Bioprocessing and biotechnology are specialized forms of chemical and biological science and engineering that encompasses agriculture, food, pharmaceuticals, chemicals, paper, and other materials. It also covers large scale industry production for yield optimization and end product quality. From the NJIT Department of Chemistry and Environmental Science, the Graduate Certificate in Biotechnology will cover these topics in depth.

Who would be suited to take this program?

Typical students in this program could be from the pharmaceutical/biopharmaceutical world or strictly come from a biological or chemical science background, but could also come from an environmental science or engineering background as well. Such occupations may be pharmaceutical biologics scientists, food/drug development specialists, agricultural scientists, biomedical scientists, bacteriologists, and others.

What are the Required Courses?

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIOL 605 (<a href="http://catalog.njit.edu/search/?P=BIOL%20605">http://catalog.njit.edu/search/?P=BIOL%20605</a>)</td>
<td>Principles in Bioscience Processing</td>
<td>3</td>
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<tr>
<td>BIOL 606 (<a href="http://catalog.njit.edu/search/?P=BIOL%20606">http://catalog.njit.edu/search/?P=BIOL%20606</a>)</td>
<td>Applied Bioprocessing and Immunological Based Therapies</td>
<td>3</td>
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<tr>
<td>CHEM 673 (<a href="http://catalog.njit.edu/search/?P=CHEM%20673">http://catalog.njit.edu/search/?P=CHEM%20673</a>)</td>
<td>Biochemistry</td>
<td>3</td>
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<td>EVSC 616 (<a href="http://catalog.njit.edu/search/?P=EVSC%20616">http://catalog.njit.edu/search/?P=EVSC%20616</a>)</td>
<td>Toxicology</td>
<td>3</td>
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<td>CHEM 714 (<a href="http://catalog.njit.edu/search/?P=CHEM%20714">http://catalog.njit.edu/search/?P=CHEM%20714</a>)</td>
<td>Pharmaceutical Analysis</td>
<td>3</td>
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<tr>
<td>CHEM 777 (<a href="http://catalog.njit.edu/search/?P=CHEM%20777">http://catalog.njit.edu/search/?P=CHEM%20777</a>)</td>
<td>Principles of Pharmaceutical Chemistry</td>
<td>3</td>
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</tbody>
</table>

What will I learn?

- **Principles in Bioscience Processing** - The main concepts of cell physiology, molecular biology, and cell biology. The fundamental aspects of biochemistry that relate directly to pharmaceutical developments are discussed and include basic organic chemistry, blood and buffers, protein based enzymes, complex carbohydrates, nucleic acids, and fats.

- **Applied Bioprocessing and Immunological Based Therapies** - The foundational knowledge of immunology and immunological applications relevant to bioprocessing science including immunoglobulin genetics, leukocyte activation and migration, transplant immunology, and immunotherapy and vaccines.

- **Biochemistry** - Fundamentals of biochemistry related to physical organic chemistry for students who have an interest in biomedical engineering, chemistry, chemical engineering, or environmental science.

- **Toxicology** - The general principles of toxicology are presented and applied to the assessment of acute, subacute and chronic effects of hazardous and toxic chemicals. Qualitative and quantitative measures of toxicity and testing protocols are addressed. The role of toxicology in risk assessment and risk management.

- **Pharmaceutical Analysis** - Instrumental techniques used in the analysis of different pharmaceutical products. Many different types of analysis are carried out in the pharmaceutical industry pertaining to active ingredients, formulations as well as impurities and degradants. The focus will be on instrumentation such as chromatography, mass spectroscopy, different types of spectroscopy, quality assurance and GMP.

- **Principles of Pharmaceutical Chemistry** - Drug design and the molecular mechanisms by which drugs act in the body. Pharmacodynamics, pharmacokinetics, molecular targets used by drugs, the interaction of a drug with a target, and the consequences of this interaction. Strategies used in discovering and designing new drugs, and surveys the "tools of the trade" involved, e.g., QSAR, combichem and computer aided design. Special topics like cholinergics, analgesics, opiates, antibacterials, antivirals, and anti-ulcer agents.

Why study Biotechnology at NJIT?

NJIT is uniquely situated among the greatest concentration of biotechnology and pharmaceutical activities in the world, with over 400 private and public biopharmaceutical companies thriving around the NJ Area. Opportunity is right outside our door. The mission of NJIT's professional Biotechnology option in the MS Pharmaceutical Chemistry program is to prepare scientists and engineers for dynamic careers in biopharmaceutical industry. The program
will focus on providing integrated coursework and training in current biotechnology industry practices. Our approach, relying on the input of our industrial advisory board, will ensure that our program will keep students up-to-date on the latest biotechnology industry changes and challenges and prepare them to work in this growing and exciting industry. NJIT’s professional Biotechnology program will provide a solid grounding in science and engineering, with an industry focus, facilitating the tailoring of coursework to meet individual career goals.

“This program complements NJIT’s programs in pharmaceutical chemistry and pharmaceutical engineering and was deliberately developed in partnership with biopharmaceutical companies to address unmet workforce needs,” said Kevin Belfield, dean of NJIT's College of Science and Liberal Arts. "We anticipate our graduates will be in high demand in the state's biopharmaceutical industry."

**Into what industries might holders of this program find employment?**

Bioprocessing and Biopharmaceutical companies, such as Celgene, Amicus Therapeutics, Chromocell, Soligenix, Vicus, Genzyme, Roka Biosciences and PTC Therapeutics.

**Prerequisites**

Applicants should have a bachelor’s degree in the chemical or biological sciences or engineering preferred.

**Related Degree Programs**

All courses in this program related entirely to the NJIT MS in Pharmaceutical Chemistry (https://chemistry.njit.edu/academics/graduate/pharmchem)

Faculty Advisor: Kevin Belfield (https://chemistry.njit.edu/faculty/belfield)