BIOPHARMACEUTICAL PROCESS ENGINEERING (MS)

Contacts

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This program is currently not accepting new applicants for enrollment for 2025-2026

Program Description

- **STEM designated program**

The transformational (12 months) 36-credit Master's Degree Program in Biopharmaceutical Process Engineering is delivered at the Jefferson Institute for Bioprocessing (JIB) and is ideal for employment focused graduates with first degrees in Life Sciences and Engineering.

The Jefferson Institute for Bioprocessing (JIB) is a 25,000 sq. ft. state-of-the art facility designed for the training of industry professionals, as well as the education of the next generation of scientists and engineers interested in pursuing rewarding careers in biomanufacturing. Biopharmaceutical Processing is a rapidly growing industry focused on the development of robust processes to manufacture high value biologics and advanced therapeutics for patients with debilitating and life limiting diseases that affect millions of patients worldwide, such as cancer, rheumatoid arthritis, Alzheimer's, and Parkinson's.

Training and education in biopharmaceutical processing are exceptionally laboratory intensive. At JIB our students spend less time in traditional classroom settings and more time in JIB's pilot-scale facility fully equipped with the most advanced technologies and processes used by industry to manufacture biopharmaceuticals.

For the hybrid option, the Fall and Spring schedules for courses requiring the completion of on-site hands-on laboratory related coursework will be available prior to the start of each respective semester. In each instance, the on-site coursework will be scheduled in continuous late-semester blocks to avoid the necessity of frequent travel.

Learning Goals/Outcomes

- Prepare graduates for a wide range of positions in industry and academia.
- Provide scientific and engineering-based knowledge necessary for employment in the field.
- Impact Bioprocessing community through scholarship and advances in research.

Curriculum: 12 Months, 36 Credits

Course	Title	Credits
Fall		
ENGR 609 or BP 601	Bioprocess Engineering for Sci or Bas Engineering for Scientists	3
ENGR 611	Princ BioPharm Proc Engineerin	3
ENGR 607	Bus & Entr in Life Sciences	1.5
ENGR 604	Biopharm Process Ops	3
ENGR 603	Appl Math & Stat Mtds in Bio	1.5
ENGR 600	Bioanalytical Reg/Qual Princip	3
	Credits	**15**
Spring		
Concentration Coursework (p. 1)		6
ENGR 605	QbD, Proc Sel & Optimization	1.5
ENGR 606	Proc Charac & Validation	1.5
BP 405	Intro to Upstream Unit Oper	4
BP 404	Intro to Downstream Unit Oper	4
	Credits	**17**
Summer		
ENGR 608	Capstone Design Project	6
	Credits	**6**
	Total Credits	**38**

Concentration Coursework

Select one concentration:

Concentration: Protein Replacement Therapies

The concentration is specifically designed to met the needs of future industry professionals that would like to specialize in the areas of bio-therapeutic development and formulation. The courses included in the concentration provide participants with the knowledge and skillset to identify emerging developments in bio-therapeutic manufacturing, design and create viral and plasmid-based vectors using recombinant DNA technology and transfect / optimize the cell lines required to produce protein-based therapeutics. Participants will also be introduced to the challenges and opportunities in formulation practice with a focus on the development of liquid formulation for proteins and monoclonal antibodies for subcutaneous and intravenous delivery.

Code	Title	Credits
ENGR 613	Vector & Cell Line Design	3
ENGR 612	Emerging Therapeutics	1.5
ENGR 622	Bio-Therapeutic Formulation	1.5

Concentration: Analytical Techniques and Regulatory Principles

The concentration in Analytical Techniques and Regulatory Principles has been designed in response to a need within the biopharmaceutical industry for individuals with an advanced knowledge of the principles and practices of state-of-the-art analytical techniques and current regulatory requirements. The required coursework focuses on GMP analytical packages, Quality Management Systems and the regulatory principles, including ICH q 10, required to produce safe and efficacious therapeutics. Additionally, students will gain an understanding of the molecular techniques required to produce biologics and biosimilars, method validation, pharmaceutical GMP and Chemistry, Manufacturing and Control (CMC).

Code	Title	Credits
ENGR 616	CMC & Pharm Good ManuPractices	1.5
ENGR 618	Tech & Regulatory Aspects	1.5

Code	Title	Credits
ENGR 615	Biologics & Biosimilars	1.5
ENGR 617	Quality Systems for Reg Compl	1.5

Concentration: Advanced Vaccine Manufacture

The unprecedented effects of newly emerging viruses with high mortality rates and pandemic disease causing potential has greatly increased the demand for vaccine manufacturing capabilities that can respond both rapidly and cost effectively. Advanced recombinant antigen vaccine manufacturing provides unparalleled opportunities to meet these needs, but requires specialized training and education. The Advanced Vaccine Manufacture concentration provides students with the knowledge and skillset to identify emerging developments in vaccine manufacturing, construct cell lines to produce advanced vaccines and formulate the end-product to meet the needs of patients in a safe and efficacious manner.

Code	Title	Credits
ENGR 613	Vector & Cell Line Design	3
ENGR 612	Emerging Therapeutics	1.5
ENGR 614	Vaccine Formulation	1.5