# Biomanufacturing (MR)

## Degree Requirements

Students may choose from the degree tracks below to complete coursework within a focus area.

Degrees earned will be distributed as: "Master of Biomanufacturing" without focus area track specifications.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
<th>Counts towards</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Core Courses</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>BEC 575</td>
<td>Global Regulatory Affairs for Medical Products</td>
<td></td>
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</tr>
<tr>
<td>BEC 577</td>
<td>Advanced Biomanufacturing and Biocatalysis</td>
<td></td>
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</tr>
<tr>
<td>BEC 590</td>
<td>Industry Practicum in Biomanufacturing (two semesters)</td>
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<tr>
<td>BEC 601</td>
<td>Biomanufacturing Seminar (two semesters)</td>
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<tr>
<td>BEC 620</td>
<td>Leadership and Preparation for Industry Internship in Biomanufacturing</td>
<td></td>
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<tr>
<td>ST 511</td>
<td>Statistical Methods For Researchers I</td>
<td></td>
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</tr>
<tr>
<td>BEC 515</td>
<td>Biopharmaceutica Product Characterization Techniques</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or BEC 588</td>
<td>Animal Cell Culture Engineering</td>
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**Focus Area Tracks**

### Upstream Track

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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</tr>
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<tbody>
<tr>
<td>CHE 563</td>
<td>Fermentation of Recombinant Microorganisms</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>BBS 526</td>
<td>Upstream Biomanufacturing Laboratory</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>BEC 580</td>
<td>cGMP Fermentation Operations</td>
<td>2</td>
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</table>

**Total Hours** 6

### Elective Courses

Select three credits of the following courses:

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<tbody>
<tr>
<td>BEC 525</td>
<td>Molecular Biology for Biomanufacturing</td>
<td>2</td>
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<tr>
<td>BEC 545</td>
<td>Cell Line Development for Biomanufacturing</td>
<td>2</td>
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</tr>
<tr>
<td>BEC 532</td>
<td>Foundations of Downstream Processing and Formulation</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>BEC 536</td>
<td>Introduction to Downstream Process Development</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>BEC 585</td>
<td>cGMP Downstream Operations</td>
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**Total Hours** 3

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*BEC 601 is to be repeated twice to meet two total credit hours.*
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<tr>
<td>BEC 583</td>
<td>Tissue Engineering Technologies</td>
<td>2</td>
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<tr>
<td>BEC 595</td>
<td>Special Topics in Biomanufacturing</td>
<td>1-6</td>
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<tr>
<td>BIT 501</td>
<td>Ethical Issues in Biotechnology</td>
<td>1</td>
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<tr>
<td>BEC 669</td>
<td>Biomanufacturing Research Projects</td>
<td>1-4</td>
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<tr>
<td>BIT 510</td>
<td>Core Technologies in Molecular and Cellular Biology</td>
<td>4</td>
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<td>BIT 566</td>
<td>Animal Cell Culture Techniques</td>
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**Downstream Track**

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<tbody>
<tr>
<td>BEC 532</td>
<td>Foundations of Downstream Processing and Formulation</td>
<td>2</td>
<td></td>
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<tr>
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Total Hours 6

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**Faculty**

**Full Professors**

Ruben G. Carbonell
Amy Michele Grunden
Harold Henry Lamb
Paul Edward Mozdziak
Balaji M. Rao
Heike Inge Ada Sederoff
John Douglas Sheppard

**Associate Professors**

Paul T. Hamilton
Gavin John Williams

**Assistant Professors**

Stefano Menegatti

**Practice/Research/Teaching Professors**

Kirill Efimenko
Gary Louis Gilleskie
Imara Yasmin Perera
John H. van Zanten

**Emeritus Faculty**

Michael Carl Flickinger