



YOUR CAREER IN
Biotechnology



What is Biotechnology?

Biotechnology is the use of cellular and biomolecular processes to solve problems or make useful products. It is a collection of technologies that capitalize on the attributes of cells, such as their manufacturing capabilities, and put biological molecules like DNA and proteins to work for us.

What exactly does that mean?

Essentially, biotechnology is science in action. The latest life-saving cancer and infectious disease treatments? Yes, that's biotechnology. Safe practices to protect and increase crop yields while reducing environmental impact? That's biotechnology, too. It also covers ongoing advancements in products people use every day, including research with smart contact lenses, speech restoration devices, absorbable stents, enhanced prosthetics and many other devices and products that will **improve our quality of life**.

While we might imagine scientists wearing lab coats, analyzing solutions, and testing hypotheses — which certainly has its place in the industry — there is much, much more. Scientists also foster creativity and drive innovation through management and leadership positions within industry.

As you browse this book, you'll learn about the limitless educational and career pathways in our region that open the door to opportunity in this growing industry. You'll also understand why the Greater Kansas City region is turning heads as a global leader in many biotechnology fields such as human health, animal health, food science, innovation and production.

***Biotechnology is
science in action***



Biotechnology AroundTheWorld

The global biotechnology market size has been valued at more than \$270 billion and is expected to **grow at over a 10 percent rate** due to the increasing demand for diagnostics and therapeutic solutions such as recombinant technology and DNA sequencing.

More than 23,000 biotechnology companies are spread throughout 29 countries. The US, Spain, France, Korea, Germany, UK, Japan, and Mexico account for 76 percent of the total companies. The Americas and European region hold the biggest share in the global biotechnology industry.

// We specifically designed our program to address the skills demands of the KC area biotech industries. Our graduates will be highly qualified, employment-ready scientists well suited to serve the biotech industries. //

– Dr. Randy Logan, Director of Biotechnology
Program at the University of Kansas



23,000


BIOTECHNOLOGY COMPANIES


370


PRODUCTS &
VACCINES IN TESTING


29

COUNTRIES

 There are more than 370 biotech drug products and vaccines currently in clinical trials targeting more than 200 diseases, including various cancers, Alzheimer's disease, heart disease, diabetes, multiple sclerosis, AIDS and arthritis.

 Biotechnology offers a means of improving food security and reducing pressures on the environment. Genetically modified crop varieties, which are resistant to drought, soil acidity, salinity and extreme temperatures, help improve sustainable farming and enhance food production. These measures will help ensure the world's growing population has a secure food supply.

 Industrial biotechnology applications have led to cleaner processes that produce less waste and use less energy and water in such industrial sectors as chemicals, pulp and paper, textiles, food, energy, metals and minerals.

 DNA fingerprinting — a biotech process — has dramatically improved criminal investigation and forensic medicine. These techniques have also produced significant advances in anthropology and wildlife management.



Biotechnology in The United States

More than **1.3 million Americans** work in biotechnology research and development areas. Fueled by innovation, biotechnology drives a perpetual cycle of financial investment and demand for highly skilled labor.



The nation's biotechnology industry is growing at roughly **12 percent** each year.



The U.S. Federal Reserve and other sources estimate the industry will make up **15 to 18 percent** of our economy within the next 20 years.

The U.S. biotechnology industry includes large multinational corporations, small entrepreneurial firms, public and private research entities, dedicated biotechnology investment companies and academia. In the United States, more than 1,900 firms generated revenue nearing \$100 billion while delivering biotechnologies that heal, feed and fuel our society.

The medical biotechnology industry in the United States produces biologic drugs, vaccines, diagnostics, and other products. It focuses research and development efforts on treatments for cancers, infectious diseases, autoimmune conditions and certain diseases where no effective treatments exist.

1,900 BIOTECHNOLOGY FIRMS
generated revenue nearing

\$100 BILLION

while delivering biotechnologies that...



370+

BIOTECHNOLOGY

health care products
and vaccines available

13 MILLION +

FARMERS USE AGRICULTURAL BIOTECHNOLOGY

to protect crops and increase yields while
reducing environment impact

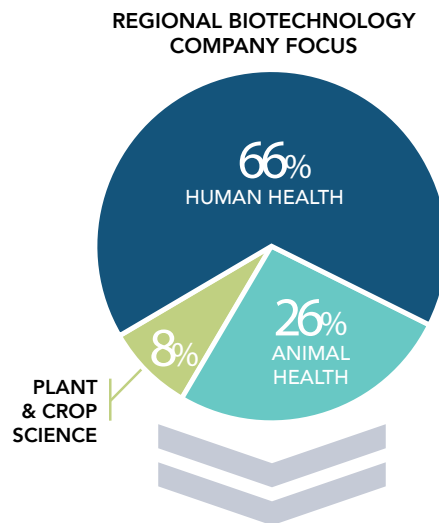


Biotechnology in THE REGION

Greater Kansas City is emerging as a world-class center of science, with research centers, animal health corridor, clinical trials hub and growing investment in the sciences. The science industry will continue to grow in this area and bring new and exciting opportunities to the Midwest.

There are 249 life science companies in 26 counties extending from Columbia, Missouri, through Kansas City and to Manhattan, Kansas. They conservatively employ between 28,000 and 30,000 people representing an increase of over 20 percent for the region since 2012.

In this region, 66% of the industry focuses on human health, 26% of companies specialize in animal health, and plant and crop science-based organizations account for 8% of the total.



58% OF ALL COMPANIES
IN THE REGION

Pharmaceuticals and biotechnology research and testing in the focus areas listed to the left account for 58% percent of companies in the region.

// Biotechnology harnesses the powers of chemistry, biology, microbiology, physics and many other disciplines to help solve everything from human illness to global warming. Biotechnology, along with perseverance, will overcome many challenges that humanity faces now and in the future. **//**

– Danny Unruh, graduate research assistant
in food science, Kansas State University Olathe

According to the 2015 Kansas City Regional Life Sciences Industry Census, the top ten largest companies in the region comprise more than 60 percent of the total employment in the Life Science Sectors: Bayer Animal Health, Bayer CropScience LP, Boehringer Ingelheim Vetmedica Inc., Cerner Corporation, Ceva Animal Health, Hill's Pet Nutrition, Inc., PRA International, Propharma Group Inc., Quest Diagnostics Inc., and Quintiles.

The KCALSI census also shows that the future looks bright for employment growth in the life sciences. More than 90 percent of companies surveyed indicated plans to add at least one employee over the next 36 months, and none projected staffing cuts. Twenty companies indicated they would be hiring more than 100 new employees.



- ▶ Local talent is in high demand: Nearly three-quarters of companies surveyed indicated they are finding qualified talent locally without a need to recruit from outside the region.
- ▶ Regionally, bioscience strengths represent a number of niches within biomedical research, drug development and manufacturing, biological materials, medical supplies and equipment, animal health, plant biotechnology, biomaterials and homeland security.
- ▶ The Kansas City metropolitan area's commitment to the biosciences has brought national attention to the midwest. The Stowers Institute for Medical Research in Kansas City, Mo., is a strong attractor for world-class scholars. And, the National Bio and Agro-defense Facility, or NBAF, is the U.S. Department of Homeland Security's foremost animal disease research facility located at Kansas State University.

Education & Training

Early Career Exploration

Ask students in grade school, “What do you want to be when you grow up?” and you’ll get a list limited only by their imaginations. Over time, the list narrows, as they are influenced by careers encountered through family, friends, school and the media.

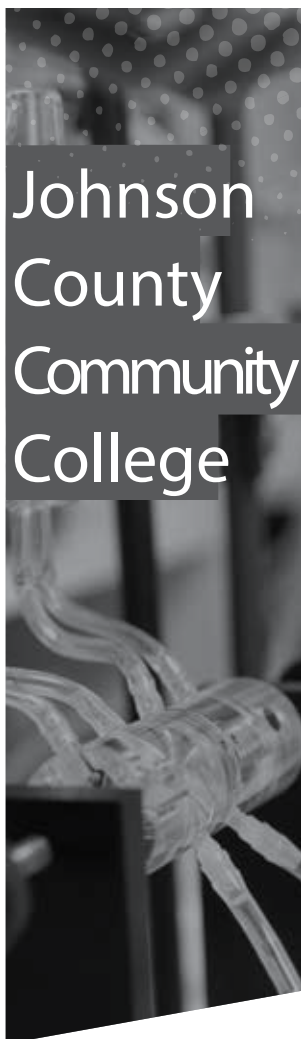
To expand their knowledge of STEM-related professions (Science, Technology, Engineering, and Math), area universities offer a range of opportunities to expose children in kindergarten through high school to careers outside of their life experiences. These include field trips, classroom speakers, lab experiences, internships and college credit courses for high school students to help pave their pathways into biotechnology careers.

Educational Opportunities

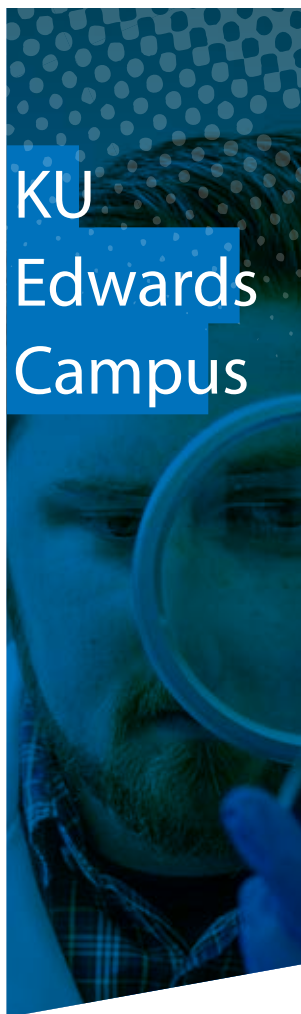
Biotechnology is a field undergoing tremendous growth, and the demand for jobs — and qualified, experienced professionals to fill those jobs — is at an all-time high. Graduates need the right educational training and experiences to land these jobs and be highly successful.

Fortunately, institutions in our region have that covered. There are a variety of degrees, certificates and other academic options at Kansas schools designed to prepare students for a future in biotechnology. Here’s a glimpse at some of the educational leaders in the Greater Kansas City Area.

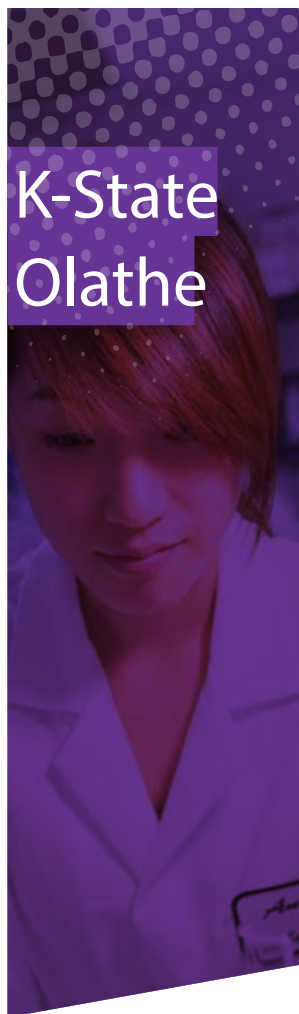




Johnson
County
Community
College



KU
Edwards
Campus



K-State
Olathe



KU
Clinical
Research
Center



JOHNSON COUNTY
EDUCATION RESEARCH
TRIANGLE

In November 2008, Kansas voters in Johnson County invested in the county's future by voting for a one-eighth cent sales tax to fund Triangle initiatives. Those initiatives include the development of the National Food and Animal Health Institute at K-State Olathe, the KU Clinical Research Center in Fairway, Kan., and the Business, Engineering, Science and Technology Building at KU Edwards Campus and 10 new degree programs, including a bachelor's in biotechnology.



SUMMARIZING RESEARCH FINDINGS
ORGANIZING DATA
 EXPLAINING
 INTERPERSONAL SKILLS
 OPERATING SCIENTIFIC EQUIPMENT
COMPUTER SKILLS
 CALCULATION
PROBLEM SOLVING
 TEAMWORK
 TESTING IDEAS
 INFORMING
 MARKETING
 PERCEPTION OF STRUCTURES
 DEFINING GRAPHS TESTING HYPOTHESIS
DATA PROCESSING
 DATA ANALYSIS
 SAMPLING SURVEYS
 DEFINING CHARTS STATISTICAL AWARENESS UTILIZING FORMULAS
COMMUNICATION
 GATHERING INFORMATION
 APPLYING CONCEPTS
CRITICAL THINKING
 PRESENTING RESEARCH FINDINGS
 WORKING INDEPENDENTLY
MANAGEMENT
 REVIEWING RELEVANT DATA
 PERCEPTION OF PATTERNS
 LEADERSHIP
 TECHNICAL SKILLS
 REPORTING DATA



Careers in Biotechnology

This industry is so important to our society and we often don't even realize it. Breakthroughs in health care and biosciences research are achieved right here in the Kansas City region and are positively impacting the United States and beyond.

This dynamic field offers a wealth of career opportunities ranging from research and development, to drug testing, to manufacturing and management, to sales and marketing, and quality control and assurance. Though options are limitless in this industry, all aspects of biotechnology are woven into these focus areas.

The Career Pathway Diagrams on the following pages provide an overview of potential career options.

// Our industry, like many others, is experiencing a significant demand for highly-skilled individuals who can support the ever-evolving biotechnology needs of the animal health business. We need to cultivate the next generation of professionals committed to science, innovation and improving the lives of both animals and humans. **//**

– Scott Bormann, vice president,
North America Commercial
Operations, Merck Animal Health

CAREER PATHWAYS: MANUFACTURING

Manufacturing involves the scale up and production of research compounds to make clinical grade commercial pharmaceuticals for use in clinical trials and in the general market.

Masters Degree:

Chemistry, Biology,
or related field

DIRECTOR OF MANUFACTURING

Bachelors Degree:

Chemistry, Biochemistry,
Biology, Microbiology,
Clinical Laboratory, or
related field

PROCESS ENGINEER

QUALITY ASSURANCE SPECIALIST

QUALITY CONTROL TECHNICIAN

BIOREACTOR OPERATOR

Associates Degree or On-the-job Training:

Biology, Chemistry,
Biotechnology

MANUFACTURING TECHNICIAN

CELL CULTURE TECHNICIAN

INSTRUMENT/CALIBRATION TECHNICIAN

CAREER PATHWAYS: QUALITY CONTROL

Quality control is an important area for biotech companies. Quality control testing helps ensure the identity, purity, potency and activity of products for the company. In other words, employees in quality control constantly make sure products are performing as expected, and adhere to the quality level expected throughout all steps in the production process.

Masters Degree:

Chemistry, Biology, or related field

DIRECTOR OF QUALITY

QUALITY CONTROL MANAGER

QUALITY ASSURANCE MANAGER

QUALITY CONTROL SUPERVISOR

QUALITY ASSURANCE SUPERVISOR

Bachelors Degree:

Chemistry, Biochemistry, Biology, Microbiology, Clinical Laboratory, or related field

QUALITY ASSURANCE SPECIALIST

MICROBIOLOGIST

QUALITY CONTROL ANALYST

Associates Degree or On-the-job Training:

Biology, Chemistry, Biotechnology

QUALITY ASSURANCE TECHNICIAN

LABORATORY ASSISTANT

QUALITY CONTROL TECHNICIAN

QUALITY CONTROL INSPECTOR

VALIDATION TECHNICIAN

KENNEL ATTENDANT

CAREER PATHWAYS: RESEARCH AND DEVELOPMENT

This area is where new ideas are developed and tested. This can include basic initial research, drug discovery and pre-clinical testing to see which products may be viable and consumable. This process is vital, but it can also be costly and time-consuming. According to PhRMA, the Pharmaceutical Research and Manufacturers of America, the average cost to research and develop each successful drug is more than \$2 billion.

Doctoral Degree:

VICE PRESIDENT OF RESEARCH & DEVELOPMENT

Masters Degree:

Chemistry, Biology, or related field

MEDICINAL CHEMIST

PHARMACOKINETIST

IMMUNOLOGIST

TOXICOLOGIST

Bachelors Degree:

Chemistry, Biochemistry, Biology, Microbiology, Clinical Laboratory, or related field

BIOCHEMIST

BIOLOGIST

CHEMIST

MICROBIOLOGIST

BIOSTATISTICIAN

BIOTECHNOLOGIST

Associates Degree or On-the-job Training:

Biology, Chemistry, Biotechnology

INSTRUMENT TECHNICIAN

ANIMAL HUSBANDRY TECHNICIAN

LABORATORY TECHNICIAN

CAREER PATHWAYS: CLINICAL

Clinical trials are experiments done in clinical research, designed to answer specific questions about the safety and efficacy of pharmaceutical interventions or treatments. This is the last step before FDA approval to wide scale adoption by the general market.

Doctoral Degree:

VICE PRESIDENT OF RESEARCH & DEVELOPMENT

Masters Degree:

Chemistry, Biology, or related field

BIostatistician

Toxicologist

Bachelors Degree:

Chemistry, Biochemistry, Biology, Microbiology, Nursing, Clinical Laboratory, or related field

CLINICAL DATA MANAGER

CLINICAL RESEARCH ASSOCIATE

MEDICAL WRITER

TECHNICAL WRITER

MICROBIOLOGIST

REGULATORY AFFAIRS SPECIALIST

Associates Degree or On-the-job Training:

Biology, Chemistry, Biotechnology

CLINICAL RESEARCH ASSOCIATE

CLINICAL DATA COORDINATOR

CLINICAL RESEARCH ADMINISTRATOR

RECRUITMENT SPECIALIST

CAREER PATHWAYS:
DIAGNOSTIC / TESTING

Biomedical diagnostics is the study of procedures that provide information to aid the screening, detection, diagnosis and monitoring of disease.

Doctoral Degree:

VICE PRESIDENT

DIRECTOR

Masters Degree:

Chemistry, Biology, or related field

LABORATORY MANAGER

LABORATORY SUPERVISOR

TOXICOLOGIST

Bachelors Degree:

Chemistry, Biochemistry, Biology, Microbiology, Clinical Laboratory, or related field

FORENSIC SCIENCE TECHNICIAN

MEDICAL TECHNOLOGIST/
CLINICAL LABORATORY SCIENTIST

HISTOTECHNICIAN

CYTOTECHNOLOGIST

MICROBIOLOGIST

TOXICOLOGIST

PATHOLOGIST

Associates Degree or On-the-job Training:

Biology, Chemistry, Biotechnology

MEDICAL LABORATORY ASSISTANT

PHLEBOTOMIST

The Intersection of Biology and Information Technology

As new technologies have emerged in biomedical research during the past 20 years, the amount of data generated also has greatly increased. In fact, so much data is being generated that sufficient access to computational processing is often one of the largest hurdles in completing projects. With that in mind, occupations related to big data and data management, including bioinformatics, medical informatics, health information technology and high-performance computing, are in high demand.

Another key intersection between biology and IT is health care software and application development. With mobile technology available at our fingertips and an increasing desire to track, evaluate and share health and medical information, career opportunities in this area are abundant as well. The Kansas City region is teeming with entrepreneurs and start-up companies engaged in health care app development, and with the appropriate training, certification or degree program, professionals in these areas can increase their hiring potential and watch their career potential exponentially expand.



Get started in Biotech today!

Johnson County Community College

12345 College Blvd.
Overland Park, KS 66210

913-469-8500

jccc.edu

University of Kansas Edwards Campus

12600 Quivira Road
Overland Park, KS 66213

913-897-8400

edwardsinfo@ku.edu

edwards.ku.edu/biotechnology

Kansas State University-Olathe

22201 W. Innovation Dr.
Olathe, KS 66061

913-541-1220

olatheinfo@k-state.edu

olathe.k-state.edu

Kansas City Area Life Sciences Institute

30 West Pershing Road, Suite 210
Kansas City, Missouri 64108

816-753-7700

kclifesciences.org

Johnson County Education Research Triangle

jocotriangle.com