

BIOTECHNOLOGY



Excellence in Action

COLLEGE OF ARTS AND SCIENCES

Kent State University's Department of Biological Sciences and Department of Chemistry and Biochemistry offer an interdisciplinary program leading to the Bachelor of Science in biotechnology.

The science of biotechnology extends across many areas of biology and chemistry and provides cutting-edge technology tools for modern biology and biomedical research.

Biotechnology utilizes living cells and cellular materials to create pharmaceutical, diagnostic, agricultural, environmental and other products to benefit society.

Biotechnology is also used to study and to alter genetic information in animals so that human diseases can be modeled and studied.

GENERAL UNIVERSITY REQUIREMENTS

All students pursuing bachelor's degrees at Kent State complete a series of general education requirements (Kent Core). In addition to the coursework specific to their major (outlined below), students pursuing a Bachelor of Science degree in biotechnology take Kent Core courses in English composition, foreign language, humanities, fine arts and social sciences. The Kent Core is the foundation of the university's mission to prepare students to live in today's complex, diverse and global society.

BIOTECHNOLOGY DEGREE REQUIREMENTS

The biotechnology program is designed to provide a strong academic foundation in biological sciences and chemistry, training in the various biotechnologies and a solid understanding of their application in industry and biomedicine. The program places particular emphasis on practical training and includes laboratories in general chemistry, cell biology, microbiology, and biological chemistry, and molecular biology. The program includes a research experience at Kent State and/or an internship in a biotechnology company or research facility. In addition to the Kent Core requirements cited above, students take courses in the following areas:

YEAR I:

biological foundations, introduction to biotechnology, cell biology, general chemistry, calculus, probability and statistics;

YEAR II:

microbiology, genetics, organic chemistry, general physics, computer science and ethics;

YEAR III

molecular biology, analytical chemistry, biological chemistry, business, and bioethics;

YEAR IV:

case studies in biotechnology, seminar in biotechnology, advanced biological chemistry and biological chemistry laboratory, bioinformatics and specialized electives.

UNDERGRADUATE RESEARCH AND INTERNSHIP EXPERIENCE

A research experience is an important component of the interdisciplinary biotechnology degree program. Students have numerous opportunities to pursue research projects and gain experience working with state-of-the-art instrumentation under the guidance of members of the faculty. This experience is invaluable to the intellectual development of students and aids in their subsequent search for technical positions in industrial, medical or government research laboratories. Students also may gain firsthand experience of working in biotechnology through internships with local or national companies or nearby research facilities.

THE FACULTY

Most of the courses for this interdisciplinary degree program in biotechnology are taught by faculty from the Department of Biological Sciences and the Department of Chemistry and Biochemistry. Several of the faculty have been honored with teaching awards, including the Alumni Association's Distinguished Teaching Award and the College of Arts and Sciences Student Advisory Council Award for Outstanding Teaching.

Many of the faculty in biological sciences and chemistry employ biotechnological methods (i.e., cell culture, antibody technologies, recombinant DNA technologies, genetic engineering and protein engineering technologies) and/or are involved in the development of such methods as part of their research (e.g., specific biomolecule detection and biomolecule separation techniques).

Faculty research in the Department of Biological Sciences is focused in several areas including aquatic ecology, evolutionary biology,

CAREER OPPORTUNITIES

Students completing a Bachelor of Science degree in biotechnology may be employed in a variety of settings following completion of the degree or they may go on to the advanced study in a number of different disciplines. Biotechnology graduates may work in basic research and development exploring fundamental mechanisms and answering questions about biological systems. Others may work in an applied research setting in which researchers set out to solve specific problems in agriculture, environmental or medical fields. Others may work in biomanufacturing in which biological products are produced for human use, often in large-scale production facilities.

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microbiology, neurobiology and behavior, cell and molecular biology and reproductive physiology. Faculty and student researchers in the cell and molecular biology group conduct projects investigating cellular, molecular and genetic processes in a variety of model systems. Research interests include the genetic and cellular control of sperm and egg function, cancer, circadian rhythms, cardiac cell function, and cellular metabolism. Work is also focused on the role of microorganisms in mediating ecologically significant processes.

The Department of Chemistry and Biochemistry maintains active research programs on many frontiers of analytical, biological, inorganic, organic and physical chemistry and has particular strengths in materials (liquid crystals, surfaces, inorganic and porous materials) and in biological chemistry (bioinorganic chemistry, biological membranes, proteins and protein engineering, proteomics, and transcriptional and translational regulation). Some work, for example is focused on the synthetic chemistry of organic molecules that possess novel optical and electronic properties. Other work focuses on the structure and activity of anticancer drugs, antiviral agents, antibiotics and interferon inducers.

FACILITIES AND RESOURCES

Students of biotechnology have access to facilities and resources in the Department of Biological Sciences which is housed in Cunningham Hall and the Department of Chemistry and Biochemistry housed in Williams Hall. Cunningham Hall has a large lecture hall, two medium-size lecture rooms, numerous teaching and research laboratories, a greenhouse, a herbarium and a fully accredited animal facility. The Cunningham Hall Annex includes 19 state-of-the-art research and support laboratories, a cell and tissue culture facility, a microscopy and imaging facility, genomics core facility and other research facilities. The Department of Chemistry is housed in Williams Hall and is part of the connecting Science Research Laboratory. Williams Hall houses two large lecture halls, classrooms, undergraduate and research laboratories. In Williams Hall, students can explore complex biochemical and biological structures using the unique-to-Ohio 3D immersive classroom. The large lecture room is also outfitted with stereoscopic

projection for classroom instruction in 3D. Research resources available to faculty and students of biotechnology conducting research include comprehensive suites of equipment and core facilities for chemical analyses, genomics, proteomics, biological imaging and computer-intensive computational analyses.

CAREER OPPORTUNITIES

Biotechnology, in part, is an old science; it refers to the use of living organisms or the materials they make to benefit humans or the human environment in some way. Humans have long altered crops and bred animals to improve agricultural and farming methods. Modern biotechnology takes advantage of the revolution in our understanding of the genetics and molecular biology of cells and organisms. Today, biotechnology is a collection of newer technologies that include among many others: plant and animal cell culture, fermentation technology to produce a large amount of biological materials, and new genetic and protein engineering technologies to allow us to better understand or manipulate cells or biomolecules to produce, among other things, stem cells that might serve to replace malfunctioning human cells in the body or drugs to treat disease.

Millions of people worldwide have been helped by biotechnology-generated drugs and vaccines. Many more biotechnology drug products and vaccines are currently in clinical trials and thousands more are in early development in the United States. Gene and stem cell therapy is a promising new approach to treat disorders by replacing the damaged or missing genes or introducing new cells to replace malfunctioning cells. Biotechnology is employed in the development and production of diagnostic equipment and tests used to detect a variety of diseases and genetic conditions. Genomic and proteomic technologies are employed to discover genes, and to identify disease biomarkers and protein targets for drug development.

Biotechnology has revolutionized the pharmaceutical industry, and the same impact is expected in the industrial sector. Industrial biotechnology applies molecular biology and fermentation technologies to improve manufacturing processes, develop new biocatalysts and reduce the environmental impact of processes used by various industries.

Environmental biotechnology employs microorganisms for a variety of applications in hazardous waste treatment, bioremediation and pollution prevention. DNA fingerprinting has improved criminal investigation and forensic science.

The prospects for employment in the biotechnology industry continue to be very good. According to the United States Department of Labor Bureau of Labor Statistics, biotechnological research and development should continue to drive much faster than average employment growth. Biotechnology graduates will find employment in commercial research and development laboratories in biotechnology, pharmaceutical industries or in hospital, university and government research laboratories.

Biotechnology

Interdisciplinary program of the College of Arts and Sciences offered by the Department of Biological Sciences and the Department of Chemistry and Biochemistry

Please visit the website for more information on the major and contact information for the program director.

www.kent.edu/cas/biotechnology

Admissions Office

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For information on all of Kent State's degrees and majors, go online to www.kent.edu/gps.