers in Biomanufacturing		
BEC/CHE 463	Fermentation of Recombinant Microorganisms		
or BEC 330	Principles and Applications of Bioseparations		
<b>Biomanufacturing Elective Courses:</b>			<b>4</b>
Select four credits of the following:			
BEC 330	Principles and Applications of Bioseparations		
BEC 425	Molecular Biology for Biomanufacturing		
BEC/BBS 426	Upstream Biomanufacturing Laboratory		
BEC 436	Introduction to Downstream Process Development		
BEC 445	Cell Line Development for Biomanufacturing		
BEC/CHE 463	Fermentation of Recombinant Microorganisms		
BEC 480	cGMP Fermentation Operations		
BEC/BME 483	Tissue Engineering Technologies		
BEC 485	cGMP Downstream Operations		
BEC/CHE 488	Animal Cell Culture Engineering		
BEC 497	Biomanufacturing Research Projects		
<b>Elective Courses:</b>			<b>5</b>
Select five credits of the following:			
Any 4** or 5** Level BEC Course			
BEC 425	Molecular Biology for Biomanufacturing		

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BEC/BBS 426	Upstream Biomanufacturing Laboratory
BEC 436	Introduction to Downstream Process Development
BEC 445	Cell Line Development for Biomanufacturing
BEC/CHE 448	Bioreactor Design
BEC/CHE 462	Fundamentals of Bio- Nanotechnology
BEC/CHE 463	Fermentation of Recombinant Microorganisms
BEC 475	Global Regulatory Affairs for Medical Products
BEC 480	cGMP Fermentation Operations
BEC/BME 483	Tissue Engineering Technologies
BEC 485	cGMP Downstream Operations
BEC/CHE 488	Animal Cell Culture Engineering
BEC 495	Special Topics in Biomanufacturing
BEC 497	Biomanufacturing Research Projects
BAE 425	Industrial Microbiology and Bioprocessing
BCH 351 or BCH 451	General Biochemistry Principles of Biochemistry
BIT 410	Manipulation of Recombinant DNA
BIT 466	Animal Cell Culture Techniques
GN 311	Principles of Genetics
MB 455	Microbial Biotechnology

**Total Hours**

**12**