Biomanufacturing (Certificate) (For Post-Baccalaureate Students)

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

The Certificate in Biomanufacturing provides graduates with the knowledge base and hands-on skills that will prepare them 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.

Program Coordinator
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W (http://www.btec.ncsu.edu/)

Admissions Requirements
Contact the Program Coordinator.

Plan of Study and Registration Information
Contact the Program Coordinator.

Academic Structure
Term Effective: 1/2009
Plan Code: 32BTECCTU
CIP Code: 26.1201
Description: Undergraduate Certificate in Biomanufacturing
Offered: On-campus format

Plan Requirements
Prerequisite: In order to enroll in the first course in the program, applicants must have earned a bachelor's level degree, and have completed CH 223 Organic Chemistry II (or equivalent) and BIO 183 Introductory Biology: Cellular and Molecular Biology. Interested graduates should contact the BTEC's manager of student programs.

Credits earned toward a bachelor's degree will not count for credit in the post-baccalaureate certificate.

Requirements for the Post-Baccalaureate Undergraduate Certificate in Biomanufacturing include a minimum of 13 credit hours as specified below. All courses must be completed with a grade of 'C-' or higher:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
<th>Counts towards</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEC 425</td>
<td>Molecular Biology for Biomanufacturing</td>
<td>6</td>
<td>6</td>
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<tr>
<td>BEC 445</td>
<td>Cell Line Development for Biomanufacturing</td>
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<tr>
<td>BEC 330</td>
<td>Principles and Applications of Bioseparations</td>
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<tr>
<td>BEC/CHE 463</td>
<td>Fermentation of Recombinant Microorganisms</td>
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Biomaneufacturing Specialization: 4
Select one specialization area:

Upstream Operations:
BEC 426 & BEC 480 Upstream Biomanufacturing Laboratory and cGMP Fermentation Operations

Downstream Operations:
BEC 436 & BEC 485 Introduction to Downstream Process Development and cGMP Downstream Operations

Elective Courses: 3
Select three credits of the following:

Any 4** or 5** Level BEC Course
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 475 Global Regulatory Affairs for Medical Products
BEC 480 cGMP Fermentation Operations
BEC/BME 483 Tissue Engineering Technologies
BEC 485 cGMP Downstream Operations
<table>
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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>BEC/CHE 488</td>
<td>Animal Cell Culture Engineering</td>
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<tr>
<td>BEC 495</td>
<td>Special Topics in Biomanufacturing</td>
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<tr>
<td>BCH 351</td>
<td>General Biochemistry</td>
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<td>or BCH 451</td>
<td>Principles of Biochemistry</td>
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<tr>
<td>BIT 410</td>
<td>Manipulation of Recombinant DNA</td>
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<tr>
<td>BIT 466</td>
<td>Animal Cell Culture Techniques</td>
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<tr>
<td>GN 311</td>
<td>Principles of Genetics</td>
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<tr>
<td>MB 455</td>
<td>Microbial Biotechnology</td>
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Total Hours: 13