

## INTRODUCTION

Biotechnology touches many aspects of our lives—in some cases, in largely unseen ways. Its chief applications are in health care, agriculture, industrial uses of biological byproducts (such as biofuels), and the environment. As a result, everything from the food we eat to the medicine we take is touched in some way by biotechnology. The list of careers that are related to biotechnology is long, including everything from Agricultural and Food Scientists to Computer Programmers and Top Executives. Our goal with this edition is not to be all-encompassing, but rather to pinpoint key careers in this fascinating and influential field.

In medicine, pharmaceutical drugs and genetic testing are just two examples of how biotechnology is used. Agriculturally, genetically modified crops are a prime example—widely adopted by farmers in order to reduce pests and diseases, reduce spoilage, and increase nutrients, among other benefits. In industry, biotechnology is prominently used to create products in sectors such as chemicals, food and feed, paper and pulp, textiles, and biofuels. In terms of the environment, bioremediation (using biological material to remove environmental pollutants) is one of the most well-known processes.

Despite the advances that biotechnology offers in all of these sectors, there are concerns that tampering with biological processes, such as the creation of genetically modified organisms (GMOs), may lead to adverse reactions in humans and the environment itself. This is where oversight, such as health and safety and quality control inspectors, come into play, and provide vital checks and balances to this constantly involving industry.

Finding the path that's right for you means thinking about your own interests, skills, and talents. Important skills for working in biotechnology include analytical, communication, creativity, critical-thinking, data-analysis, mechanical, math, problem-solving, and technical skills, not to mention a passion for technology and cutting-edge breakthroughs.

It's also worth considering how much money you want to make. A position that requires a four-year degree will earn you more money than one requiring a two-year degree, or one requiring no post-secondary education at all. The profiles in this volume include education requirements and typical earnings. Remember, however, that how much money you make is not the entire story. Benefits, job security, where you work, and self-fulfillment are important factors as well.

The “Conversations With...” spread throughout this volume show the variety of career paths available involving biotechnology, how to achieve them, and what to expect when you get there. They are interviews with real individuals working in the field at real jobs.

The list of jobs contained in this volume is not exhaustive, and should be viewed as an entry point into a world with numerous branches and sub-disciplines, many of which can intersect in novel ways. The aim is to provide readers—especially students embarking on their lifelong careers—with accurate and detailed examples of some the many possibilities available in this field, which is so integral to modern human life.

# Agricultural/Food Science Technician

## Snapshot

**Career Cluster(s):** Agriculture, Food & Natural Resources; Science, Technology, Engineering & Mathematics

**Interests:** Agriculture; Animals; Food

**Earnings (Yearly Average):** \$44,700

**Employment & Outlook:** Faster Than Average Growth Expected

## OVERVIEW

### Sphere of Work

Agricultural and food science technicians assist agricultural and food scientists by performing duties such as measuring and analyzing the quality of food and agricultural products, as well as maintaining the health and wellness of livestock. Duties range from performing agricultural labor with added recordkeeping duties to laboratory testing with significant amounts of office work, depending on the field the technician works. Technicians may be involved in the application of biotechnology, such as working on projects related to genetic engineering.

### Work Environment

Agricultural and food science technicians primarily work in offices and laboratories, but may also work in greenhouses, processing plants, and



Photo via iStock/AlexRaths. [Used under license.]

on farms or ranches. In non-office settings, they may be required to be physically active for long periods.

### **Occupation Interest**

Agricultural and food science technicians have a passion for both science and nature. They want to ensure that crops and livestock remain vibrant and healthy, for the benefit of the environment and for human

### **Duties and Responsibilities**

#### **Agricultural Science Technician**

- Following protocols to collect, prepare, analyze, and safely store crop or animal samples
- Operating farm equipment and maintaining agricultural production areas to conform to scientific testing parameters
- Examining animal and crop specimens to determine the presence of diseases or other problems
- Measuring ingredients used in animal feed and other inputs
- Preparing and operating laboratory testing equipment
- Compiling and analyzing test results
- Preparing charts, presentations, and reports describing test results

#### **Food Science Technician**

- Collecting and preparing samples in accordance with established procedures
- Testing food, food additives, and food containers to ensure that they comply with established safety standards
- Helping food scientists with food research, development, and quality control
- Analyzing chemical properties of food to determine ingredients and formulas
- Compiling and analyzing test results
- Preparing charts, presentations, and reports describing test results
- Preparing and maintaining quantities of chemicals needed to perform laboratory tests
- Maintaining a safe, sterile laboratory environment

### **Profile**

**Working Conditions:** Both Inside & Outside

**Physical Strength:** Moderate Work

**Education Needs:** Associate Degree; Bachelor's Degree

**Licensure/Certification:** Not Required

**Opportunities for Experience:** Internship

**Interest Score:** RIC

quality of life. They may have an added interest in new technologies within the field, such as the latest developments in biotechnology and how they can aid agriculture and food science—genetically modified crops being one prime example.

### **A Day in the Life—Duties and Responsibilities**

Agricultural and food science technicians often specialize by subject area, which includes animal health, farm machinery, fertilizers, agricultural chemicals, or processing technology. Duties can vary considerably by specialization, and many duties are influenced by biological science.

Agricultural science technicians typically study ways to increase the productivity of crops and animals. These workers may keep detailed records, collect samples for analyses, ensure that samples meet proper safety and quality standards, and test crops and animals for disease or to confirm the results of scientific experiments.

Food science technicians who work in manufacturing investigate new production or processing techniques. They also ensure

# Biological Technician

## Snapshot

**Career Cluster(s):** Health Science; Science, Technology, Engineering & Mathematics

**Interests:** Biology; Science; Human Health; Animal Health

**Earnings (Yearly Average):** \$48,140

**Employment & Outlook:** Faster Than Average Growth Expected

## OVERVIEW

### Sphere of Work

Biological technicians help biological and medical scientists conduct laboratory tests and experiments, working in many research areas, including biotechnology. They may assist medical researchers by administering new medicines and treatments to laboratory animals. They may also separate proteins from other cell material and analyze data from an experiment.

Biological technicians working in a microbiological context typically study living microbes and perform techniques specific to microbiology, such as staining specimens to aid identification.

### Work Environment

Biological technicians usually work in laboratories and offices, conducting experiments and analyzing the results under the supervision of senior scientists. They may also perform field work, collecting samples in the wild, in a variety of environmental conditions.



Photo via iStock/shironosov. [Used under license.]

### Occupation Interest

Biological technicians have a keen interest in science, and particularly living systems—human, plant, and animal. They have a desire to advance human knowledge about the way organic matter functions and may be interested in a long-term career in biology or related sciences, including advancement to higher positions within the field. They may also have a specialized interest in applying biological research to new biotechnology products and processes.

### Profile

**Working Conditions:** Inside

**Education Needs:** Bachelor's Degree

**Licensure/Certification:** Not Required

**Opportunities for Experience:** Internship;  
Laboratory Work

**Interest Score:** RIC

### A Day in the Life—Duties and Responsibilities

Biological technicians, sometimes called laboratory assistants, typically are responsible for doing scientific tests, experiments, and analyses under the supervision of biologists (such as microbiologists) or medical scientists who direct and evaluate their work. Biological technicians use traditional laboratory instruments, advanced robotics, and automated equipment to conduct experiments. They use specialized computer software to collect, analyze, and model experimental data. Some biological technicians, such as those who assist the work of zoologists and wildlife biologists, may collect samples in the field, so they may need the ability to hike rugged terrain or otherwise travel through wilderness areas.

### Duties and Responsibilities

- Setting up, maintaining, and cleaning laboratory instruments and equipment, such as microscopes, scales, pipets, and test tubes
- Gathering and preparing biological samples, such as blood, food, and bacteria cultures, for laboratory analysis
- Conducting biological tests and experiments
- Documenting work, including procedures, observations, and results
- Analyzing experimental data and interpreting results
- Writing reports that summarize findings

## WORK ENVIRONMENT

### Immediate Physical Environment

Biological technicians typically work in laboratories and offices, where they conduct experiments and analyze the results under the supervision of biological scientists and medical scientists. Some biological technicians who do fieldwork may be exposed to weather events and wildlife, such as mosquitoes. They may also work in private industry and assist in the study of a wide range of topics concerning industrial production. They may test samples in environmental im-

# Environmental Science/Protection Technician

## Snapshot

**Career Cluster(s):** Agriculture, Food & Natural Resources;  
Manufacturing; Science, Technology, Engineering & Mathematics;  
Transportation, Distribution & Logistics

**Interests:** Science; Environmental Issues

**Earnings (Yearly Average):** \$47,370

**Employment & Outlook:** As Fast As Average Growth Expected

## OVERVIEW

### Sphere of Work

Environmental science and protection technicians monitor the environment and investigate sources of pollution and contamination, including those affecting public and animal health. They must rely on their knowledge of the natural sciences, including biology, in order to identify the effects of pollution and trace the potential sources.

### Work Environment

Environmental science and protection technicians typically work in laboratories and offices and conduct fieldwork.



Photo via iStock/Chatchawal. [Used under license.]

# Mechanical Engineering Technologist/Technician

## Snapshot

**Career Cluster(s):** Architecture & Construction; Science, Technology, Engineering & Mathematics

**Interests:** Science; Mechanics; Design; Technology

**Earnings (Yearly Average):** \$60,460

**Employment & Outlook:** Slower Than Average Growth Expected

## OVERVIEW

### Sphere of Work

Mechanical engineering technicians and technologists help mechanical engineers design, develop, test, and manufacture tools, engines, machines, and other devices. They may make sketches and rough layouts, record and analyze data, and report their findings. Mechanical engineering technicians also help mechanical engineers manufacture industrial machinery and other equipment. Since mechanical engineering is one of the broadest engineering fields, technicians and technologists have the opportunity to work in a wide variety of areas, including biotechnology.

### Work Environment

Majority of mechanical engineering technicians work in factories or research and development (R&D) laboratories. Throughout the day, they will be participating in many tests of project



Photo via iStock/kzenon. [Used under license.]

## LIST OF ORGANIZATIONS AND RESOURCES

### **Academic Data Science Alliance**

www.academicdatascience.org

### **Accreditation Board for Engineering and Technology, Inc. (ABET)**

415 N. Charles Street  
Baltimore, MD 21201  
410.347.7700  
comms@abet.org  
www.abet.org

### **Accreditation Council for Pharmacy Education**

190 S. LaSalle Street, Suite 3000  
Chicago, IL 60603  
312.664.3575  
info@acpe-accredit.org  
www.acpe-accredit.org

### **Alliance for Data Science Professionals**

info@afdsp.co.uk  
www.alliancefordatascienceprofessionals.com

### **American Academy of Environmental Engineers and Scientists (AAEES)**

147 Old Solomons Island Road, Suite 303  
Annapolis, MD 21401  
410.266.3311  
info@aaees.org  
www.aaees.org

### **American Academy of Forensic Sciences (AAFS)**

410 North 21st Street  
Colorado Springs, CO 80904  
719.636.1100  
info@aafs.org  
www.aafs.org

### **American Association of Bioanalysts (AAB)**

906 Olive Street, Suite 1200  
Saint Louis, MO 63101  
314.241.1445  
www.aab.org

### **American Association of Colleges of Pharmacy**

1400 Crystal Drive, Suite 300  
Arlington, VA 22202  
703.739.2330  
mail@aacp.org  
www.aacp.org

### **American Association of Engineering Societies (AAES)**

1801 Alexander Bell Drive  
Reston, VA 20191  
202.296.2237  
orders@aaes.org  
www.aaes.org

### **American Board of Criminalistics**

P.O. Box 1358  
Palmetto, FL 34220  
941.729.9050  
acbcregistrar@criminalistics.com  
www.criminalistics.com

### **American Board of Industrial Hygiene (ABIH)**

6005 W. St. Joseph Highway, Suite 300  
Lansing, MI 48917  
517.321.2638  
www.abih.org

### **American Board of Medicolegal Death Investigators (ABMDI)**

10104 Senate Drive, Suite 241  
Lanham, MD 20706  
410.807.3007  
info@abmdi.org  
www.abmdi.org

### **The American Ceramic Society (ACerS)**

550 Polaris Parkway, Suite 510  
Westerville, OH 43082  
866.721.3322  
ceramics.org

### **American Chemical Society (ACS)**

1155 Sixteenth Street NW  
Washington, DC 20036  
800.227.5558  
www.acs.org

### **American Chemistry Council (ACC)**

700 Second Street NE  
Washington, DC 20002  
202.249.7000  
www.americanchemistry.com