

Science Technicians

(O*NET 19-4011.01, 19-4011.02, 19-4021.00, 19-4031.00, 19-4041.01, 19-4041.02, 19-4051.01, 19-4051.02, 19-4091.00, 19-4092.00, 19-4093.00)

Significant Points

- Science technicians in production jobs often work in 8-hour shifts around the clock.
- Job opportunities are expected to be best for qualified graduates of science technician training programs or applied science technology programs.

Nature of the Work

Science technicians use the principles and theories of science and mathematics to solve problems in research and development and to help invent and improve products and processes. However, their jobs are more practically oriented than those of scientists. Technicians set up, operate, and maintain laboratory instruments, monitor experiments, make observations, calculate and record results, and often develop conclusions. They must keep detailed logs of all their work-related activities. Those who work in production monitor manufacturing processes and may be involved in ensuring quality by testing products for proper proportions of ingredients, purity, or for strength and durability.

As laboratory instrumentation and procedures have become more complex in recent years, the role of science technicians in research and development has expanded. In addition to performing routine tasks, many technicians also develop and adapt laboratory procedures to achieve the best results, interpret data, and devise solutions to problems, under the direction of scientists. Moreover, technicians must master the laboratory equipment so that they can adjust settings when necessary and recognize when equipment is malfunctioning.

The increasing use of robotics to perform many routine tasks has freed technicians to operate more sophisticated laboratory equipment. Science technicians make extensive use of computers, computer-interfaced equipment, robotics, and high-technology industrial applications, such as biological engineering.

Most science technicians specialize, learning skills and working in the same disciplines as scientists. Occupational titles, therefore, tend to follow the same structure as scientists. *Agricultural technicians* work with agricultural scientists in food, fiber, and animal research, production, and processing. Some conduct tests and experiments to improve the yield and quality of crops or to increase the resistance of plants and animals to disease, insects, or other hazards. Other agricultural technicians do animal breeding and nutrition work. *Food science technicians* assist food scientists and technologists in research and development, production technology, and quality control. For example, food science technicians may conduct tests on food additives and preservatives to ensure FDA compliance on factors such as color, texture, and nutrients. They analyze, record, and compile test results; order supplies to maintain laboratory inventory; and clean and sterilize laboratory equipment.

Biological technicians work with biologists studying living organisms. Many assist scientists who conduct medical research—helping to find a cure for cancer or AIDS, for example. Those who work in pharmaceutical companies help develop and manufacture medicinal and pharmaceutical preparations. Those working in the

field of microbiology generally work as lab assistants, studying living organisms and infectious agents. Biological technicians also analyze organic substances, such as blood, food, and drugs, and some examine evidence in criminal investigations. Biological technicians working in biotechnology labs use the knowledge and techniques gained from basic research by scientists, including gene splicing and recombinant DNA, and apply these techniques in product development.

Chemical technicians work with chemists and chemical engineers, developing and using chemicals and related products and equipment. Most do research and development, testing, or other laboratory work. For example, they might test packaging for design, integrity of materials, and environmental acceptability; assemble and operate new equipment to develop new products; monitor product quality; or develop new production techniques. Some chemical technicians collect and analyze samples of air and water to monitor pollution levels. Those who focus on basic research might produce compounds through complex organic synthesis. Chemical technicians within chemical plants are also referred to as *process technicians*. They may operate equipment, monitor plant processes and analyze plant materials.

Environmental science and protection technicians perform laboratory and field tests to monitor environmental resources and determine the contaminants and sources of pollution. They may collect samples for testing or be involved in abating, controlling, or remediating sources of environmental pollutants. Some are responsible for waste management operations, control and management of hazardous materials inventory, or general activities involving regulatory compliance. There is a growing emphasis on pollution prevention activities.

Forensic science technicians investigate crimes by collecting and analyzing physical evidence. Often, they specialize in areas such as DNA analysis or firearm examination, performing tests on weapons or substances, such as fiber, hair, tissue, or body fluids to determine significance to the investigation. They also prepare reports to document their findings and the laboratory techniques used. When criminal cases come to trial, forensic science technicians often provide testimony, as expert witnesses, on specific laboratory findings by identifying and classifying substances, materials, and other evidence collected at the crime scene.

Forest and conservation technicians compile data on the size, content, and condition of forest land tracts. These workers travel through sections of forest to gather basic information, such as species and population of trees, disease and insect damage, tree seedling mortality, and conditions that may cause fire danger. Forest and conservation technicians also train and lead forest and conservation workers in seasonal activities, such as planting tree seedlings, putting out forest fires, and maintaining recreational facilities.

Geological and petroleum technicians measure and record physical and geologic conditions in oil or gas wells, using instruments lowered into wells or by analysis of the mud from wells. In oil and gas exploration, these technicians collect and examine geological data or test geological samples to determine petroleum and mineral content. Some petroleum technicians, called *scouts*, collect information about oil and gas well drilling operations, geological and geophysical prospecting, and land or lease contracts.

Nuclear technicians operate nuclear test and research equipment, monitor radiation, and assist nuclear engineers and physicists



Environmental science technicians perform laboratory tests to determine the presence or absence of various contaminants.

in research. Some also operate remote control equipment to manipulate radioactive materials or materials to be exposed to radioactivity.

Other science technicians collect weather information or assist oceanographers.

Working Conditions

Science technicians work under a wide variety of conditions. Most work indoors, usually in laboratories, and have regular hours. Some occasionally work irregular hours to monitor experiments that can not be completed during regular working hours. Production technicians often work in 8-hour shifts around the clock. Others, such as agricultural, forest and conservation, geological and petroleum, and environmental science and protection technicians, perform much of their work outdoors, sometimes in remote locations.

Some science technicians may be exposed to hazards from equipment, chemicals, or toxic materials. Chemical technicians sometimes work with toxic chemicals or radioactive isotopes, nuclear technicians may be exposed to radiation, and biological technicians sometimes work with disease-causing organisms or radioactive agents. Forensic science technicians often are exposed to human body fluids and firearms. However, these working conditions pose little risk, if proper safety procedures are followed. For forensic science technicians, collecting evidence from crime scenes can be distressing and unpleasant

Employment

Science technicians held about 198,000 jobs in 2000. Employment was distributed as follows:

Chemical technicians	73,000
Biological technicians	41,000
Environmental science and protection technicians, including health	27,000
Forest and conservation technicians	18,000
Agricultural and food science technicians	18,000
Geological and petroleum technicians	10,000
Forensic science technicians	6,400
Nuclear technicians	3,300

Chemical technicians held jobs in a wide range of manufacturing and service industries, but were concentrated in chemical

manufacturing, where they held over 30,000 jobs. A significant number, 12,000, worked in research and testing firms. About 45 percent of biological technicians also worked in research and testing firms. Most of the rest of biological technicians worked in drug manufacturing or for Federal, State, or local governments. Significant numbers of environmental science and protection technicians also worked for State and local governments and research and testing services. Others worked for engineering and architectural services and management and public relations firms. Nearly 68 percent of forest and conservation technicians held jobs in Federal Government; another 22 percent worked for State governments. More than 30 percent of agricultural and food science technicians worked for food processing companies; the rest worked for research and testing firms, State governments, and non-veterinary animal services. More than 47 percent of geological and petroleum technicians worked for oil and gas extraction companies, and forensic science technicians worked primarily for State and local governments.

Training, Other Qualifications, and Advancement

There are several ways to qualify for a job as a science technician. Many employers prefer applicants who have at least 2 years of specialized training or an associate degree in applied science or science-related technology. Because employers' preferences vary, however, some science technicians have a bachelor's degree in chemistry, biology, or forensic science, or have taken several science and math courses at 4-year colleges.

Many technical and community colleges offer associate degrees in a specific technology or a more general education in science and mathematics. A number of 2-year associate degree programs are designed to provide easy transfer to a 4-year college or university, if desired. Technical institutes usually offer technician training, but provide less theory and general education than technical or community colleges. The length of programs at technical institutes varies, although 1-year certificate programs and 2-year associate degree programs are common.

About 20 colleges or universities offer bachelor's degree programs in forensic technology, often with an emphasis in a specialty area, such as criminalistics, pathology, jurisprudence, odontology, or toxicology. In contrast to some other science technician positions that require only a 2-year degree, a 4-year degree in forensics science is usually necessary to work in the field. Forestry and conservation technicians can choose from 23 associate degree programs accredited by the Society of American Foresters.

Some schools offer cooperative-education or internship programs, allowing students the opportunity to work at a local company or other workplace, while attending classes in alternate terms. Participation in such programs can significantly enhance a student's employment prospects.

Persons interested in careers as science technicians should take as many high school science and math courses as possible. Science courses taken beyond high school, in an associate's or bachelor's program, should be laboratory oriented, with an emphasis on bench skills. Because computers and computer-interfaced equipment often are used in research and development laboratories, technicians should have strong computer skills. Communication skills are also important; technicians often are required to report their findings both through speaking and in writing. Additionally, technicians should be able to work well with others, because teamwork is common. Organizational ability, an eye for detail, and skill in interpreting scientific results are also important.

Prospective science technicians can acquire good career preparation through 2-year formal training programs that combine the

teaching of scientific principles and theory with practical hands-on application in a laboratory setting with up-to-date equipment. Graduates of 4-year bachelor's degree programs in science who have considerable experience in laboratory-based courses, have completed internships, or held summer jobs in laboratories, are also well-qualified for science technician positions and are preferred by some employers. However, those with a bachelor's degree who accept technician jobs generally cannot find employment that uses their advanced academic education.

Technicians usually begin work as trainees in routine positions, under the direct supervision of a scientist or a more experienced technician. Job candidates whose training or educational background encompasses extensive hands-on experience with a variety of laboratory equipment, including computers and related equipment, usually require a short period of on-the-job training. As they gain experience, technicians take on more responsibility and carry out assignments under only general supervision, and some eventually become supervisors. However, technicians employed at universities often have their fortunes tied to particular professors; when professors retire or leave, these technicians face uncertain employment prospects.

Job Outlook

Overall employment of science technicians is expected to increase about as fast as the average for all occupations through the year 2010. Continued growth of scientific and medical research, as well as the development and production of technical products, should stimulate demand for science technicians in many industries. In particular, the growing number of agricultural and medicinal products developed from using biotechnology techniques will increase the need for biological technicians. Also, stronger competition among drug companies and an aging population are expected to contribute to the need for innovative and improved drugs, further spurring demand for biological technicians. Fastest employment growth of biological technicians should occur in the drug manufacturing industry and research and testing service firms.

The chemical and drug industry, the major employers of chemical technicians, should face stable demand for new and better pharmaceuticals and personal care products. To meet these demands, chemical and drug manufacturing firms are expected to continue to devote money to research and development, either through in-house teams or outside contractors, spurring employment growth of chemical technicians. An increasing focus on quality assurance will further stimulate demand for these workers. However, growth will be moderated somewhat by an expected slowdown in overall employment in the chemical industry.

Overall employment growth of science technicians will also be fueled by demand for environmental technicians to help regulate waste products; to collect air, water, and soil samples for measuring levels of pollutants; to monitor compliance with environmental regulations; and to clean up contaminated sites.

Demand for forest and conservation technicians at the Federal and State government levels will result from a continuing emphasis on sustainability issues, such as environmental protection and responsible land management. However, employment growth may be moderated by downsizing in the Federal Government and continuing reductions in timber harvesting on Federal lands.

Agricultural and food science technicians will be needed to assist agricultural scientists in biotechnology research as it becomes increasingly important to balance greater agricultural output with protection and preservation of soil, water, and the ecosystem. Jobs for forensic science technicians are expected to grow slowly. Crime

scene technicians who work for State Public Safety Departments may experience favorable employment prospects if the number of qualified applicants remains low.

Job opportunities are expected to be best for qualified graduates of science technician training programs or applied science technology programs who are well-trained on equipment used in industrial and government laboratories and production facilities. As the instrumentation and techniques used in industrial research, development, and production become increasingly more complex, employers are seeking well-trained individuals with highly developed technical and communication skills.

Along with opportunities created by growth, many job openings should arise from the need to replace technicians who retire or leave the labor force for other reasons. During periods of economic recession, layoffs of science technicians may occur.

Earnings

Median hourly earnings of science technicians in 2000 were as follows:

Nuclear technicians	\$28.44
Forensic science technicians	18.04
Geological and petroleum technicians	17.55
Chemical technicians	17.05
Environmental science and protection technicians, including health	16.26
Biological technicians	15.16
Forest and conservation technicians	14.22
Agricultural and food science technicians	13.02

In the Federal Government in 2001, science technicians started at \$17,483, \$19,453, or \$22,251, depending on education and experience. Beginning salaries were slightly higher in selected areas of the country where the prevailing local pay level was higher. The average annual salary for biological science technicians in nonsupervisory, supervisory, and managerial positions employed by the Federal Government in 2001 was \$32,753; for physical science technicians, \$42,657; for geodetic technicians, \$53,143; for hydrologic technicians, \$39,518; and for meteorologic technicians, \$48,630.

Related Occupations

Other technicians who apply scientific principles at a level usually taught in 2-year associate degree programs include engineering technicians, broadcast technicians and sound engineering technicians and radio operators, drafters, and various health technologists and technicians, including clinical laboratory technologists and technicians, diagnostic medical sonographers, and radiologic technologists and technicians.

Sources of Additional Information

For information about a career as a chemical technician, contact:
 ▶ American Chemical Society, Education Division, Career Publications, 1155 16th St. NW., Washington, DC 20036. Internet: <http://www.acs.org>

For career information and a list of undergraduate, graduate, and doctoral programs in forensics sciences, contact:

▶ American Academy of Forensic Sciences, P.O. BOX 669, Colorado Springs, CO, 80901. Internet: <http://www.aafs.org>

For information on forestry technicians and lists of schools offering education in forestry, send a self-addressed, stamped business envelope to:

▶ Society of American Foresters, 5400 Grosvenor Ln., Bethesda, MD 20814. Internet: <http://www.safnet.org>