

Highest Paying Jobs That Require A Two-Year College Degree

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*Data Compiled from the Federal Government's Bureau of Labor Statistics
for the Year 2002 by Resumagic.com*

Significant Points

- Most dental hygiene programs grant an associate degree; others offer a certificate, a bachelor's degree, or a master's degree.
- Job prospects are expected to remain excellent.
- Opportunities for part-time work and flexible schedules are common.

Nature of the Work

Dental hygienists remove soft and hard deposits from teeth, teach patients how to practice good oral hygiene, and provide other preventive dental care. Hygienists examine patients' teeth and gums, recording the presence of diseases or abnormalities. They remove calculus, stains, and plaque from teeth; perform root planing as a periodontal therapy; take and develop dental x rays; and apply cavity-preventive agents such as fluorides and pit and fissure sealants. In some States, hygienists administer anesthetics; place and carve filling materials, temporary fillings, and periodontal dressings; remove sutures; and smooth and polish metal restorations. Although hygienists may not diagnose diseases, they can prepare clinical and laboratory diagnostic tests for the dentist to interpret. Hygienists sometimes work chair side with the dentist during treatment.

Dental hygienists also help patients develop and maintain good oral health. For example, they may explain the relationship between diet and oral health or inform patients how to select toothbrushes and show them how to brush and floss their teeth.

Dental hygienists use hand and rotary instruments and ultrasonics to clean and polish teeth, x-ray machines to take dental pictures, syringes with needles to administer local anesthetics, and models of teeth to explain oral hygiene.

Working Conditions

Flexible scheduling is a distinctive feature of this job. Full-time, part-time, evening, and weekend schedules are widely available. Dentists frequently hire hygienists to work only 2 or 3 days a week, so hygienists may hold jobs in more than one dental office.

Dental hygienists work in clean, well-lighted offices. Important health safeguards include strict adherence to proper radiological procedures, and the use of appropriate protective devices when administering anesthetic gas. Dental hygienists also wear safety glasses, surgical masks, and gloves to protect themselves and patients from infectious diseases.

Employment

Dental hygienists held about 148,000 jobs in 2002. Because multiple jobholding is common in this field, the number of jobs exceeds the number of hygienists. More than half of all dental hygienists worked part time—less than 35 hours a week.

Almost all jobs for dental hygienists were in offices of dentists. A very small number worked for employment services or in offices of physicians.

Training, Other Qualifications, and Advancement

Dental hygienists must be licensed by the State in which they practice. To qualify for licensure, a candidate must graduate from an accredited dental hygiene school and pass both a written and clinical examination. The American Dental Association Joint Commission on National Dental Examinations administers the written examination, which is accepted by all States and the District of Columbia. State or regional testing agencies administer the clinical examination. In addition, most States require an examination on the legal aspects of dental hygiene practice. Alabama allows candidates to take its examinations if they have been trained through a State-regulated on-the-job program in a dentist's office.

In 2002, the Commission on Dental Accreditation accredited about 265 programs in dental hygiene. Most dental hygiene programs grant an associate degree, although some also offer a certificate, a bachelor's degree, or a master's degree. A minimum of an associate degree or certificate in dental hygiene is required for practice in a private dental office. A bachelor's or master's degree usually is required for research, teaching, or clinical practice in public or school health programs.

About half of the dental hygiene programs prefer applicants who have completed at least 1 year of college. However, requirements vary from one school to another. Schools offer laboratory, clinical, and classroom instruction in subjects such as anatomy, physiology, chemistry, microbiology, pharmacology, nutrition, radiography, histology (the study of tissue structure), periodontology (the study of gum diseases), pathology, dental materials, clinical dental hygiene, and social and behavioral sciences.

Dental hygienists should work well with others and must have good manual dexterity, because they use dental instruments within a patient's mouth, with little room for error. High school students interested in becoming a dental hygienist should take courses in biology, chemistry, and mathematics.

Job Outlook

Employment of dental hygienists is expected to grow much faster than the average for all occupations through 2012, in response to increasing demand for dental care and the greater utilization of hygienists to perform services previously performed by dentists. Job prospects are expected to remain excellent. In fact, dental hygienists is expected to be one of the fastest growing occupations through the year 2012.

Population growth and greater retention of natural teeth will stimulate demand for dental hygienists. Older dentists, who have been less likely to employ dental hygienists, are leaving the occupation and will be replaced by recent graduates, who are more likely to employ one or even two hygienists. In addition, as dentists' workloads increase, they are expected to hire more hygienists to perform preventive dental care, such as cleaning, so that they may devote their own time to more profitable procedures.

Earnings

Median hourly earnings of dental hygienists were \$26.59 in 2002. The middle 50 percent earned between \$21.96 and \$32.48 an hour. The lowest 10 percent earned less than \$17.34, and the highest 10 percent earned more than \$39.24 an hour.

Earnings vary by geographic location, employment setting, and years of experience. Dental hygienists may be paid on an hourly, daily, salary, or commission basis.

Benefits vary substantially by practice setting and may be contingent upon full-time employment. According to the American Dental Association, almost all full-time dental hygienists employed by private practitioners received paid vacation. The ADA also found that 9 out of 10 full-time and part-time dental hygienists received dental coverage. Dental hygienists who work for school systems, public health agencies, the Federal Government, or State agencies usually have substantial benefits.

Sources of Additional Information

For information on a career in dental hygiene, including educational requirements, contact Division of Education, American Dental Hygienists' Association, 444 N. Michigan Ave., Suite 3400, Chicago, IL 60611. Internet: <http://www.adha.org>

For information about accredited programs and educational requirements, contact Commission on Dental Accreditation, American Dental Association, 211 E. Chicago Ave., Suite 1814, Chicago, IL 60611. Internet: <http://www.ada.org>

The State Board of Dental Examiners in each State can supply information on licensing requirements.

Funeral Directors

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Significant Points

- Funeral directors must be licensed by their State.
- Job opportunities should be good, particularly for those who also embalm; however, mortuary science graduates may have to relocate to find jobs.

Nature of the Work

Funeral practices and rites vary greatly among cultures and religions. Among the many diverse groups in the United States, funeral practices usually share some common elements—removing the deceased to a mortuary, preparing the remains, performing a ceremony that honors the deceased and addresses the spiritual needs of the family, and final disposition of the remains. Funeral directors arrange and direct these tasks for grieving families.

Funeral directors also are called morticians or undertakers. This career may not appeal to everyone, but those who work as funeral directors take great pride in their

ability to provide efficient and appropriate services. They also comfort the family and friends of the deceased.

Funeral directors arrange the details and handle the logistics of funerals. They interview the family to learn what family members desire with regard to the nature of the funeral, the clergy members or other persons who will officiate, and the final disposition of the remains. Sometimes, the deceased leaves detailed instructions for his or her own funeral. Together with the family, funeral directors establish the location, dates, and times of wakes, memorial services, and burials. They arrange for a hearse to carry the body to the funeral home or mortuary.

Funeral directors also prepare obituary notices and have them placed in newspapers, arrange for pallbearers and clergy, schedule the opening and closing of a grave with a representative of the cemetery, decorate and prepare the sites of all services, and provide transportation for the remains, mourners, and flowers between sites. They also direct preparation and shipment of remains for out-of-State burial.

Most funeral directors also are trained, licensed, and practicing embalmers. Embalming is a sanitary, cosmetic, and preservative process through which the body is prepared for interment. If more than 24 hours elapses between death and interment, State laws usually require that the remains be refrigerated or embalmed.

When embalming a body, funeral directors wash the body with germicidal soap and replace the blood with embalming fluid to preserve the tissues. They may reshape and reconstruct disfigured or maimed bodies using materials, such as clay, cotton, plaster of paris, and wax. They also may apply cosmetics to provide a natural appearance, and then dress the body and place it in a casket. Funeral directors maintain records such as embalming reports, and itemized lists of clothing or valuables delivered with the body. In large funeral homes, an embalming staff of two or more, plus several apprentices may be employed.

Funeral services may take place in a home, house of worship, or funeral home, or at the gravesite or crematory. Services may be nonreligious, but often they reflect the religion of the family, so funeral directors must be familiar with the funeral and burial customs of many faiths, ethnic groups, and fraternal organizations. For example, members of some religions seldom have the bodies of the deceased embalmed or cremated.

Burial in a casket is the most common method of disposing of remains in this country, although entombment also occurs. Cremation, which is the burning of the body in a special furnace, is increasingly selected because it can be less expensive, and is becoming more appealing. Memorial services can be held anywhere, and at any time, sometimes months later when all relatives and friends can get together. Even when the remains are cremated, many people still want a funeral service.

A funeral service followed by cremation need not be any different from a funeral service followed by a burial. Usually cremated remains are placed in some type of permanent receptacle, or urn, before being committed to a final resting place. The urn may be buried, placed in an indoor or outdoor mausoleum or columbarium, or interred in a special urn garden that many cemeteries provide for cremated remains.

Funeral directors handle the paperwork involved with the person's death, such as submitting papers to State authorities so that a formal certificate of death may be issued and copies distributed to the heirs. They may help family members apply for veterans' burial benefits, and notify the Social Security Administration of the death. Also, funeral directors may apply for the transfer of any pensions, insurance policies, or annuities on behalf of survivors.

Funeral directors also prearrange funerals. Increasingly, they arrange funerals in advance of need to provide peace of mind by ensuring that the client's wishes will be taken care of in a way that is satisfying to the person and to those who will survive.

Most funeral homes are small, family-run businesses, and the funeral directors are either owner-operators or employees of the operation. Funeral directors, therefore, are responsible for the success and the profitability of their businesses. Directors keep records of expenses, purchases, and services rendered; prepare and send invoices for services; prepare and submit reports for unemployment insurance; prepare Federal, State, and local tax forms; and prepare itemized bills for customers. Funeral directors increasingly are using computers for billing, bookkeeping, and marketing. Some are beginning to use the Internet to communicate with clients who are preplanning their funerals, or to assist clients by developing electronic obituaries and guest books. Directors strive to foster a cooperative spirit and friendly attitude among employees and a compassionate demeanor towards the families. A growing number of funeral directors also are involved in helping individuals adapt to changes in their lives following a death through aftercare services or support group activities.

Most funeral homes have a chapel, one or more viewing rooms, a casket-selection room, and a preparation room. An increasing number also have a crematory on the premises. Equipment may include a hearse, a flower car, limousines, and, sometimes, an ambulance. Funeral homes usually stock a selection of caskets and urns for families to purchase or rent.

Working Conditions

Funeral directors often work long, irregular hours, and the occupation can be highly stressful. Many work on an on-call basis, because they may be needed to remove remains in the middle of the night. Shift work sometimes is necessary because funeral home hours include evenings and weekends. In smaller funeral homes, working hours vary, but in larger homes employees usually work 8 hours a day, 5 or 6 days a week.

Funeral directors occasionally come into contact with the remains of persons who had contagious diseases, but the possibility of infection is remote if strict health regulations are followed.

To show proper respect and consideration for the families and the dead, funeral directors must dress appropriately. The profession usually requires short, neat haircuts and trim beards, if any, for men. Suits, ties, and dresses are customary for a conservative look.

Employment

Funeral directors held about 24,000 jobs in 2002. Eleven percent were self-employed. Nearly all worked in the death care services industry.

Training, Other Qualifications, and Advancement

Funeral directors must be licensed in all States. Licensing laws vary from State to State, but most require applicants to be 21 years old, have 2 years of formal education that includes studies in mortuary science, serve a 1-year apprenticeship, and pass a qualifying examination. After becoming licensed, new funeral directors may join the staff of a funeral home. Funeral directors who embalm must be licensed in all States, and some States issue a single license for funeral directors who embalm. In States that have separate licensing requirements, most people in the field obtain both licenses. Persons interested in a career as a funeral director should contact their State licensing board for specific requirements.

College programs in mortuary science usually last from 2 to 4 years; the American Board of Funeral Service Education accredits about 50 mortuary science programs. A small number of community and junior colleges offer 2-year programs, and a few colleges and universities offer both 2-year and 4-year programs. Mortuary science programs include courses in anatomy, physiology, pathology, embalming techniques, restorative art, business management, accounting and use of computers in funeral home management, and client services. They also include courses in the social sciences and legal, ethical, and regulatory subjects, such as psychology, grief counseling, oral and written communication, funeral service law, business law, and ethics.

Many State and national associations offer continuing education programs designed for licensed funeral directors. These programs address issues in communications, counseling, and management. More than 30 States have requirements that funeral directors receive continuing education credits in order to maintain their licenses.

Apprenticeships must be completed under the direction of an experienced and licensed funeral director. Depending on State regulations, apprenticeships last from 1 to 3 years and may be served before, during, or after mortuary school. Apprenticeships provide practical experience in all facets of the funeral service, from embalming to transporting remains.

State board licensing examinations vary, but they usually consist of written and oral parts and include a demonstration of practical skills. Persons who want to work in another State may have to pass the examination for that State; however, some States have reciprocity arrangements and will grant licenses to funeral directors from another State without further examination.

High school students can start preparing for a career as a funeral director by taking courses in biology and chemistry and participating in public speaking or debate clubs. Part-time or summer jobs in funeral homes consist mostly of maintenance and cleanup tasks, such as washing and polishing limousines and hearses, but these tasks can help students to become familiar with the operation of funeral homes.

Important personal traits for funeral directors are composure, tact, and the ability to communicate easily with the public. They also should have the desire and ability to comfort people in a time of sorrow.

Advancement opportunities are best in larger funeral homes—funeral directors may earn promotions to higher paying positions such as branch manager or general manager. Some directors eventually acquire enough money and experience to establish their own funeral home businesses.

Job Outlook

Employment opportunities for funeral directors are expected to be good, particularly for those who also embalm. However, mortuary science graduates may have to relocate to find jobs.

Employment of funeral directors is projected to grow more slowly than the average for all occupations through the year 2012, as the population and the number of deaths increase. The need to replace funeral directors who retire or leave the occupation for other reasons will account for more job openings than will employment growth. Typically, a number of mortuary science graduates leave the profession shortly after becoming licensed funeral directors to pursue other career interests, and this trend is expected to continue. In addition, funeral directors are older, on average, than workers in most other occupations, and should be retiring in greater numbers between 2002 and 2012.

Earnings

Median annual earnings for funeral directors were \$43,380 in 2002. The middle 50 percent earned between \$33,540 and \$58,140. The lowest 10 percent earned less than \$24,950, and the top 10 percent more than \$84,060.

Salaries of funeral directors depend on the number of years of experience in funeral service, the number of services performed, the number of facilities operated, the area of the country, the size of the community, and the level of formal education. Funeral directors in large cities earn more than their counterparts in small towns and rural areas.

Sources of Additional Information

For a list of accredited mortuary science programs and information on the funeral service profession, write to The National Funeral Directors Association, 13625 Bishop's Dr., Brookfield, WI 53005. Internet: <http://www.nfda.org>

For information about college programs in mortuary science, scholarships, and funeral service as a career, contact The American Board of Funeral Service Education, 38 Florida Ave., Portland, ME 04103. Internet: <http://www.abfse.org/index.html>

Significant Points

- Registered nurses constitute the largest healthcare occupation, with 2.3 million jobs.
- More new jobs are expected to be created for registered nurses than for any other occupation.
- Job opportunities are expected to be very good.
- The three major educational paths to registered nursing are a bachelor's degree, an associate degree, and a diploma.

Nature of the Work

Registered nurses (RNs) work to promote health, prevent disease, and help patients cope with illness. They are advocates and health educators for patients, families, and communities. When providing direct patient care, they observe, assess, and record symptoms, reactions, and progress in patients; assist physicians during surgeries, treatments, and examinations; administer medications; and assist in convalescence and rehabilitation. RNs also develop and manage nursing care plans, instruct patients and their families in proper care, and help individuals and groups take steps to improve or maintain their health. While State laws govern the tasks that RNs may perform, it is usually the work setting that determines their daily job duties.

Hospital nurses form the largest group of nurses. Most are staff nurses, who provide bedside nursing care and carry out medical regimens. They also may supervise licensed practical nurses and nursing aides. Hospital nurses usually are assigned to one department, such as surgery, maternity, pediatrics, the emergency room, intensive care, or the treatment of cancer patients. Some may rotate among departments.

Office nurses care for outpatients in physicians' offices, clinics, ambulatory surgical centers, and emergency medical centers. They prepare patients for, and assist with, examinations; administer injections and medications; dress wounds and incisions; assist with minor surgery; and maintain records. Some also perform routine laboratory and office work.

Nursing care facility nurses manage care for residents with conditions ranging from a fracture to Alzheimer's disease. Although they often spend much of their time on administrative and supervisory tasks, RNs also assess residents' health, develop treatment plans, supervise licensed practical nurses and nursing aides, and perform invasive procedures, such as starting intravenous fluids. They also work in specialty-care departments, such as long-term rehabilitation units for patients with strokes and head injuries.

Home health nurses provide nursing services to patients at home. RNs assess patients' home environments and instruct patients and their families. Home health nurses care for a broad range of patients, such as those recovering from illnesses and accidents, cancer, and childbirth. They must be able to work independently and may supervise home health aides.

Public health nurses work in government and private agencies, including clinics, schools, retirement communities, and other community settings. They focus on populations, working with individuals, groups, and families to improve the overall health of communities. They also work with communities to help plan and implement programs. Public health nurses instruct individuals, families, and other groups regarding health issues such as preventive care, nutrition, and childcare. They arrange for immunizations, blood pressure testing, and other health screening. These nurses also work with community leaders, teachers, parents, and physicians in community health education.

Occupational health nurses, also called **industrial nurses**, provide nursing care at worksites to employees, customers, and others with injuries and illnesses. They give emergency care, prepare accident reports, and arrange for further care if necessary. They also offer health counseling, conduct health examinations and inoculations, and assess work environments to identify potential or actual health problems.

Head nurses or nurse supervisors direct nursing activities, primarily in hospitals. They plan work schedules and assign duties to nurses and aides, provide or arrange for training, and visit patients to observe nurses and to ensure that the patients receive proper care. They also may ensure that records are maintained and equipment and supplies are ordered.

At the advanced level, **nurse practitioners** provide basic, primary healthcare. They diagnose and treat common acute illnesses and injuries. Nurse practitioners also can prescribe medications—but certification and licensing requirements vary by State. Other advanced practice nurses include **clinical nurse specialists, certified registered nurse anesthetists**, and **certified nurse midwives**. Advanced practice nurses must meet educational and clinical practice requirements beyond the basic nursing education and licensing required of all RNs.

Working Conditions

Most nurses work in well-lighted, comfortable healthcare facilities. Home health and public health nurses travel to patients' homes, schools, community centers, and other sites. Nurses may spend considerable time walking and standing. Patients in hospitals and nursing care facilities require 24-hour care; consequently, nurses in these institutions may work nights, weekends, and holidays. RNs also may be on call—available to work on short notice. Office, occupational health, and public health nurses are more likely to work regular business hours. More than 1 in 5 RNs worked part time in 2002 and nearly 1 in 10 held more than one job.

Nursing has its hazards, especially in hospitals, nursing care facilities, and clinics, in all three of which nurses may care for individuals with infectious diseases. Nurses must observe rigid standardized guidelines to guard against disease and other dangers, such as those posed by radiation, accidental needle sticks, chemicals used to sterilize instruments, and anesthetics. In addition, they are vulnerable to back injury when moving patients, shocks from electrical equipment, and hazards posed by compressed gases.

Employment

As the largest healthcare occupation, registered nurses held about 2.3 million jobs in 2002. Almost 3 out of 5 jobs were in hospitals, in inpatient and outpatient departments. Others worked in offices of physicians, nursing care facilities, home healthcare services, employment services, government agencies, and outpatient care centers. The remainder worked mostly in social assistance agencies and educational services, public and private. About 1 in 5 RNs worked part time.

Training, Other Qualifications, and Advancement

In all States and the District of Columbia, students must graduate from an approved nursing program and pass a national licensing examination in order to obtain a nursing license. Nurses may be licensed in more than one State, either by examination, by the endorsement of a license issued by another State, or through a multi-State licensing agreement. All States require periodic renewal of licenses, which may involve continuing education.

There are three major educational paths to registered nursing: a bachelor's of science degree in nursing (BSN), an associate degree in Nursing (ADN), and a diploma. BSN programs, offered by colleges and universities, take about 4 years to complete. In 2002, 678 nursing programs offered degrees at the bachelor's level. ADN programs, offered by community and junior colleges, take about 2 to 3 years to complete. About 700 RN programs in 2002 were at the ADN level. Diploma programs, administered in hospitals, last about 3 years. Only a small and declining number of programs offer diplomas. Generally, licensed graduates of any of the three types of educational programs qualify for entry-level positions as staff nurses.

Many ADN- and diploma-educated nurses later enter bachelor's programs to prepare for a broader scope of nursing practice. Often, they can find a staff nurse position and then take advantage of tuition reimbursement benefits to work toward a BSN by completing one of many RN-to-BSN programs.

Accelerated BSN programs also are available for individuals who have a bachelor's or higher degree in another field and who are interested in moving into nursing. In 2002, more than 110 of these programs were available. Accelerated BSN programs last 12 to 18 months and provide the fastest route to a BSN for individuals who already hold a degree. Accelerated master's degree programs in nursing also are available and take about 3 years to complete.

Individuals considering nursing should carefully weigh the advantages and disadvantages of enrolling in a BSN program, because, if they do, their advancement opportunities usually are broader. In fact, some career paths are open only to nurses with bachelor's or advanced degrees. A bachelor's degree often is necessary for administrative positions and is a prerequisite for admission to graduate nursing programs in research, consulting, teaching, or a clinical specialization.

Nursing education includes classroom instruction and supervised clinical experience in hospitals and other healthcare facilities. Students take courses in anatomy, physiology, microbiology, chemistry, nutrition, psychology and other behavioral sciences, and nursing. Course work also includes the liberal arts.

Supervised clinical experience is provided in hospital departments such as pediatrics, psychiatry, maternity, and surgery. A growing number of programs include clinical experience in nursing care facilities, public health departments, home health agencies, and ambulatory clinics.

Nurses should be caring, sympathetic, responsible, and detail oriented. They must be able to direct or supervise others, correctly assess patients' conditions, and determine when consultation is required. They need emotional stability to cope with human suffering, emergencies, and other stresses.

Experience and good performance can lead to promotion to more responsible positions. In management, nurses can advance to assistant head nurse or head nurse and, from there, to assistant director, director, and vice president. Increasingly, management-level nursing positions require a graduate or an advanced degree in nursing or health services administration. They also require leadership, negotiation skills, and good judgment. Graduate programs preparing executive-level nurses usually last about 2 years.

Within patient care, nurses can move into a nursing specialty such as clinical nurse specialist, nurse practitioner, certified nurse midwife, or certified registered nurse anesthetist. These positions require about 2 years of graduate education leading to a master's degree.

Some nurses move into the business side of health care. Their nursing expertise and experience on a healthcare team equip them with the ability to manage ambulatory, acute, home health, and chronic care services. Employers—including hospitals, insurance companies, pharmaceutical manufacturers, and managed care organizations, among others—need RNs for health planning and development, marketing, consulting, policy development, and quality assurance. Other nurses work as college and university faculty or conduct research.

Job Outlook

Job opportunities for RNs are expected to be very good. Employment of registered nurses is expected to grow faster than the average for all occupations through 2012, and because the occupation is very large, many new jobs will result. In fact, more new jobs are expected to be created for RNs than for any other occupation. Thousands of job openings also will result from the need to replace experienced nurses who leave the occupation, especially as the median age of the registered nurse population continues to rise.

Faster-than-average growth will be driven by technological advances in patient care, which permit a greater number of medical problems to be treated, and an increasing emphasis on preventive care. In addition, the number of older people, who are much more likely than younger people to need nursing care, is projected to grow rapidly.

Employers in some parts of the country are reporting difficulty in attracting and retaining an adequate number of RNs, due primarily to an aging RN workforce and insufficient nursing school enrollments. Imbalances between the supply of, and demand for, qualified workers should spur efforts to attract and retain qualified RNs. For example, employers may restructure workloads, improve compensation and working conditions, and subsidize training or continuing education.

Employment in hospitals, the largest sector, is expected to grow more slowly than in most other healthcare sectors. While the intensity of nursing care is likely to increase, requiring more nurses per patient, the number of inpatients (those who remain in the hospital for more than 24 hours) is not likely to increase much. Patients are being discharged earlier and more procedures are being done on an outpatient basis, both inside and outside hospitals. Rapid growth is expected in hospital outpatient facilities, such as those providing same-day surgery, rehabilitation, and chemotherapy.

An increasing proportion of sophisticated procedures, which once were performed only in hospitals, are being performed in physicians' offices and in outpatient care centers, such as freestanding ambulatory surgical and emergency centers. Accordingly, employment is expected to grow faster than average in these places as healthcare in general expands.

Employment in nursing care facilities is expected to grow faster than average due to increases in the number of elderly, many of whom require long-term care. In addition, the financial pressure on hospitals to discharge patients as soon as possible should produce more admissions to nursing care facilities. Job growth also is expected in units that provide specialized long-term rehabilitation for stroke and head injury patients, as well as units that treat Alzheimer's victims.

Employment in home healthcare is expected to increase rapidly in response to the growing number of older persons with functional disabilities, consumer preference for care in the home, and technological advances that make it possible to bring increasingly complex treatments into the home. The type of care demanded will require nurses who are able to perform complex procedures.

In evolving integrated healthcare networks, nurses may rotate among various employment settings. Because jobs in traditional hospital nursing positions are no longer the only option, RNs will need to be flexible. Opportunities should be excellent, particularly for nurses with advanced education and training.

Earnings

Median annual earnings of registered nurses were \$48,090 in 2002. The middle 50 percent earned between \$40,140 and \$57,490. The lowest 10 percent earned less than \$33,970, and the highest 10 percent earned more than \$69,670. Median annual earnings in the industries employing the largest numbers of registered nurses in 2002 were as follows:

Employment services	\$55,980
General medical and surgical hospitals	49,190
Home health care services	45,890
Offices of physicians	44,870
Nursing care facilities	43,850

Many employers offer flexible work schedules, childcare, educational benefits, and bonuses.

Sources of Additional Information

For information on a career as a registered nurse and nursing education, contact National League for Nursing, 61 Broadway, New York, NY 10006. Internet:

<http://www.nln.org>

For a list of BSN, graduate, and accelerated nursing programs, contact American Association of Colleges of Nursing, 1 Dupont Circle NW., Suite 530, Washington, DC 20036. Internet: <http://www.aacn.nche.edu>

Information on registered nurses also is available from American Nurses Association, 600 Maryland Ave. SW., Washington, DC 20024-2571. Internet:

<http://www.nursingworld.org>

Engineering Technicians

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Significant Points

- Electrical and electronic engineering technicians make up 42 percent of all engineering technicians.
- Because the type and quality of training programs vary considerably, prospective students should carefully investigate training programs before enrolling.
- Opportunities will be best for individuals with an associate degree or extensive job training in engineering technology.

Nature of the Work

Engineering technicians use the principles and theories of science, engineering, and mathematics to solve technical problems in research and development, manufacturing, sales, construction, inspection, and maintenance. Their work is more limited in scope and more practically oriented than that of scientists and engineers. Many engineering technicians assist engineers and scientists, especially in research and development. Others work in quality control—inspecting products and processes, conducting tests, or collecting data. In manufacturing, they may assist in product design, development, or production.

Engineering technicians who work in research and development build or set up equipment, prepare and conduct experiments, collect data, calculate or record results, and help engineers or scientists in other ways, such as making prototype versions of newly designed equipment. They also assist in design work, often using computer-aided design (CAD) equipment.

Most engineering technicians specialize in certain areas, learning skills and working in the same disciplines as engineers. Occupational titles, therefore, tend to reflect those of engineers.

Aerospace engineering and operations technicians install, construct, maintain, and test systems used to test, launch, or track aircraft and space vehicles. They may calibrate test equipment and determine causes of equipment malfunctions. Using

computer and communications systems, aerospace engineering and operations technicians often record and interpret test data.

Chemical engineering technicians usually are employed in industries producing pharmaceuticals, chemicals, and petroleum products, among others. They work in laboratories as well as processing plants. They help to develop new chemical products and processes, test processing equipment and instrumentation, gather data, and monitor quality.

Civil engineering technicians help civil engineers to plan and build highways, buildings, bridges, dams, wastewater treatment systems, and other structures, and to do related research. Some estimate construction costs and specify materials to be used, and some may even prepare drawings or perform land-surveying duties. Others may set up and monitor instruments used to study traffic conditions.

Electrical and electronics engineering technicians help to design, develop, test, and manufacture electrical and electronic equipment such as communication equipment, radar, industrial and medical measuring or control devices, navigational equipment, and computers. They may work in product evaluation and testing, using measuring and diagnostic devices to adjust, test, and repair equipment.

Electrical and electronic engineering technology also is applied to a wide variety of systems such as communication and process controls. **Electromechanical engineering technicians** combine fundamental principles of mechanical engineering technology with knowledge of electrical and electronic circuits to design, develop, test, and manufacture electrical and computer-controlled mechanical systems.

Environmental engineering technicians work closely with environmental engineers and scientists in developing methods and devices used in the prevention, control, or correction of environmental hazards. They inspect and maintain equipment affecting air pollution and recycling. Some inspect water and wastewater treatment systems to ensure that pollution control requirements are met.

Industrial engineering technicians study the efficient use of personnel, materials, and machines in factories, stores, repair shops, and offices. They prepare layouts of machinery and equipment, plan the flow of work, make statistical studies, and analyze production costs.

Mechanical engineering technicians help engineers to design, develop, test, and manufacture industrial machinery, consumer products, and other equipment. They may assist in product tests—by setting up instrumentation for auto crash tests, for example. They may make sketches and rough layouts, record data, make computations, analyze results, and write reports. When planning production, mechanical engineering technicians prepare layouts and drawings of the assembly process and of parts to be manufactured. They estimate labor costs, equipment life, and plant space. Some test and inspect machines and equipment or work with engineers to eliminate production problems.

Working Conditions

Most engineering technicians work at least 40 hours a week in laboratories, offices, or manufacturing or industrial plants, or on construction sites. Some may be exposed to hazards from equipment, chemicals, or toxic materials.

Employment

Engineering technicians held 478,000 jobs in 2002. 204,000 of these were electrical and electronics engineering technicians, as indicated by the following tabulation.

Electrical and electronic engineering technicians	204,000
Civil engineering technicians	92,000
Industrial engineering technicians	62,000
Mechanical engineering technicians	55,000
Electro-mechanical technicians	31,000
Environmental engineering technicians	19,000
Aerospace engineering and operations technicians	15,000

About 39 percent of all engineering technicians worked in manufacturing, mainly in the computer and electronic equipment, transportation equipment, and machinery manufacturing industries. Another 20 percent worked in professional, scientific, and technical service industries, mostly in engineering or business services companies that do engineering work on contract for government, manufacturing firms, or other organizations.

In 2002, the Federal Government employed 11,000 engineering technicians. State governments employed 34,000, and local governments employed 24,000.

Training, Other Qualifications, and Advancement

Although it may be possible to qualify for certain engineering technician jobs without formal training, most employers prefer to hire someone with at least a 2-year associate degree in engineering technology. Training is available at technical institutes, community colleges, extension divisions of colleges and universities, and public and private vocational-technical schools, and in the Armed Forces. Persons with college courses in science, engineering, and mathematics may qualify for some positions but may need additional specialized training and experience. Although employers usually do not require engineering technicians to be certified, such certification may provide jobseekers a competitive advantage.

Prospective engineering technicians should take as many high school science and math courses as possible to prepare for postsecondary programs in engineering technology. Most 2-year associate degree programs accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC/ABET) require, at a minimum, college algebra and trigonometry, and one or two basic science courses. Depending on the specialty, more math or science may be required.

The type of technical courses required also depends on the specialty. For example, prospective mechanical engineering technicians may take courses in fluid mechanics, thermodynamics, and mechanical design; electrical engineering technicians may need classes in electric circuits, microprocessors, and digital electronics; and those preparing to work in environmental engineering technology need courses in environmental regulations and safe handling of hazardous materials.

Because many engineering technicians assist in design work, creativity is desirable. Because these workers often are part of a team of engineers and other technicians, good communication skills and the ability to work well with others also are important.

Engineering technicians usually begin by performing routine duties under the close supervision of an experienced technician, technologist, engineer, or scientist. As they gain experience, they are given more difficult assignments with only general supervision. Some engineering technicians eventually become supervisors.

Many publicly and privately operated schools provide technical training; the type and quality of training varies considerably. Therefore, prospective students should be careful in selecting a program. They should contact prospective employers regarding their preferences and ask schools to provide information about the kinds of jobs obtained by graduates, instructional facilities and equipment, and faculty qualifications. Graduates of ABET-accredited programs usually are recognized to have achieved an acceptable level of competence in the mathematics, science, and technical courses required for this occupation.

Technical institutes offer intensive technical training through application and practice, but less theory and general education than do community colleges. Many offer 2-year associate degree programs, and are similar to or part of a community college or State university system. Other technical institutes are run by private, often for-profit organizations, sometimes called proprietary schools. Their programs vary considerably in length and types of courses offered, although some are 2-year associate degree programs.

Community colleges offer curriculums that are similar to those in technical institutes, but that may include more theory and liberal arts. There may be little or no difference between programs at technical institutes and community colleges, as both offer associate degrees. After completing the 2-year program, some graduates get jobs as engineering technicians, while others continue their education at 4-year colleges. However, there is a difference between an associate degree in pre-engineering and one in engineering technology. Students who enroll in a 2-year pre-engineering program may find it very difficult to find work as an engineering technician should they decide not to enter a 4-year engineering program, because pre-engineering programs usually focus less on hands-on applications and more on academic preparatory work. Conversely, graduates of 2-year engineering technology programs may not receive credit for some of the courses they have taken if they choose to transfer to a 4-year engineering program. Colleges with these 4-year programs usually do not offer engineering technician training, but college courses in science, engineering, and mathematics are useful for obtaining a job as an engineering technician. Many 4-year colleges offer bachelor's degrees in engineering technology, but graduates of these programs often are hired to work as technologists or applied engineers, not technicians.

Area vocational-technical schools, another source of technical training, include postsecondary public institutions that serve local students and emphasize training needed by local employers. Most require a high school diploma or its equivalent for admission.

Other training in technical areas may be obtained in the Armed Forces. Many military technical training programs are highly regarded by employers. However, skills acquired in military programs are often narrowly focused, so they may not be useful in civilian industry, which often requires broader training. Therefore, some additional training may be needed, depending on the acquired skills and the kind of job.

The National Institute for Certification in Engineering Technologies (NICET) has established a voluntary certification program for engineering technicians. Certification is available at various levels, each level combining a written examination in 1 of about 30 specialties with a certain amount of job-related experience, a supervisory evaluation, and a recommendation.

Job Outlook

Opportunities will be best for individuals with an associate degree or extensive job training in engineering technology. As technology becomes more sophisticated, employers will continue to look for technicians who are skilled in new technology and require a minimum of additional job training. An increase in the number of jobs related to public health and safety should create job opportunities for engineering technicians with the appropriate certification.

Overall employment of engineering technicians is expected to increase about as fast as the average for all occupations through 2012. Competitive pressures will force companies to improve and update manufacturing facilities and product designs, resulting in more jobs for engineering technicians. However, the growing use of advanced technologies, such as computer simulation and computer-aided design and drafting will continue to increase productivity and limit job growth. In addition to growth, many job openings will stem from the need to replace technicians who retire or leave the labor force.

As is the case for engineers, employment of engineering technicians is influenced by local and national economic conditions. As a result, the employment outlook varies with industry and specialization. Growth in the largest specialty—electrical and electronics engineering technicians—is expected to be about as fast as the average, and there will also be many jobs created by the need to replace technicians who retire or leave the labor force. Employment of environmental engineering technicians is expected to grow faster than average, partly due to increased demand for environmental protection and partly due to recognition of environmental engineering technicians as a separate occupation.

Earnings

Median annual earnings of engineering technicians by specialty is shown in the following tabulation.

Aerospace engineering and operations technicians	\$51,650
Electrical and electronic engineering technicians	42,950
Industrial engineering technicians	41,910
Mechanical engineering technicians	41,280
Electro-mechanical technicians	38,120
Civil engineering technicians	37,720
Environmental engineering technicians	36,850

Median annual earnings of electrical and electronics engineering technicians were \$42,950 in 2002. The middle 50 percent earned between \$33,760 and \$53,200. The lowest 10 percent earned less than \$26,770, and the highest 10 percent earned more than \$64,070. Median annual earnings in the industries employing the largest numbers of electrical and electronics engineering technicians in 2002 are shown below.

Federal government	\$58,520
Wired telecommunications carriers	49,610
Architectural, engineering, and related services	43,670
Semiconductor and other electronic component manufacturing	40,110
Navigational, measuring, electromedical, and control instruments manufacturing	39,760

Median annual earnings of civil engineering technicians were \$37,720 in 2002. The middle 50 percent earned between \$29,030 and \$47,260. The lowest 10 percent earned less than \$23,080, and the highest 10 percent earned more than \$56,910. Median annual earnings in the industries employing the largest numbers of civil engineering technicians in 2002 are shown below.

Local government	42,120
Architectural, engineering, and related services	36,930
State government	34,800

In 2002, the average annual salary for aerospace engineering and operations technicians in the aerospace products and parts manufacturing industry was \$54,530, and the average annual salary for environmental engineering technicians in the architectural, engineering, and related services industry was \$32,690. The average annual salary for industrial engineering technicians in the semiconductor and other electronic component manufacturing industry was \$38,230. In the architectural, engineering, and related services industry, the average annual salary for mechanical engineering technicians was \$42,090.

Sources of Additional Information

High school students interested in obtaining information about careers in engineering technology should visit the JETS web site JETS-Guidance, 1420 King St., Suite 405, Alexandria, VA 22314-2794. Internet: <http://www.jets.org>

Information on ABET-accredited engineering technology programs is available from Accreditation Board for Engineering and Technology, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202. Internet: <http://www.abet.org>

Information on certification of engineering technicians as well as job and career information is available from National Institute for Certification in Engineering Technologies (NICET), 1420 King St., Alexandria, VA 22314-2794. Internet: <http://www.nicet.org>

Court Reporters

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Significant Points

- Court reporters usually need a 2- or 4- year postsecondary school degree.
- Demand for real-time and broadcast captioning and translating will result in employment growth in the occupation.
- Job opportunities should be best for those with certification.

Nature of the Work

Court reporters typically take verbatim reports of speeches, conversations, legal proceedings, meetings, and other events when written accounts of spoken words are necessary for correspondence, records, or legal proof. Court reporters play a critical role not only in judicial proceedings, but at every meeting where the spoken word must be preserved as a written transcript. They are responsible for ensuring a complete, accurate, and secure legal record. In addition to preparing and protecting the legal record, many court reporters assist judges and trial attorneys in a variety of ways, such as organizing and searching for information in the official record or making suggestions to judges and attorneys regarding courtroom administration and procedure. Increasingly, court reporters are providing closed-captioning and real-time translating services to the deaf and hard-of-hearing community.

There are two main methods of court reporting: Stenotyping and voice writing. Using a stenotype machine, stenotypists document all statements made in official proceedings. The machine allows them to press multiple keys at a time to record combinations of letters representing sounds, words, or phrases. These symbols are then recorded on computer disks or CD-ROM, which are then translated and displayed as text in a process called computer-aided transcription. In all cases, accuracy is crucial because there is only one person creating an official transcript. In a judicial setting, for example, appeals often depend on the court reporter's transcript. Stenotype machines used for real-time captioning are linked directly to the computer. As the reporter keys in the symbols, they instantly appear as text on the screen. This process, called communications access real-time translation (CART),

is used in courts, in classrooms, at meetings, and for closed captioning for the hearing-impaired on television.

The other method of court reporting is called voice writing. Using the voice-writing method, a court reporter speaks directly into a stenomask—a hand-held mask containing a microphone with a voice silencer. As the reporter repeats the testimony into the recorder, the mask and silencer prevent the reporter from being heard during testimony. Voice writers record everything that is said by judges, witnesses, attorneys, and other parties to a proceeding, including gestures and emotional reactions.

Some voice writers produce a transcript in real time, using computer speech recognition technology. Other voice writers prefer to translate their voice files after the proceeding is over, or they transcribe the files manually, without using speech recognition at all. In any event, speech recognition technology is allowing voice writers to pursue not only court reporting careers, but also careers as closed captioners, CART reporters for hearing-impaired individuals, and Internet streaming text or caption providers.

Court reporters that use either method are responsible for a number of duties both before and after transcribing events. First, they must create and maintain the computer dictionary that they use to translate stenographic strokes or voice record files into written text. They may customize the dictionary with parts of words, entire words, or terminology specific to the proceeding, program, or event—such as a religious service—they plan to transcribe. After documenting proceedings, court reporters must edit their CART translation for correct grammar, for accurate identification of proper names and places, and to ensure that the record or testimony is discernible. They usually prepare written transcripts, make copies, and provide information from the transcript to courts, counsels, parties, and the public upon request. Court reporters also develop procedures for easy storage and retrieval of all stenographic notes and files in paper or digital format.

Although many court reporters record official proceedings in the courtroom, others work outside the courtroom. For example, they may take depositions for attorneys in offices and document proceedings of meetings, conventions, and other private activities. Still others capture the proceedings taking place in government agencies at all levels, from the U.S. Congress to State and local governing bodies. Court reporters, both stenotypists and voice writers, who specialize in captioning live television programming for people with hearing loss are commonly known as **stenocaptioners**. They work for television networks or cable stations, captioning news, emergency broadcasts, sporting events, and other programming. With CART and broadcast captioning, the level of understanding gained by a person with hearing loss depends entirely on the skill of the stenocaptioner. In an emergency, such as a tornado or a hurricane, people's safety may depend entirely on the accuracy of information provided in the form of captioning.

Working Conditions

The majority of court reporters work in comfortable settings, such as offices of attorneys, courtrooms, legislatures, and conventions. An increasing number of court reporters work from home-based offices as independent contractors, or freelancers.

Work in this occupation presents few hazards, although sitting in the same position for long periods can be tiring, and workers can suffer wrist, back, neck, or eye problems due to strain. Workers also risk repetitive motion injuries such as carpal tunnel syndrome. In addition, the pressure to be accurate and fast can be stressful.

Many official court reporters work a standard 40-hour week. Self-employed court reporters, or freelancers, usually work flexible hours, including part time, evenings, and weekends, or they can work on an on-call basis.

Employment

Court reporters held about 18,000 jobs in 2002. About 60 percent worked for State and local governments, a reflection of the large number of court reporters working in courts, legislatures, and various agencies. Most of the remaining wage and salary workers worked for court reporting agencies. Eleven percent of court reporters were self-employed.

Training, Other Qualifications, and Advancement

The amount of training required to become a court reporter varies with the type of reporting chosen. It usually takes less than a year to become a voice writer. In contrast, the average length of time it takes to become a stenotypist is 33 months. Training is offered by about 160 postsecondary vocational and technical schools and colleges. The National Court Reporters Association (NCRA) has approved about 82 programs, all of which offer courses in stenotype computer-aided transcription and real-time reporting. NCRA-approved programs require students to capture a minimum of 225 words per minute, a Federal Government requirement as well.

Some States require court reporters to be notary publics. Others require the certified court reporter (CCR) designation, for which a reporter must pass a State certification test administered by a board of examiners. The NCRA confers the entry-level designation "registered professional reporter" (RPR) upon those who pass a four-part examination and participate in mandatory continuing education programs. Although voluntary, the designation is recognized as a mark of distinction in the field. A reporter may obtain additional certifications that demonstrate higher levels of competency, such as "registered merit reporter" (RMR) or "registered diplomate reporter" (RDR). The RDR is the highest level of certification available to court reporters. In order to receive the designation, a court reporter must either have 5 consecutive years of experience as an RMR or be an RMR and hold a 4-year baccalaureate degree.

The NCRA also offers the designations "certified real-time reporter" (CRR), "certified broadcast captioner" (CBC), and "certified CART provider" (CCP). These designations promote and recognize competence in the specialized skill of converting the spoken word into the written word instantaneously.

Some States require voice writers to pass a test and to earn State licensure. As a substitute for State certification, the National Verbatim Reporters Association offers three national certifications to voice writers: "certified verbatim reporter" (CVR), the certificate of merit (CM), and "real-time verbatim reporter" (RVR). Earning these certifications may be sufficient to get licensed in the State. In order to get the CM or RVR, one must first earn the CVR. Candidates for the CVR must pass a written test

covering punctuation, spelling, grammar, legal terminology, definitions, and more and also must pass, three five-minute dictation and transcription examinations that test for speed as well as accuracy. Passing the CM exam requires a higher level of speed and accuracy. The RVR measures the candidate's skill at real-time transcription. In order to retain these certifications, the voice writer must obtain continuing education credits. Credits are given for voice writer education courses, continuing legal education courses, and college courses.

In addition to possessing speed and accuracy, court reporters must have excellent listening skills, as well as good English grammar, vocabulary, and punctuation skills. Voice writers must learn to listen and speak simultaneously and very quickly, while also identifying speakers and describing peripheral activities in the courtroom or deposition room. They must be aware of business practices and current events as well as the correct spelling of names of people, places, and events that may be mentioned in a broadcast or in court proceedings. For those who work in courtrooms, an expert knowledge of legal terminology and criminal and appellate procedure is essential. Because capturing proceedings requires the use of computerized stenography or speech recognition equipment, court reporters must be knowledgeable about computer hardware and software applications.

With experience and education, court reporters can advance to administrative and management positions, consulting, or teaching.

Job Outlook

Employment of court reporters is projected to grow about as fast as the average for all occupations through 2012. Demand for court reporter services will be spurred by the continuing need for accurate transcription of proceedings in courts and in pretrial depositions and by the growing need to create captions for live or prerecorded television and to provide other real-time translating services for the deaf and hard-of-hearing community. Despite the good job prospects, fewer people are going into this profession, creating a shortage of court reporters—particularly stenographic typists—and making job opportunities very good to excellent. Because of this shortage, voice writers have become more widely accepted as speech recognition technology improves and error rates decline. Still, many courts hire only stenotypists to perform court reporting duties, and because of this practice, demand for these highly skilled reporters will remain high.

Federal legislation mandates that, by 2006, all new television programming must be captioned for the deaf and hard-of-hearing. In addition, the Americans with Disabilities Act gives deaf and hard-of-hearing students in colleges and universities the right to request access to real-time translation in their classes. Both of these factors are expected to increase demand for court reporters to provide real-time captioning and CART services. Although these services forgo transcripts and differ from traditional court reporting, which uses computer-aided transcription to turn spoken words into permanent text, they require the same skills that court reporters learn in their training.

Despite increasing numbers of civil and criminal cases, budget constraints are expected to limit the ability of Federal, State, and local courts to expand, thereby also limiting the demand for traditional court reporting services in courtrooms and other legal venues. Further, in efforts to keep costs down, many courtrooms have

installed tape recorders to maintain records of proceedings. Some jurisdictions have found the error rates associated with tape recorders to be unacceptable, bringing court reporters back to their courtrooms despite budgetary issues. Still, despite the use of audiotape and videotape technology, court reporters can quickly turn spoken words into readable, searchable, permanent text, so they will continue to be needed to produce written legal transcripts and proceedings for publication.

Earnings

Court reporters had median annual earnings of \$41,550 in 2002. The middle 50 percent earned between \$29,770 and \$55,360. The lowest paid 10 percent earned less than \$23,120, and the highest paid 10 percent earned more than \$73,440. Median annual earnings in 2002 were \$40,720 for court reporters working in local government.

Both compensation and compensation methods for court reporters vary with the type of reporting job, the experience of the individual reporter, the level of certification achieved, and the region of the country the reporter works in. Official court reporters earn a salary and a per-page fee for transcripts. Many salaried court reporters supplement their income by doing additional freelance work. Freelance court reporters are paid per job and receive a per-page fee for transcripts. Communication access realtime translation providers are paid hourly. Stenocaptioners receive a salary and benefits if they work as employees of a captioning company; stenocaptioners working as independent contractors are paid hourly.

Sources of Additional Information

State employment service offices can provide information about job openings for court reporters. For information about careers, training, and certification in court reporting, contact any of the following sources:

- National Court Reporters Association, 8224 Old Courthouse Rd., Vienna, VA 22182. Internet: <http://www.ncraonline.org>
- United States Court Reporters Association, P.O. Box 465, Chicago, IL 60690-0465. Internet: <http://www.uscra.org>
- National Verbatim Reporters Association, 207 Third Avenue, Hattiesburg, MS 39401 . Internet: <http://www.nvra.org>

Significant Points

- Formal training programs in radiography range in length from 1 to 4 years and lead to a certificate, associate degree, or bachelor's degree.
- Although hospitals will remain the primary employer, a greater number of new jobs will be found in physicians' offices and diagnostic imaging centers.
- Job opportunities are expected to be favorable; some employers report difficulty hiring sufficient numbers of radiologic technologists and technicians.

Nature of the Work

Radiologic technologists and technicians take x rays and administer nonradioactive materials into patients' bloodstreams for diagnostic purposes. Some specialize in diagnostic imaging technologies, such as computerized tomography (CT) and magnetic resonance imaging (MRI).

Radiologic technologists and technicians, also referred to as **radiographers**, produce x ray films (radiographs) of parts of the human body for use in diagnosing medical problems. They prepare patients for radiologic examinations by explaining the procedure, removing articles such as jewelry, through which x rays cannot pass, and positioning patients so that the parts of the body can be appropriately radiographed. To prevent unnecessary radiation exposure, these workers surround the exposed area with radiation protection devices, such as lead shields, or limit the size of the x ray beam. Radiographers position radiographic equipment at the correct angle and height over the appropriate area of a patient's body. Using instruments similar to a measuring tape, they may measure the thickness of the section to be radiographed and set controls on the x ray machine to produce radiographs of the appropriate density, detail, and contrast. They place the x ray film under the part of the patient's body to be examined and make the exposure. They then remove the film and develop it.

Experienced radiographers may perform more complex imaging procedures. For fluoroscopies, radiographers prepare a solution of contrast medium for the patient to drink, allowing the radiologist (a physician who interprets radiographs) to see soft tissues in the body. Some radiographers, called **CT technologists**, operate CT scanners to produce cross-sectional images of patients. Radiographers who operate machines that use strong magnets and radio waves, rather than radiation, to create an image are called **MRI technologists**.

Radiologic technologists and technicians must follow physicians' orders precisely and conform to regulations concerning the use of radiation to protect themselves, their patients, and their coworkers from unnecessary exposure.

In addition to preparing patients and operating equipment, radiologic technologists and technicians keep patient records and adjust and maintain equipment. They also may prepare work schedules, evaluate equipment purchases, or manage a radiology department.

Working Conditions

Most full-time radiologic technologists and technicians work about 40 hours a week; they may have evening, weekend, or on-call hours. Opportunities for part-time and shift work also are available.

Because technologists and technicians are on their feet for long periods and may lift or turn disabled patients, physical stamina is important. Technologists and technicians work at diagnostic machines, but may also perform some procedures at patients' bedsides. Some travel to patients in large vans equipped with sophisticated diagnostic equipment.

Although radiation hazards exist in this occupation, they are minimized by the use of lead aprons, gloves, and other shielding devices, as well as by instruments monitoring radiation exposure. Technologists and technicians wear badges measuring radiation levels in the radiation area, and detailed records are kept on their cumulative lifetime dose.

Employment

Radiologic technologists and technicians held about 174,000 jobs in 2002. Almost 1 in 5 worked part time. About half of all jobs were in hospitals. Most of the rest were in offices of physicians; medical and diagnostic laboratories, including diagnostic imaging centers; and outpatient care centers.

Training, Other Qualifications, and Advancement

Preparation for this profession is offered in hospitals, colleges and universities, vocational-technical institutes, and the U.S. Armed Forces. Hospitals, which employ most radiologic technologists and technicians, prefer to hire those with formal training.

Formal training programs in radiography range in length from 1 to 4 years and lead to a certificate, associate degree, or bachelor's degree. Two-year associate degree programs are most prevalent.

Some 1-year certificate programs are available for experienced radiographers or individuals from other health occupations, such as medical technologists and registered nurses, who want to change fields or specialize in CT or MRI. A bachelor's or master's degree in one of the radiologic technologies is desirable for supervisory, administrative, or teaching positions.

The Joint Review Committee on Education in Radiologic Technology accredits most formal training programs for the field. The committee accredited 587 radiography programs in 2003. Radiography programs require, at a minimum, a high school diploma or the equivalent. High school courses in mathematics, physics, chemistry, and biology are helpful. The programs provide both classroom and clinical instruction in anatomy and physiology, patient care procedures, radiation physics, radiation protection, principles of imaging, medical terminology, positioning of patients, medical ethics, radiobiology, and pathology.

Federal legislation protects the public from the hazards of unnecessary exposure to medical and dental radiation by ensuring operators of radiologic equipment are properly trained. Under this legislation, the Federal Government sets voluntary standards that the States, in turn, may use for accrediting training programs and certifying individuals who engage in medical or dental radiography.

In 2003, about 38 States licensed radiologic technologists and technicians. Voluntary registration is offered by the American Registry of Radiologic Technologists. To be eligible for registration, technologists generally must have graduated from an accredited program and pass an examination. Many employers prefer to hire registered radiographers. To be recertified, radiographers must complete 24 hours of continuing education every other year.

Radiologic technologists and technicians should be sensitive to patients' physical and psychological needs. They must pay attention to detail, follow instructions, and work as part of a team. In addition, operating complicated equipment requires mechanical ability and manual dexterity.

With experience and additional training, staff technologists may become specialists, performing CT scanning, angiography, and magnetic resonance imaging. Experienced technologists also may be promoted to supervisor, chief radiologic technologist, and, ultimately, department administrator or director. Depending on the institution, courses or a master's degree in business or health administration may be necessary for the director's position. Some technologists progress by leaving the occupation to become instructors or directors in radiologic technology programs; others take jobs as sales representatives or instructors with equipment manufacturers.

Job Outlook

Job opportunities are expected to be favorable. Some employers report difficulty hiring sufficient numbers of radiologic technologists and technicians. Imbalances between the demand for, and supply of, qualified workers should spur efforts to attract and retain qualified radiologic technologists and technicians. As an example of such efforts, employers may provide more flexible training programs or improve compensation and working conditions.

Radiologic technologists who also are experienced in more complex diagnostic imaging procedures, such as CT or MRI, will have better employment opportunities, as employers seek to control costs by using multiskilled employees.

Employment of radiologic technologists and technicians is expected to grow faster than the average for all occupations through 2012, as the population grows and ages, increasing the demand for diagnostic imaging. Although healthcare providers are enthusiastic about the clinical benefits of new technologies, the extent to which they are adopted depends largely on cost and reimbursement considerations. For example, digital imaging technology can improve quality and efficiency, but remains expensive. Some promising new technologies may not come into widespread use because they are too expensive and third-party payers may not be willing to pay for their use.

Hospitals will remain the principal employer of radiologic technologists and technicians. However, a greater number of new jobs will be found in offices of

physicians and diagnostic imaging centers. Health facilities such as these are expected to grow rapidly through 2012, due to the strong shift toward outpatient care, encouraged by third-party payers and made possible by technological advances that permit more procedures to be performed outside the hospital. Some job openings also will arise from the need to replace technologists and technicians who leave the occupation.

Earnings

Median annual earnings of radiologic technologists and technicians were \$38,970 in 2002. The middle 50 percent earned between \$32,370 and \$46,510. The lowest 10 percent earned less than \$27,190, and the highest 10 percent earned more than \$55,430. Median annual earnings in the industries employing the largest numbers of radiologic technologists and technicians in 2002 were as follows:

Medical and diagnostic laboratories	\$42,470
General medical and surgical hospitals	39,580
Offices of physicians	36,490

Sources of Additional Information

For career information, send a stamped, self-addressed business-size envelope with your request to American Society of Radiologic Technologists, 15000 Central Ave. SE., Albuquerque, NM 87123-3917. Telephone (tollfree): 800-444-2778. Internet: <http://www.asrt.org>

For the current list of accredited education programs in radiography, write to Joint Review Committee on Education in Radiologic Technology, 20 N. Wacker Dr., Suite 900, Chicago, IL 60606-2901. Internet: <http://www.jrcert.org>

For information on certification, contact American Registry of Radiologic Technologists, 1255 Northland Dr., St. Paul, MN 55120-1155. Internet: <http://www.arrt.org>

Significant Points

- An associate degree has become the general requirement for entry into this field.
- Hospitals will continue to employ the vast majority of respiratory therapists, but a growing number of therapists will work in other settings.
- Job opportunities will be very good, especially for therapists with cardiopulmonary care skills or experience working with newborns and infants.

Nature of the Work

Respiratory therapists and respiratory therapy technicians—also known as respiratory care practitioners—evaluate, treat, and care for patients with breathing or other cardiopulmonary disorders. Respiratory therapists, practicing under physician direction, assume primary responsibility for all respiratory care therapeutic treatments and diagnostic procedures, including the supervision of respiratory therapy technicians. Respiratory therapy technicians follow specific, well-defined respiratory care procedures, under the direction of respiratory therapists and physicians. In clinical practice, many of the daily duties of therapists and technicians overlap, although therapists generally have greater responsibility than technicians. For example, respiratory therapists will primarily consult with physicians and other healthcare staff to help develop and modify individual patient care plans. Respiratory therapists are also more likely to provide complex therapy requiring considerable independent judgment, such as caring for patients on life support in hospital intensive care units. In this statement, the term **respiratory therapists** includes both respiratory therapists and respiratory therapy technicians.

To evaluate patients, respiratory therapists interview them, perform limited physical examinations, and conduct diagnostic tests. For example, respiratory therapists test patients' breathing capacity and determine the concentration of oxygen and other gases in patients' blood. They also measure patients' pH, which indicates the acidity or alkalinity level of the blood. To evaluate a patient's lung capacity, respiratory therapists have the patient breathe into an instrument that measures the volume and flow of oxygen during inhalation and exhalation. By comparing the reading with the norm for the patient's age, height, weight, and sex, respiratory therapists can provide information that helps determine whether the patient has any lung deficiencies. To analyze oxygen, carbon dioxide, and pH levels, therapists draw an arterial blood sample, place it in a blood gas analyzer, and relay the results to a physician. Physicians rely on data provided by respiratory therapists to make treatment decisions.

Respiratory therapists treat all types of patients, ranging from premature infants whose lungs are not fully developed to elderly people whose lungs are diseased. Respiratory therapists provide temporary relief to patients with chronic asthma or emphysema, as well as emergency care to patients who are victims of a heart attack, stroke, drowning, or shock.

To treat patients, respiratory therapists use oxygen or oxygen mixtures, chest physiotherapy, and aerosol medications. When a patient has difficulty getting enough oxygen into their blood, therapists increase the patient's concentration of oxygen by

placing an oxygen mask or nasal cannula on a patient and set the oxygen flow at the level prescribed by a physician. Therapists also connect patients who cannot breathe on their own to ventilators that deliver pressurized oxygen into the lungs. The therapists insert a tube into the patient's trachea, or windpipe; connect the tube to the ventilator; and set the rate, volume, and oxygen concentration of the oxygen mixture entering the patient's lungs.

Therapists perform regular checks on patients and equipment. If the patient appears to be having difficulty, or if the oxygen, carbon dioxide, or pH level of the blood is abnormal, therapists change the ventilator setting according to the doctor's orders or check the equipment for mechanical problems. In home care, therapists teach patients and their families to use ventilators and other life-support systems. In addition, therapists visit patients several times a month to inspect and clean equipment and to ensure its proper use. Therapists also make emergency visits if equipment problems arise.

Respiratory therapists perform chest physiotherapy on patients to remove mucus from their lungs and make it easier for them to breathe. For example, during surgery, anesthesia depresses respiration, so chest physiotherapy may be prescribed to help get the patient's lungs back to normal and to prevent congestion. Chest physiotherapy also helps patients suffering from lung diseases, such as cystic fibrosis, that cause mucus to collect in the lungs. Therapists place patients in positions that help drain mucus, and then they thump and vibrate the patients' rib cages and instruct the patients to cough.

Respiratory therapists also administer aerosols—liquid medications suspended in a gas that forms a mist which is inhaled—and teach patients how to inhale the aerosol properly to ensure its effectiveness.

In some hospitals, therapists perform tasks that fall outside their traditional role. Therapists' tasks are expanding into cardiopulmonary procedures such as taking electrocardiograms and administering stress tests, as well as other areas—for example, drawing blood samples from patients. Therapists also keep records of materials used and charges to patients.

Working Conditions

Respiratory therapists generally work between 35 and 40 hours a week. Because hospitals operate around the clock, therapists may work evenings, nights, or weekends. They spend long periods standing and walking between patients' rooms. In an emergency, therapists work under a great deal of stress. Respiratory therapists employed in home healthcare must travel frequently to the homes of patients.

Respiratory therapists are trained to work with gases stored under pressure that can be hazardous. Adherence to safety precautions and regular maintenance and testing of equipment minimize the risk of injury. As in many other health occupations, respiratory therapists run a risk of catching an infectious disease, but carefully following proper procedures minimizes this risk.

Employment

Respiratory therapists held about 112,000 jobs in 2002. More than 4 out of 5 jobs were in hospital departments of respiratory care, anesthesiology, or pulmonary medicine. Most of the remaining jobs were found in offices of physicians or other health practitioners, consumer goods rental firms that supply respiratory equipment for home use, nursing care facilities, and home healthcare services. Holding a second job is relatively common for respiratory therapists. About 17 percent held another job, compared with 5 percent of workers in all occupations.

Training, Other Qualifications, and Advancement

Formal training is necessary for entry into this field. Training is offered at the postsecondary level by colleges and universities, medical schools, vocational-technical institutes, and the Armed Forces. An associate degree has become the general requirement for entry into this field. Most programs award associate or bachelor's degrees and prepare graduates for jobs as advanced respiratory therapists. Other programs award associate degrees or certificates and lead to jobs as entry-level respiratory therapists. According to the Commission on Accreditation of Allied Health Education Programs (CAAHEP), 59 entry-level and 319 advanced respiratory therapy programs are presently accredited in the United States, including Puerto Rico.

Areas of study in respiratory therapy programs include human anatomy and physiology, pathophysiology, chemistry, physics, microbiology, pharmacology, and mathematics. Other courses deal with therapeutic and diagnostic procedures and tests, equipment, patient assessment, cardiopulmonary resuscitation, application of clinical practice guidelines, patient care outside of hospitals, cardiac and pulmonary rehabilitation, respiratory health promotion and disease prevention, and medical recordkeeping and reimbursement.

More than 40 States license respiratory care personnel. Aspiring respiratory care practitioners should check on licensure requirements with the board of respiratory care examiners for the State in which they plan to work. Also, most employers require respiratory therapists to maintain a cardiopulmonary resuscitation (CPR) certification.

The National Board for Respiratory Care (NBRC) offers voluntary certification and registration to graduates of programs accredited by CAAHEP or the Committee on Accreditation for Respiratory Care (CoARC). Two credentials are awarded to respiratory therapists who satisfy the requirements: Registered Respiratory Therapist (RRT) and Certified Respiratory Therapist (CRT). Graduates from accredited programs in respiratory therapy may take the CRT examination. CRTs who meet education and experience requirements can take two separate examinations leading to the award of the RRT credential. The CRT examination is the standard in the States requiring licensure.

Most employers require applicants for entry-level or generalist positions to hold the CRT or at least be eligible to take the certification examination. Supervisory positions and intensive-care specialties usually require the RRT or RRT eligibility.

Therapists should be sensitive to patients' physical and psychological needs. Respiratory care practitioners must pay attention to detail, follow instructions, and work as part of a team. In addition, operating advanced equipment requires proficiency with computers.

High school students interested in a career in respiratory care should take courses in health, biology, mathematics, chemistry, and physics. Respiratory care involves basic mathematical problem solving and an understanding of chemical and physical principles. For example, respiratory care workers must be able to compute dosages of medication and calculate gas concentrations.

Respiratory therapists advance in clinical practice by moving from general care to care of critical patients who have significant problems in other organ systems, such as the heart or kidneys. Respiratory therapists, especially those with 4-year degrees, may also advance to supervisory or managerial positions in a respiratory therapy department. Respiratory therapists in home healthcare and equipment rental firms may become branch managers. Some respiratory therapists advance by moving into teaching positions.

Job Outlook

Job opportunities are expected to be very good, especially for respiratory therapists with cardiopulmonary care skills or experience working with infants. Employment of respiratory therapists is expected to increase faster than the average for all occupations through the year 2012, because of substantial growth in numbers of the middle-aged and elderly population—a development that will heighten the incidence of cardiopulmonary disease.

Older Americans suffer most from respiratory ailments and cardiopulmonary diseases such as pneumonia, chronic bronchitis, emphysema, and heart disease. As their numbers increase, the need for respiratory therapists will increase as well. In addition, advances in treating victims of heart attacks, accident victims, and premature infants (many of whom are dependent on a ventilator during part of their treatment) will increase the demand for the services of respiratory care practitioners.

Although hospitals will continue to employ the vast majority of therapists, a growing number can expect to work outside of hospitals in home healthcare services, offices of physicians or other health practitioners, or consumer goods rental firms.

Earnings

Median annual earnings of respiratory therapists were \$40,220 in 2002. The middle 50 percent earned between \$34,430 and \$46,130. The lowest 10 percent earned less than \$30,270, and the highest 10 percent earned more than \$54,030. In general, medical and surgical hospitals, median annual earnings of respiratory therapists were \$40,390 in 2002.

Median annual earnings of respiratory therapy technicians were \$34,130 in 2002. The middle 50 percent earned between \$28,460 and \$41,140. The lowest 10 percent earned less than \$23,230, and the highest 10 percent earned more than \$47,800.

Median annual earnings of respiratory therapy technicians employed in general medical and surgical hospitals were \$34,210 in 2002.

Sources of Additional Information

Information concerning a career in respiratory care is available from American Association for Respiratory Care, 9425 N. MacArthur Blvd Suite 100, Irving, TX 75063-4706. Internet: <http://www.aarc.org>

For a list of accredited educational programs for respiratory care practitioners, contact:

- Commission on Accreditation for Allied Health Education Programs, 39 East Wacker Dr., Chicago, IL 60601. Internet: <http://www.caahep.org>
- Committee on Accreditation for Respiratory Care, 1248 Harwood Rd., Bedford, TX 76021-4244.

Information on gaining credentials in respiratory care and a list of State licensing agencies can be obtained from National Board for Respiratory Care, Inc., 8310 Nieman Rd., Lenexa, KS 66214-1579. Internet: <http://www.nbrc.org>

Science Technicians

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Significant Points

- Science technicians in production jobs can be employed on day, evening, or night shifts.
- Many employers prefer applicants who have at least 2 years of specialized training or an associate degree.
- Job opportunities are expected to be best for graduates of applied science technology programs.
- Job growth will be concentrated in pharmaceutical manufacturing, chemical manufacturing, and biotechnological research and development firms.

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 of 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, for 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 in which scientists work. Occupational titles, therefore, tend to follow the same structure as those for 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 a forensic science laboratory. 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 them in product development.

Chemical technicians work with chemists and chemical engineers, developing and using chemicals and related products and equipment. Generally, there are two types of chemical technicians—research and development technicians who work in experimental laboratories, and process control technicians who work in manufacturing or other industrial plants. Many research and development chemical technicians conduct a variety of laboratory procedures, from routine process control to complex research projects. For example, they may collect and analyze samples of air and water to monitor pollution levels or produce compounds through complex organic synthesis. Most process technicians work in manufacturing, where they test packaging for design, integrity of materials, and environmental acceptability. Often, process technicians who work in plants also focus on quality assurance: there, they monitor product quality or production processes and develop new production techniques. A few work in shipping to provide technical support and expertise for these functions.

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.

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, and may provide information and expert opinion to investigators. 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 usually work in a forest under the supervision of a forester, conducting specific tasks such as measuring timber, supervising harvesting operations, assisting in road building operations, and locating property lines and features. They also may 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 advanced 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 and element composition using scanning electron microscopes. 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 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 cannot 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 208,000 jobs in 2002. As indicated by the following tabulation, chemical and biological technicians accounted for over half of all jobs:

Chemical technicians	69,000
Biological technicians	48,000
Environmental science and protection technicians, including health	28,000
Agricultural and food science technicians	20,000
Forest and conservation technicians	19,000
Geological and petroleum technicians	11,000
Forensic science technicians	8,400
Nuclear technicians	5,700

Chemical technicians held jobs in a wide range of manufacturing and service industries, but were concentrated in chemical manufacturing, where they held 26,000 jobs. About 17,000 worked in professional, scientific, or technical services firms; about 17,000 biological technicians also worked in professional, scientific, or technical services firms. Most other biological technicians worked in pharmaceutical and medicine manufacturing or for Federal, State, or local governments. Significant numbers of environmental science and protection technicians also worked for State and local governments and professional, scientific, and technical services firms. Almost two-thirds of forest and conservation technicians held jobs in the Federal Government; another 20 percent worked for State governments. Around 22 percent of agricultural and food science technicians worked for food processing companies; most of the rest worked for scientific research and development services firms and State governments. Over one-fifth of all 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 do 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.

More than 20 colleges or universities offer a bachelor's degree program in forensic science; more than 10 additional schools offer a bachelor's of science in chemistry, biochemistry, or genetic engineering with an emphasis on forensic science; a few additional schools offer a bachelor's of science degree with an emphasis in a specialty area, such as criminalistics, pathology, jurisprudence, odontology, toxicology, or forensic accounting. 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. Knowledge and understanding of legal procedures also can be helpful. Forestry and conservation technicians can choose from more than 20 associate degree programs in forest technology accredited by the Society of American Foresters.

Most chemical process technicians have a 2-year degree, usually an associate degree in process technology, although in some cases a high school diploma is sufficient. They usually receive additional on-the-job training. Entry-level workers whose college training encompasses extensive hands-on experience with a variety of diagnostic laboratory equipment usually require less on-the-job training. Those with a high school diploma typically begin work as trainees under the direct supervision of a more experienced process technician. Many with only a high school diploma eventually earn a 2-year degree in process technology, often paid for by their employer.

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 or bachelor's degree program, should be laboratory oriented, with an emphasis on bench skills. A solid background in applied basic chemistry, physics, and math is vital. Because computers often are used in research and development laboratories, technicians should have strong computer skills. Communication skills also are important; technicians often are required to report their findings both orally 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 also are important. High mechanical aptitude, attention to detail, and analytical thinking are all important characteristics of science technicians.

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 have held summer jobs in laboratories also are 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 those of 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 2012. Continued growth of scientific and medical research, particularly research related to biotechnology, as well as the development and production of technical products, should stimulate demand for science technicians in many industries. The increase in the number of biological technicians will be about as fast as average, as the growing number of agricultural and medicinal products developed using biotechnology techniques will boost demand for these workers. Also, stronger competition among pharmaceutical 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 pharmaceutical and medicine manufacturing industry and in scientific research and development services firms.

Job growth for chemical technicians is projected to grow more slowly than average. The chemical manufacturing industry, the major employer of chemical technicians, will experience a decline in overall employment as companies downsize and turn to outside contractors to provide specialized services. Job opportunities are expected to be more plentiful in pharmaceutical and medicine manufacturing as the public continues to demand newer and better pharmaceuticals. To meet this demand, pharmaceutical manufacturing firms are expected to continue to devote money to research and development, either through in-house teams, or, increasingly, by contracting to scientific research and development services firms, spurring employment growth of chemical technicians in that industry. An increasing focus on quality assurance will require a greater number of process technicians, further stimulating demand for these workers.

Employment of environmental science and protection technicians should grow much faster than average 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.

There will be limited demand for forest and conservation technicians at the Federal and State government levels, leading to slower-than-average growth, due to general downsizing and reductions in timber harvesting on Federal lands. However, increased emphasis on specific conservation issues, such as environmental protection, water resources preservation, and control of exotic and invasive pests, may provide some employment opportunities.

Employment of agricultural and food science technicians should grow more slowly than average, mainly due to limited growth in agriculture and the food processing industry. However, research will still be necessary, particularly biotechnological research in the private sector, as it becomes increasingly important to balance greater agricultural output with protection and preservation of soil, water, and the ecosystem. Specifically, research will be needed to combat insects and diseases as they continue to adapt to pesticides and as soil fertility and water quality continue to need improvement.

Jobs for forensic science technicians are expected to increase about as fast as average. Crime scene technicians who work for State Public Safety Departments may experience favorable employment prospects if the number of qualified applicants remains low.

Little or no growth in employment of geological and petroleum technicians is expected because employment in the oil and gas extraction and mining industries, among the largest employers of geological and petroleum technicians, is expected to decline. Job opportunities will be more favorable in professional, scientific, and technical services firms, as geological and petroleum technicians will be needed to consult companies regarding environmental policy and Federal Government mandates, such as those requiring lower sulfur emissions.

Job opportunities are expected to be best for graduates of 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 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 2002 were as follows:

Nuclear technicians	\$28.84
Forensic science technicians	19.73
Geological and petroleum technicians	18.96
Chemical technicians	18.00
Environmental science and protection technicians, including health	16.98

Biological technicians	15.73
Forest and conservation technicians	14.90
Agricultural and food science technicians	13.74

In 2003, the average annual salary in nonsupervisory, supervisory, and managerial positions in the Federal Government was \$30,440 for biological science technicians; \$44,068 for physical science technicians; \$55,374 for geodetic technicians; \$40,781 for hydrologic technicians; and \$52,585 for meteorological 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 forensic sciences, contact American Academy of Forensic Sciences, P.O. Box 669, Colorado Springs, CO, 80901. Internet: <http://www.aafs.org>

For general education 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>

Heavy Vehicle Mechanics

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Significant Points

- Opportunities should be good for persons with formal postsecondary training in diesel or heavy equipment mechanics, especially if they also have training in basic electronics and hydraulics.
- This occupation offers relatively high wages and the challenge of skilled repair work.
- Skill in using computerized diagnostic equipment is becoming more important.

Nature of the Work

Heavy vehicles and mobile equipment are indispensable to many industrial activities, from construction to railroads. Various types of equipment move materials, till land, lift beams, and dig earth to pave the way for development and production. **Heavy vehicle and mobile equipment service technicians and mechanics** repair and maintain engines and hydraulic, transmission, and electrical systems powering farm equipment, cranes, bulldozers, and railcars.

Service technicians perform routine maintenance checks on diesel engines and on fuel, brake, and transmission systems to ensure peak performance, safety, and longevity of the equipment. Maintenance checks and comments from equipment operators usually alert technicians to problems. With many types of modern heavy

and mobile equipment, technicians can plug hand-held diagnostic computers into onboard computers to diagnose any component needing adjustment or repair. After locating the problem, these technicians rely on their training and experience to use the best possible technique to solve the problem. If necessary, they may partially dismantle the component to examine parts for damage or excessive wear. Then, using hand-held tools, they repair, replace, clean, and lubricate parts as necessary. In some cases, technicians calibrate systems by typing codes into the onboard computer. After reassembling the component and testing it for safety, they put it back into the equipment and return the equipment to the field.

Many types of heavy and mobile equipment use hydraulics, to raise and lower movable parts. When hydraulic components malfunction, technicians examine them for fluid leaks, ruptured hoses, or worn gaskets on fluid reservoirs. Occasionally, the equipment requires extensive repairs, as when a defective hydraulic pump is replaced.

In addition to conducting routine maintenance checks, service technicians perform a variety of other repairs. They diagnose electrical problems and adjust or replace defective components. They also disassemble and repair undercarriages and track assemblies. Occasionally, technicians weld broken equipment frames and structural parts, using electric or gas welders.

It is common for technicians in large shops to specialize in one or two types of repair. For example, a shop may have individual specialists in major engine repair, transmission work, electrical systems, and suspension or brake systems. The technology used in heavy equipment is becoming more sophisticated with the increased use of electronic and computer-controlled components. Training in electronics is essential for these technicians to make engine adjustments and diagnose problems. Training in the use of hand-held computers also is necessary, because computers help technicians diagnose problems and adjust the functions of components.

Service technicians use a variety of tools in their work: power tools, such as pneumatic wrenches, to remove bolts quickly; machine tools, like lathes and grinding machines, to rebuild brakes; welding and flame-cutting equipment, to remove and repair exhaust systems; and jacks and hoists, to lift and move large parts. Service technicians also use common hand tools—screwdrivers, pliers, and wrenches—to work on small parts and to get at hard-to-reach places. They may use a variety of computerized testing equipment to pinpoint and analyze malfunctions in electrical systems and other essential systems. For example, tachometers and dynamometers serve to locate engine malfunctions. Service technicians also use ohmmeters, ammeters, and voltmeters when working on electrical systems.

Mobile heavy equipment mechanics and service technicians keep construction and surface mining equipment, such as bulldozers, cranes, crawlers, draglines, graders, excavators, and other equipment, in working order. Typically, these workers are employed by equipment wholesale distribution and leasing firms, large construction and mining companies, local and Federal governments, and other organizations operating and maintaining heavy machinery and equipment fleets. Service technicians employed by the Federal Government may work on tanks and other armored equipment.

Farm equipment mechanics service, maintain, and repair farm equipment, as well as smaller lawn and garden tractors sold to suburban homeowners. What typically was a general repairer's job around the farm has evolved into a specialized technical career. Farmers have increasingly turned to farm equipment dealers to service and repair their equipment because the machinery has grown in complexity. Modern equipment uses more electronics and hydraulics, making it difficult to perform repairs without some specialized training.

Farm equipment mechanics work mostly on equipment brought into the shop for repair and adjustment. During planting and harvesting seasons, they may travel to farms to make emergency repairs to minimize delays in farm operations.

Railcar repairers specialize in servicing railroad locomotives and other rolling stock, streetcars and subway cars, or mine cars. Most work for railroads, public and private transit companies, and railcar manufacturers.

Working Conditions

Service technicians usually work indoors, although many make repairs at the worksite. To repair vehicles and equipment, technicians often lift heavy parts and tools, handle greasy and dirty parts, and stand or lie in awkward positions. Minor cuts, burns, and bruises are common; serious accidents normally are avoided when the shop is kept clean and orderly and when safety practices are observed.

Technicians usually work in well-lighted, heated, and ventilated areas. However, some shops are drafty and noisy. Many employers provide uniforms, locker rooms, and shower facilities.

When heavy or mobile equipment breaks down at a construction site, it may be too difficult or expensive to bring it into a repair shop, so the shop often sends a field service technician to the site to make repairs. Field service technicians work outdoors and spend much of their time away from the shop. Generally, the more experienced service technicians specialize in field service. They usually drive trucks specially equipped with replacement parts and tools. On occasion, they must travel many miles to reach disabled machinery. Field technicians normally earn a higher wage than their counterparts, because they are required to make on-the-spot decisions that are necessary to serve their customers.

The hours of work for farm equipment mechanics vary according to the season of the year. During the busy planting and harvesting seasons, mechanics often work 6 or 7 days a week, 10 to 12 hours daily. In slow winter months, however, mechanics may work fewer than 40 hours a week.

Employment

Heavy vehicle and mobile equipment service technicians and mechanics held about 176,000 jobs in 2002. Approximately 126,000 were mobile heavy equipment mechanics, 35,000 were farm equipment mechanics, and 15,000 were railcar repairers. About a third were employed by machinery, equipment, and supplies merchant wholesalers. More than 12 percent were employed by Federal, State, and local governments, and another 12 percent worked in construction, primarily for specialty trade contractors and highway, street, and bridge construction companies. Other service technicians worked in agriculture; mining; rail transportation and

support activities; and commercial and industrial machinery and equipment rental, leasing, and repair. A small number repaired equipment for machinery and railroad rolling stock manufacturers or lawn and garden equipment and supplies stores. Less than 5 percent of service technicians were self-employed.

Nearly every section of the country employs heavy and mobile equipment service technicians and mechanics, although most work in towns and cities where equipment dealers, equipment rental and leasing companies, and construction companies have repair facilities.

Training, Other Qualifications, and Advancement

Many persons qualify for service technician jobs through years of on-the-job training, but most employers prefer that applicants complete a formal diesel or heavy equipment mechanic training program after graduating from high school. They seek persons with mechanical aptitude who are knowledgeable about the fundamentals of diesel engines, transmissions, electrical systems, and hydraulics. In addition, the constant change in equipment technology makes it necessary for technicians to be flexible and have the capacity to learn new skills quickly.

Many community colleges and vocational schools offer programs in diesel technology. Some tailor programs to heavy equipment mechanics. These programs educate the student in the basics of analytical and diagnostic techniques, electronics, and hydraulics. The increased use of electronics and computers makes training in the fundamentals of electronics essential for new heavy and mobile equipment mechanics. Some 1- to 2-year programs lead to a certificate of completion, whereas others lead to an associate degree in diesel or heavy equipment mechanics. These programs not only provide a foundation in the components of diesel and heavy equipment technology, but also enable trainee technicians to advance more rapidly to the journey, or experienced worker, level.

A combination of formal and on-the-job training prepares trainee technicians with the knowledge to service and repair equipment handled by a shop. After a few months' experience, most beginners perform routine service tasks and make minor repairs. As they prove their ability and competence, they advance to harder jobs. After trainees master the repair and service of diesel engines, they learn to work on related components, such as brakes, transmissions, and electrical systems. Generally, a service technician with at least 3 to 4 years of on-the-job experience is accepted as fully qualified.

Many employers send trainee technicians to training sessions conducted by heavy equipment manufacturers. The sessions, which typically last up to 1 week, provide intensive instruction in the repair of the manufacturer's equipment. Some sessions focus on particular components found in the equipment, such as diesel engines, transmissions, axles, and electrical systems. Other sessions focus on particular types of equipment, such as crawler-loaders and crawler-dozers. As they progress, trainees may periodically attend additional training sessions. When appropriate, experienced technicians attend training sessions to gain familiarity with new technology or equipment.

High school courses in automobile repair, physics, chemistry, and mathematics provide a strong foundation for a career as a service technician or mechanic. It is

also essential for technicians to be able to read and interpret service manuals in order to keep abreast of engineering changes. Experience working on diesel engines and heavy equipment acquired in the Armed Forces is valuable as well.

Voluntary certification by the National Institute for Automotive Service Excellence is recognized as the standard of achievement for heavy vehicle and mobile equipment service technicians, who may be certified as a master heavy-duty diesel technician or in a specific area of heavy-duty equipment repair, such as brakes, gasoline engines, diesel engines, drive trains, electrical systems, or suspension and steering. For certification in each area, technicians must pass a written examination and have at least 2 years' experience. High school, vocational or trade school, or community or junior college training in gasoline or diesel engine repair may substitute for up to 1 year's experience. To remain certified, technicians must be retested every 5 years. Retesting ensures that service technicians keep up with changing technology. However, there are currently no certification programs for other heavy vehicle and mobile equipment repair specialties.

The most important work possessions of technicians are their hand tools. Service technicians typically buy their own hand tools, and many experienced technicians have thousands of dollars invested in them. Employers typically furnish expensive power tools, computerized engine analyzers, and other diagnostic equipment, but handtools are normally accumulated with experience.

Experienced technicians may advance to field service jobs, wherein they have a greater opportunity to tackle problems independently and earn additional pay. Technicians with leadership ability may become shop supervisors or service managers. Some technicians open their own repair shops or invest in a franchise.

Job Outlook

Opportunities for heavy vehicle and mobile equipment service technicians and mechanics should be good for those who have completed formal training programs in diesel or heavy equipment mechanics. Persons without formal training are expected to encounter growing difficulty entering these jobs.

Employment of heavy vehicle and mobile equipment service technicians and mechanics is expected to grow slower than the average for all occupations through the year 2012. Most job openings will arise from the need to replace experienced repairers who retire. Employers report difficulty finding candidates with formal postsecondary training to fill available service technician positions, because many young people with mechanic training and experience opt to take jobs as automotive service technicians, diesel service technicians, or industrial machinery repairers—jobs that offer more openings and a wider variety of locations in which to work.

Faster employment growth is expected for mobile heavy equipment mechanics than for farm equipment mechanics or railcar repairers. Increasing numbers of heavy duty and mobile equipment service technicians will be required to support growth in the construction industry, equipment dealers, and rental and leasing companies. Because of the nature of construction activity, demand for service technicians follows the Nation's economic cycle. As the economy expands, construction activity increases, resulting in the use of more mobile heavy equipment to grade construction sites, excavate basements, and lay water and sewer lines. The increased use of such

equipment increases the need for periodic service and repair. In addition, the construction and repair of highways and bridges requires more technicians to service equipment. As equipment becomes more complicated, repairs increasingly must be made by specially trained technicians. Job openings for farm equipment mechanics and railcar repairers are expected to arise mostly because of replacement needs.

Construction and mining are particularly sensitive to changes in the level of economic activity; therefore, heavy and mobile equipment may be idled during downturns. In addition, winter is traditionally the slow season for construction and farming activity, particularly in cold regions. Few technicians may be needed during periods when equipment is used less; however, employers usually try to retain experienced workers. Employers may be reluctant to hire inexperienced workers during slow periods.

Earnings

Median hourly earnings of mobile heavy equipment mechanics were \$17.29 in 2002. The middle 50 percent earned between \$14.13 and \$20.88. The lowest 10 percent earned less than \$11.54, and the highest 10 percent earned more than \$24.90. Median hourly earnings in the industries employing the largest numbers of mobile heavy equipment mechanics in 2002 were as follows:

Federal Government	\$19.44
Local government	18.03
Other specialty trade contractors	17.72
Machinery, equipment, and supplies merchant wholesalers	17.10
Commercial and industrial machinery and equipment rental and leasing	15.81

Median hourly earnings of farm equipment mechanics were \$13.03 in 2002. The middle 50 percent earned between \$10.50 and \$16.01. The lowest 10 percent earned less than \$8.73, and the highest 10 percent earned more than \$18.86.

Median hourly earnings of railcar repairers were \$18.78 in 2002. The middle 50 percent earned between \$15.65 and \$21.18. The lowest 10 percent earned less than \$12.07, and the highest 10 percent earned more than \$23.76. In 2002, median hourly earnings were \$19.72 in rail transportation, the industry employing the largest number of railcar repairers.

Many heavy vehicle and mobile equipment service technicians and mechanics are members of unions, including the International Association of Machinists and Aerospace Workers, the International Union of Operating Engineers, and the International Brotherhood of Teamsters.

Sources of Additional Information

More details about job openings for heavy vehicle and mobile equipment service technicians and mechanics may be obtained from local heavy and mobile equipment dealers and distributors, construction contractors, and government agencies. Local

offices of the State employment service also may have information on job openings and training programs.

For general information about a career as a heavy vehicle and mobile equipment service technician or mechanic, contact:

- Association of Equipment Management Professionals, P.O. Box 1368, Glenwood Springs, CO 81602. Internet: <http://www.equipment.org>
- The AED Foundation (Associated Equipment Distributors affiliate), 615 W. 22nd St., Oak Brook, IL 60523. Internet: http://www.aednet.org/aed_foundation

For a directory of public training programs in heavy and mobile equipment mechanics, contact SkillsUSA-VICA, P.O. Box 3000, Leesburg, VA 20177-0300. Internet: <http://www.skillsusa.org>

A list of certified diesel service technician training programs can be obtained from National Automotive Technician Education Foundation (NATEF), 101 Blue Seal Dr., Suite 101, Leesburg, VA 20175. Internet: <http://www.natef.org>

Information on certification as a heavy-duty diesel service technician is available from National Institute for Automotive Service Excellence (ASE), 101 Blue Seal Dr. SE., Suite 101, Leesburg, VA 20175. Internet: <http://www.asecert.org>

Significant Points

- Both formal and on-the-job training are suggested if a worker wants to become a fully skilled automotive body repairer, because advances in technology have greatly changed the structure, components, and materials used in automobiles.
- Repairers need good reading ability and basic mathematics and computer skills in order to follow instructions and diagrams in print and computer-based technical manuals.

Nature of the Work

Thousands of motor vehicles are damaged in traffic accidents every day. Although some of these vehicles are beyond repair, others can be made to look and drive like new. Automotive body repairers straighten bent bodies, remove dents, and replace crumpled parts that cannot be fixed. They repair all types of vehicles, but work mostly on cars and small trucks, although some work on large trucks, buses, or tractor-trailers.

Automotive body repairers use special equipment to restore damaged metal frames and body sections. Repairers chain or clamp frames and sections to alignment machines that use hydraulic pressure to align damaged components. “Unibody” vehicles—designs built without frames—must be restored to precise factory specifications for the vehicle to operate correctly. To do so, repairers use benchmark systems to make accurate measurements of how much each section is out of alignment and hydraulic machinery to return the vehicle to its original shape.

Body repairers remove badly damaged sections of body panels with a pneumatic metal-cutting gun or by other means and weld in replacement sections. Repairers pull out less serious dents with a hydraulic jack or hand prying bar or knock them out with hand tools or pneumatic hammers. They smooth out small dents and creases in the metal by holding a small anvil against one side of the damaged area while hammering the opposite side. Repairers also remove very small pits and dimples with pick hammers and punches in a process called metal finishing.

Body repairers also repair or replace the plastic body parts that are increasingly being used on new-model vehicles. They remove damaged panels and identify the type and properties of the plastic used on the vehicle. With most types of plastic, repairers can apply heat from a hot-air welding gun or by immersion in hot water and press the softened panel back into its original shape by hand. They replace plastic parts that are badly damaged or very difficult to repair.

Body repairers use plastic or solder to fill small dents that cannot be worked out of the plastic or metal panel. On metal panels, they file or grind the hardened filler to the original shape and clean the surface with a media blaster before painting. In many shops, automotive painters do the painting. In small shops, workers often do both body repairing and painting. A few body repairers specialize in repairing fiberglass car bodies.

The advent of assembly-line repairs in large shops enables the establishment to move away from the one-vehicle, one-repairer method to a team approach and allows body repairers to specialize in one type of repair, such as straightening frames or repairing doors and fenders. Some body repairers specialize in installing and repairing glass in automobiles and other vehicles. **Automotive glass installers and repairers** remove broken, cracked, or pitted windshields and window glass. Glass installers apply a moisture-proofing compound along the edges of the glass, place the glass in the vehicle, and install rubber strips around the sides of the windshield or window to make it secure and weatherproof.

Body repair work has variety and challenges: each damaged vehicle presents a different problem. Using their broad knowledge of automotive construction and repair techniques, repairers must develop appropriate methods for each job. They usually work alone, with only general directions from supervisors. In some shops, helpers or apprentices assist experienced repairers.

Working Conditions

Most automotive body repairers work a standard 40-hour week, although some, including the self-employed, work more than 40 hours a week. Repairers work indoors in body shops that are noisy with the clatters of hammers against metal and the whine of power tools. Most shops are well ventilated, in order to disperse dust and paint fumes. Body repairers often work in awkward or cramped positions, and much of their work is strenuous and dirty. Hazards include cuts from sharp metal edges, burns from torches and heated metal, injuries from power tools, and fumes from paint. However, serious accidents usually are avoided when the shop is kept clean and orderly and when safety practices are observed.

Employment

Automotive body and related repairers held about 220,000 jobs in 2002; about 1 in 10 specialized in automotive glass installation and repair. Most repairers worked for automotive repair and maintenance shops or automobile dealers. Others worked for organizations that maintain their own motor vehicles, such as trucking companies. A small number worked for wholesalers of motor vehicles, parts, and supplies. More than 1 automotive body repairer in 10 was self-employed, almost twice the proportion for all installation, maintenance, and repair occupations.

Training, Other Qualifications, and Advancement

Most employers prefer to hire persons who have completed formal training programs in automotive body repair, but these programs supply only a portion of employers' needs. Therefore, most new repairers receive primarily on-the-job training, supplemented, when available, with short-term training sessions given by vehicle, parts, and equipment manufacturers. Some degree of training is necessary because advances in technology have greatly changed the structure, components, and materials used in automobiles. As a result, proficiency in new repair techniques is necessary. For example, bodies of many newer automobiles are a combination of materials—traditional steel, aluminum, and a growing variety of metal alloys and plastics. Each of these materials or composites requires the use of somewhat different techniques to reshape parts and smooth out dents and small pits. Many

high schools, vocational schools, private trade schools, and community colleges offer automotive body repair training as part of their automotive service programs.

A fully skilled automotive body repairer must have good reading ability and basic mathematics and computer skills. Restoring unibody automobiles to their original form requires body repairers to follow instructions and diagrams in technical manuals in order to make precise three-dimensional measurements of the position of one body section relative to another.

A new repairer begins by assisting experienced body repairers in tasks such as removing damaged parts, sanding body panels, and installing repaired parts. Novices learn to remove small dents and to make other minor repairs. They then progress to more difficult tasks, such as straightening body parts and returning them to their correct alignment. Generally, to become skilled in all aspects of body repair requires 3 to 4 years of on-the-job training.

Certification by the National Institute for Automotive Service Excellence (ASE), although voluntary, is the recognized standard of achievement for automotive body repairers. ASE offers a series of four exams for collision repair professionals twice a year. Repairers may take from one to four ASE Master Collision Repair and Refinish Exams. Repairers who pass at least one exam and have 2 years of hands-on work experience earn ASE certification. The completion of a postsecondary program in automotive body repair may be substituted for 1 year of work experience. Those who pass all four exams become ASE Master Collision Repair and Refinish Technicians. Automotive body repairers must retake the examination at least every 5 years to retain their certification.

Continuing education is required throughout a career in automotive body repair. Automotive parts, body materials, and electronics continue to change and to become more complex and technologically advanced. To keep up with the technological advances, repairers must continue to gain new skills, read technical manuals, and attend seminars and classes.

As beginners increase their skills, learn new techniques, and complete work more rapidly, their pay increases. An experienced automotive body repairer with supervisory ability may advance to shop supervisor. Some workers open their own body repair shops. Others become automobile damage appraisers for insurance companies.

Job Outlook

Employment of automotive body repairers is expected to grow about as fast as the average for all occupations through the year 2012. The need to replace experienced repairers who transfer to other occupations or who retire or stop working for other reasons will account for the majority of job openings. Opportunities should be best for persons with formal training in automotive body repair and mechanics.

Demand for qualified body repairers will increase as the number of motor vehicles in operation continues to grow in line with the Nation's population. With each rise in the number of motor vehicles in use, the number of vehicles damaged in accidents also will grow. New automobile designs increasingly have body parts made of steel alloys, aluminum, and plastics—materials that are more difficult to work with than are

traditional steel body parts. In addition, new automotive designs of lighter weight are prone to greater collision damage than are older, heavier designs and, consequently, more time is consumed in repair.

However, increasing demand due to growth in the number of vehicles in operation will be somewhat tempered by improvements in the quality of vehicles and technological innovations that enhance safety and reduce the likelihood of accidents. Employment growth also will be limited by changes in body shop management that will increase productivity, reduce overhead expenses, and improve standardization. Larger shops will employ a team approach to repairs to decrease repair time and expand their volume of work. Insurers are increasingly looking to shop networks for repair services. In addition, demand for repair services will grow slowly as more vehicles are declared a total loss after accidents. In many such cases, the vehicles are not repaired because of the high cost of fixing the extensive damage that results when airbags deploy and of replacing the increasingly complex parts and electronic components of new vehicles.

Employment growth will continue to be concentrated in automotive repair and maintenance shops and automobile dealers. The automotive repair business is not very sensitive to changes in economic conditions, and experienced body repairers are rarely laid off. However, although major body damage must be repaired if a vehicle is to be restored to safe operating condition, repair of minor dents and crumpled fenders often can be deferred during an economic slowdown. In times of economic contractions, most employers will hire few new workers, some unprofitable body shops may go out of business, and some dealers might consolidate body shops.

Earnings

Median hourly earnings of automotive body and related repairers, including incentive pay, were \$15.71 in 2002. The middle 50 percent earned between \$11.64 and \$20.94 an hour. The lowest 10 percent earned less than \$8.70, and the highest 10 percent earned more than \$27.10 an hour. In 2002, median hourly earnings of automotive body and related repairers were \$16.96 in automobile dealers and \$15.45 in automotive repair and maintenance.

Median hourly earnings of automotive glass installers and repairers, including incentive pay, were \$12.93 in 2002. The middle 50 percent earned between \$9.90 and \$16.58 an hour. The lowest 10 percent earned less than \$7.91, and the highest 10 percent earned more than \$20.24 an hour. Median hourly earnings in 2002 in automotive repair and maintenance shops, the industry employing the largest number of automotive glass installers and repairers, were \$12.86.

The majority of body repairers employed by automotive dealers and repair shops are paid on an incentive basis. Under this method, body repairers are paid a predetermined amount for various tasks, and earnings depend on the amount of work assigned to the repairer and how fast it is completed. Employers frequently guarantee workers a minimum weekly salary. Body repairers who work for trucking companies, bus lines, and other organizations that maintain their own vehicles usually receive an hourly wage.

Helpers and trainees typically earn from 30 percent to 60 percent of the earnings of skilled workers. Helpers and trainees usually receive an hourly rate, until they are skilled enough to be paid on an incentive basis.

Sources of Additional Information

Additional details about work opportunities may be obtained from automotive body repair shops, automobile dealers, locals of the unions previously mentioned, or local offices of your State employment service. State employment services also are a source of information about training programs.

For general information about automotive body repairer careers, write to any of the following sources:

- Automotive Service Association, P.O. Box 929, Bedford, Texas 76095-0929. Internet: <http://www.asashop.org>
- National Automobile Dealers Association, 8400 Westpark Dr., McLean, VA 22102. Internet: <http://www.nada.org>
- Inter-Industry Conference On Auto Collision Repair Education Foundation (I-CAR), 3701 Algonquin Rd., Suite 400, Rolling Meadow, IL 60008. Telephone (toll free): 800-422-7872.

For information on how to become a certified automotive body repairer, write to National Institute for Automotive Service Excellence (ASE), 101 Blue Seal Dr. SE., Suite 101, Leesburg, VA 20175. Internet: <http://www.asecert.org>

For a directory of certified automotive body repairer programs, contact National Automotive Technician Education Foundation, 101 Blue Seal Dr., SE., Suite 101, Leesburg, VA 20175. Internet: <http://www.natef.org>

For a directory of accredited private trade and technical schools that offer training programs in automotive body repair, contact Accrediting Commission of Career Schools and Colleges of Technology, 2101 Wilson Blvd., Suite 302, Arlington, VA 22201. Internet: <http://www.accsct.org>

For a list of public automotive body repair training programs, contact SkillsUSA-VICA, P.O. Box 3000, Leesburg, VA 20177-0300. Internet: <http://www.skillsusa.org>

Significant Points

- While some paralegals train on the job, employers increasingly prefer graduates of postsecondary paralegal education programs; college graduates who have taken some paralegal courses are especially in demand in some markets.
- Paralegals are projected to grow faster than average, as law offices try to reduce costs by assigning them tasks formerly carried out by lawyers.
- Paralegals are employed by law firms, corporate legal departments, and various government offices and they may specialize in many different areas of the law.

Nature of the Work

While lawyers assume ultimate responsibility for legal work, they often delegate many of their tasks to paralegals. In fact, paralegals—also called legal assistants—continue to assume a growing range of tasks in the Nation’s legal offices and perform many of the same tasks as lawyers. Nevertheless, they are still explicitly prohibited from carrying out duties which are considered to be the practice of law, such as setting legal fees, giving legal advice, and presenting cases in court.

One of a paralegal’s most important tasks is helping lawyers prepare for closings, hearings, trials, and corporate meetings. Paralegals investigate the facts of cases and ensure that all relevant information is considered. They also identify appropriate laws, judicial decisions, legal articles, and other materials that are relevant to assigned cases. After they analyze and organize the information, paralegals may prepare written reports that attorneys use in determining how cases should be handled. Should attorneys decide to file lawsuits on behalf of clients, paralegals may help prepare the legal arguments, draft pleadings and motions to be filed with the court, obtain affidavits, and assist attorneys during trials. Paralegals also organize and track files of all important case documents and make them available and easily accessible to attorneys.

In addition to this preparatory work, paralegals also perform a number of other vital functions. For example, they help draft contracts, mortgages, separation agreements, and trust instruments. They also may assist in preparing tax returns and planning estates. Some paralegals coordinate the activities of other law office employees and maintain financial office records. Various additional tasks may differ, depending on the employer.

Paralegals are found in all types of organizations, but most are employed by law firms, corporate legal departments, and various government offices. In these organizations, they can work in many different areas of the law, including litigation, personal injury, corporate law, criminal law, employee benefits, intellectual property, labor law, bankruptcy, immigration, family law, and real estate. As the law has become more complex, paralegals have responded by becoming more specialized. Within specialties, functions often are broken down further so that paralegals may deal with a specific area. For example, paralegals specializing in labor law may deal exclusively with employee benefits.

The duties of paralegals also differ widely based on the type of organization in which they are employed. Paralegals who work for corporations often assist attorneys with employee contracts, shareholder agreements, stock-option plans, and employee benefit plans. They also may help prepare and file annual financial reports, maintain corporate minute books and record resolutions, and prepare forms to secure loans for the corporation. Paralegals often monitor and review government regulations to ensure that the corporation is aware of new requirements and it operates within the law.

The duties of paralegals who work in the public sector usually vary within each agency. In general, they analyze legal material for internal use, maintain reference files, conduct research for attorneys, and collect and analyze evidence for agency hearings. They may then prepare informative or explanatory material on laws, agency regulations, and agency policy for general use by the agency and the public. Paralegals employed in community legal-service projects help the poor, the aged, and others in need of legal assistance. They file forms, conduct research, prepare documents, and when authorized by law, may represent clients at administrative hearings.

Paralegals in small and medium-sized law firms usually perform a variety of duties that require a general knowledge of the law. For example, they may research judicial decisions on improper police arrests or help prepare a mortgage contract. Paralegals employed by large law firms, government agencies, and corporations, however, are more likely to specialize in one aspect of the law.

Computer use and technical knowledge has become essential to paralegal work. Computer software packages and the Internet are increasingly used to search legal literature stored in computer databases and on CD-ROM. In litigation involving many supporting documents, paralegals may use computer databases to retrieve, organize, and index various materials. Imaging software allows paralegals to scan documents directly into a database, while billing programs help them to track hours billed to clients. Computer software packages also may be used to perform tax computations and explore the consequences of possible tax strategies for clients.

Working Conditions

Paralegals employed by corporations and government usually work a standard 40-hour week. Although most paralegals work year round, some are temporarily employed during busy times of the year, and then released when the workload diminishes. Paralegals who work for law firms sometimes work very long hours when they are under pressure to meet deadlines. Some law firms reward such loyalty with bonuses and additional time off.

These workers handle many routine assignments, particularly when they are inexperienced. As they gain experience, paralegals usually assume more varied tasks with additional responsibility. Paralegals do most of their work at desks in offices and law libraries. Occasionally, they travel to gather information and perform other duties.

Employment

Paralegals and legal assistants held about 200,000 jobs in 2002. Private law firms employed 7 out of 10 paralegals and legal assistants; most of the remainder worked for corporate legal departments and various levels of government. Within the Federal Government, the U.S. Department of Justice is the largest employer, followed by the Social Security Administration and the U.S. Department of Treasury. A small number of paralegals own their own businesses and work as freelance legal assistants, contracting their services to attorneys or corporate legal departments.

Training, Other Qualifications, and Advancement

There are several ways to become a paralegal. The most common is through a community college paralegal program that leads to an associate's degree. The other common method of entry, mainly for those who have a college degree, is through a certification program that leads to a certification in paralegal studies. A small number of schools also offer bachelor's and master's degrees in paralegal studies. Some employers train paralegals on the job, hiring college graduates with no legal experience or promoting experienced legal secretaries. Other entrants have experience in a technical field that is useful to law firms, such as a background in tax preparation for tax and estate practice, criminal justice, or nursing or health administration for personal injury practice.

Formal paralegal training programs are offered by an estimated 600 colleges and universities, law schools, and proprietary schools. Approximately 250 paralegal programs are approved by the American Bar Association (ABA). Although this approval is neither required nor sought by many programs, graduation from an ABA-approved program can enhance one's employment opportunities. The requirements for admission to these programs vary. Some require certain college courses or a bachelor's degree; others accept high school graduates or those with legal experience; and a few schools require standardized tests and personal interviews.

Paralegal programs include 2-year associate's degree programs, 4-year bachelor's degree programs, and certificate programs that can take only a few months to complete. Most certificate programs provide intensive paralegal training for individuals who already hold college degrees, while associate's and bachelor's degree programs usually combine paralegal training with courses in other academic subjects. The quality of paralegal training programs varies; the better programs usually include job placement. Programs increasingly include courses introducing students to the legal applications of computers, including how to perform legal research using the Internet. Many paralegal training programs include an internship in which students gain practical experience by working for several months in a private law firm, office of a public defender or attorney general, bank, corporate legal department, legal-aid organization, or government agency. Experience gained in internships is an asset when seeking a job after graduation. Prospective students should examine the experiences of recent graduates before enrolling in those programs.

Although most employers do not require certification, earning a voluntary certificate from a professional society may offer advantages in the labor market. The National Association of Legal Assistants, for example, has established standards for certification requiring various combinations of education and experience. Paralegals

who meet these standards are eligible to take a 2-day examination, given three times each year at several regional testing centers. Those who pass this examination may use the designation Certified Legal Assistant (CLA). In addition, the Paralegal Advanced Competency Exam, established in 1996 and administered through the National Federation of Paralegal Associations, offers professional recognition to paralegals with a bachelor's degree and at least 2 years of experience. Those who pass this examination may use the designation Registered Paralegal (RP).

Paralegals must be able to document and present their findings and opinions to their supervising attorney. They need to understand legal terminology and have good research and investigative skills. Familiarity with the operation and applications of computers in legal research and litigation support also is increasingly important. Paralegals should stay informed of new developments in the laws that affect their area of practice. Participation in continuing legal education seminars allows paralegals to maintain and expand their legal knowledge.

Because paralegals frequently deal with the public, they should be courteous and uphold the ethical standards of the legal profession. The National Association of Legal Assistants, the National Federation of Paralegal Associations, and a few States have established ethical guidelines for paralegals to follow.

Paralegals usually are given more responsibilities and less supervision as they gain work experience. Experienced paralegals who work in large law firms, corporate legal departments, and government agencies may supervise and delegate assignments to other paralegals and clerical staff. Advancement opportunities also include promotion to managerial and other law-related positions within the firm or corporate legal department. However, some paralegals find it easier to move to another law firm when seeking increased responsibility or advancement.

Job Outlook

Paralegals and legal assistants are projected to grow faster than the average for all occupations through 2012. Some employment growth stems from law firms and other employers with legal staffs increasingly hiring paralegals to lower the cost and increase the availability and efficiency of legal services. The majority of job openings for paralegals in the future will be new jobs created by employment growth, but additional job openings will arise as people leave the occupation. Despite projections of fast employment growth, competition for jobs should continue as many people seek to go into this profession; however, highly skilled, formally trained paralegals have excellent employment potential.

Private law firms will continue to be the largest employers of paralegals, but a growing array of other organizations, such as corporate legal departments, insurance companies, real estate and title insurance firms, and banks hire paralegals. Corporations, in particular, are boosting their in-house legal departments to cut costs. Demand for paralegals also is expected to grow as an increasing population requires legal services, especially in areas such as intellectual property, healthcare, international, elder issues, criminal, and environmental law. The growth of prepaid legal plans also should contribute to the demand for legal services. Paralegal employment is expected to increase as organizations presently employing paralegals assign them a growing range of tasks, and as paralegals are increasingly employed

in small and medium-sized establishments. A growing number of experienced paralegals are expected to establish their own businesses.

Job opportunities for paralegals will expand in the public sector as well. Community legal-service programs, which provide assistance to the poor, aged, minorities, and middle-income families, will employ additional paralegals to minimize expenses and serve the most people. Federal, State, and local government agencies, consumer organizations, and the courts also should continue to hire paralegals in increasing numbers.

To a limited extent, paralegal jobs are affected by the business cycle. During recessions, demand declines for some discretionary legal services, such as planning estates, drafting wills, and handling real estate transactions. Corporations are less inclined to initiate certain types of litigation when falling sales and profits lead to fiscal belt tightening. As a result, full-time paralegals employed in offices adversely affected by a recession may be laid off or have their work hours reduced. On the other hand, during recessions, corporations and individuals are more likely to face other problems that require legal assistance, such as bankruptcies, foreclosures, and divorces. Paralegals, who provide many of the same legal services as lawyers at a lower cost, tend to fare relatively better in difficult economic conditions.

Earnings

Earnings of paralegals and legal assistants vary greatly. Salaries depend on education, training, experience, type and size of employer, and geographic location of the job. In general, paralegals who work for large law firms or in large metropolitan areas earn more than those who work for smaller firms or in less populated regions. In addition to a salary, many paralegals receive bonuses. In 2002, full-time, wage and salary paralegals and legal assistants had median annual earnings, including bonuses of \$37,950. The middle 50 percent earned between \$30,020 and \$48,760. The top 10 percent earned more than \$61,150, while the bottom 10 percent earned less than \$24,470. Median annual earnings in the industries employing the largest numbers of paralegals in 2002 were as follows:

Federal government	\$53,770
Legal services	36,780
Local government	36,030
State government	34,750

Sources of Additional Information

General information on a career as a paralegal can be obtained from Standing Committee on Legal Assistants, American Bar Association, 541 N. Fairbanks Ct., Chicago, IL 60611. Internet: <http://www.abanet.org>

For information on the Certified Legal Assistant exam, schools that offer training programs in a specific State, and standards and guidelines for paralegals, contact National Association of Legal Assistants, Inc., 1516 South Boston St., Suite 200, Tulsa, OK 74119. Internet: <http://www.nala.org>

Information on a career as a paralegal, schools that offer training programs, job postings for paralegals, the Paralegal Advanced Competency Exam, and local paralegal associations can be obtained from National Federation of Paralegal Associations, P.O. Box 33108, Kansas City, MO 64114. Internet: <http://www.paralegals.org>

Information on paralegal training programs, including the pamphlet "How to Choose a Paralegal Education Program," may be obtained from American Association for Paralegal Education, 407 Wekiva Springs Road, Suite 241, Longwood, FL 32779. Internet: <http://www.aafpe.org>

Information on obtaining a position as a paralegal specialist with the Federal Government is available from the Office of Personnel Management at <http://www.usajobs.opm.gov>.

Cardiovascular Technologists

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Significant Points

- Employment will grow faster than the average, but the number of job openings created will be low because the occupation is small.
- Employment of most specialties will grow, but fewer EKG technicians will be needed.
- About 3 out of 4 jobs were in hospitals.

Nature of the Work

Cardiovascular technologists and technicians assist physicians in diagnosing and treating cardiac (heart) and peripheral vascular (blood vessel) ailments. Cardiovascular technologists may specialize in three areas of practice—invasive cardiology, echocardiography, and vascular technology. Cardiovascular technicians who specialize in electrocardiograms (EKGs), stress testing, and Holter monitors are known as **cardiographic**, or **EKG technicians**.

Cardiovascular technologists specializing in invasive procedures are called **cardiology technologists**. They assist physicians with cardiac catheterization procedures in which a small tube, or catheter, is wound through a patient's blood vessel from a spot on the patient's leg into the heart. The procedure can determine whether a blockage exists in the blood vessels that supply the heart muscle. The procedure also can help to diagnose other problems. Part of the procedure may involve balloon angioplasty, which can be used to treat blockages of blood vessels or heart valves without the need for heart surgery. Cardiology technologists assist physicians as they insert a catheter with a balloon on the end to the point of the obstruction.

Technologists prepare patients for cardiac catheterization and balloon angioplasty by first positioning them on an examining table and then shaving, cleaning, and administering anesthesia to the top of their leg near the groin. During the procedures, they monitor patients' blood pressure and heart rate with EKG

equipment and notify the physician if something appears to be wrong. Technologists also may prepare and monitor patients during open-heart surgery and the implantation of pacemakers.

Cardiovascular technologists who specialize in echocardiography or vascular technology often run noninvasive tests using ultrasound instrumentation, such as Doppler ultrasound. Tests are called "noninvasive" if they do not require the insertion of probes or other instruments into the patient's body. The ultrasound instrumentation transmits high-frequency sound waves into areas of the patient's body and then processes reflected echoes of the sound waves to form an image. Technologists view the ultrasound image on a screen, and may record the image on videotape or photograph it for interpretation and diagnosis by a physician. As the instrument scans the image, technologists check the image on the screen for subtle differences between healthy and diseased areas, decide which images to include in the report to the physician, and judge if the images are satisfactory for diagnostic purposes. They also explain the procedure to patients, record any additional medical history the patient relates, select appropriate equipment settings, and change the patient's position as necessary.

Those who assist physicians in the diagnosis of disorders affecting the circulation are known as **vascular technologists** or **vascular sonographers**. They perform a medical history and evaluate pulses by listening to the sounds of the arteries for abnormalities. Then, they perform a noninvasive procedure using ultrasound instrumentation to record vascular information, such as vascular blood flow, blood pressure, limb volume changes, oxygen saturation, cerebral circulation, peripheral circulation, and abdominal circulation. Many of these tests are performed during or immediately after surgery.

Technologists who use ultrasound to examine the heart chambers, valves, and vessels are referred to as **cardiac sonographers**, or **echocardiographers**. They use ultrasound instrumentation to create images called echocardiograms. An echocardiogram may be performed while the patient is either resting or physically active. Technologists may administer medication to physically active patients to assess their heart function. Cardiac sonographers may also assist physicians who perform transesophageal echocardiography, which involves placing a tube in the patient's esophagus to obtain ultrasound images.

Cardiovascular technicians who obtain EKGs are known as **electrocardiograph (or EKG) technicians**. To take a basic EKG, which traces electrical impulses transmitted by the heart, technicians attach electrodes to the patient's chest, arms, and legs, and then manipulate switches on an EKG machine to obtain a reading. A printout is made for interpretation by the physician. This test is done before most kinds of surgery or as part of a routine physical examination, especially for persons who have reached middle age or who have a history of cardiovascular problems.

EKG technicians with advanced training perform Holter monitor and stress testing. For Holter monitoring, technicians place electrodes on the patient's chest and attach a portable EKG monitor to the patient's belt. Following 24 or more hours of normal activity by the patient, the technician removes a tape from the monitor and places it in a scanner. After checking the quality of the recorded impulses on an electronic screen, the technician usually prints the information from the tape so that a physician can interpret it later. Physicians use the output from the scanner to

diagnose heart ailments, such as heart rhythm abnormalities or problems with pacemakers.

For a treadmill stress test, EKG technicians document the patient's medical history, explain the procedure, connect the patient to an EKG monitor, and obtain a baseline reading and resting blood pressure. Next, they monitor the heart's performance while the patient is walking on a treadmill, gradually increasing the treadmill's speed to observe the effect of increased exertion. Like vascular technologists and cardiac sonographers, cardiographic technicians who perform EKG, Holter monitor, and stress tests are known as "noninvasive" technicians.

Some cardiovascular technologists and technicians schedule appointments, type doctors' interpretations, maintain patient files, and care for equipment.

Working Conditions

Technologists and technicians generally work a 5-day, 40-hour week that may include weekends. Those in catheterization labs tend to work longer hours and may work evenings. They also may be on call during the night and on weekends.

Cardiovascular technologists and technicians spend a lot of time walking and standing. Those who work in catheterization labs may face stressful working conditions because they are in close contact with patients with serious heart ailments. Some patients, for example, may encounter complications from time to time that have life-or-death implications.

Employment

Cardiovascular technologists and technicians held about 43,000 jobs in 2002. About 3 out of 4 jobs were in hospitals, primarily in cardiology departments. The remaining jobs were mostly in offices of physicians, including cardiologists; or in medical and diagnostic laboratories, including diagnostic imaging centers.

Training, Other Qualifications, and Advancement

Although a few cardiovascular technologists, vascular technologists, and cardiac sonographers are currently trained on the job, most receive training in 2- to 4-year programs. Cardiovascular technologists, vascular technologists, and cardiac sonographers normally complete a 2-year junior or community college program. The first year is dedicated to core courses and is followed by a year of specialized instruction in either invasive, noninvasive cardiovascular, or noninvasive vascular technology. Those who are qualified in an allied health profession need to complete only the year of specialized instruction.

Graduates from the 29 programs accredited by the Joint Review Committee on Education in Cardiovascular Technology are eligible to obtain professional certification in cardiac catheterization, echocardiography, vascular ultrasound, and cardiographic techniques from Cardiovascular Credentialing International. Cardiac sonographers and vascular technologists also may obtain certification from the American Registry of diagnostic medical sonographers.

For basic EKGs, Holter monitoring, and stress testing, 1-year certification programs exist, but most EKG technicians are still trained on the job by an EKG supervisor or a cardiologist. On-the-job training usually lasts about 8 to 16 weeks. Most employers prefer to train people already in the healthcare field—nursing aides, for example. Some EKG technicians are students enrolled in 2-year programs to become technologists, working part time to gain experience and make contact with employers.

Cardiovascular technologists and technicians must be reliable, have mechanical aptitude, and be able to follow detailed instructions. A pleasant, relaxed manner for putting patients at ease is an asset.

Job Outlook

Employment of cardiovascular technologists and technicians is expected to grow faster than the average for all occupations through the year 2012. Growth will occur as the population ages, because older people have a higher incidence of heart problems. Employment of vascular technologists and echocardiographers will grow as advances in vascular technology and sonography reduce the need for more costly and invasive procedures. However, fewer EKG technicians will be needed, as hospitals train nursing aides and others to perform basic EKG procedures. Individuals trained in Holter monitoring and stress testing are expected to have more favorable job prospects than are those who can perform only a basic EKG.

Some job openings for cardiovascular technologists and technicians will arise from replacement needs, as individuals transfer to other jobs or leave the labor force. However, job growth and replacement needs will produce relatively few job openings because the occupation is small.

Earnings

Median annual earnings of cardiovascular technologists and technicians were \$36,430 in 2002. The middle 50 percent earned between \$26,730 and \$46,570. The lowest 10 percent earned less than \$20,920, and the highest 10 percent earned more than \$56,080. Median annual earnings of cardiovascular technologists and technicians in 2002 were \$36,420 in offices of physicians and \$35,800 in general medical and surgical hospitals.

Sources of Additional Information

For general information about a career in cardiovascular technology, contact Alliance of Cardiovascular Professionals, 4456 Thalia Landing Offices, Bldg. 2, 4356 Bonney Rd., Suite 103, Virginia Beach, VA 23452-1200. Internet: <http://www.acp-online.org>

For a list of accredited programs in cardiovascular technology, contact Committee on Accreditation for Allied Health Education Programs, 39 East Wacker Dr., Chicago, IL 60601. Internet: <http://www.caahep.org>

For information on vascular technology, contact Society of Vascular Ultrasound, 4601 Presidents Dr., Suite 260, Lanham, MD 20706-4381. Internet: <http://www.svunet.org>

For information on echocardiography, contact American Society of Echocardiography, 1500 Sunday Dr., Suite 102, Raleigh, NC 27607. Internet: <http://www.asecho.org>

For information regarding registration and certification, contact:

- Cardiovascular Credentialing International, 1500 Sunday Dr., Suite 102, Raleigh, NC 27607. Internet: <http://www.cci-online.org>
- American Registry of diagnostic medical sonographers, 51 Monroe St., Plaza East One, Rockville, MD 20850-2400. Internet: <http://www.ardms.org>

Sales Worker Supervisors

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Significant Points

- Applicants with retail experience should have the best job opportunities in this occupation.
- Overall employment is projected to grow more slowly than average; the number of self-employed sales worker supervisors is expected to decline.
- Long, irregular hours, including evenings and weekends, are common.
- In many retail establishments, managers are promoted from within the company; a postsecondary degree may speed a sales worker supervisor's advancement into management.

Nature of the Work

Sales worker supervisors oversee the work of sales and related workers, such as retail salespersons, cashiers, customer service representatives, stock clerks and order fillers, sales engineers, and wholesale and manufacturing sales representatives. Sales worker supervisors are responsible for interviewing, hiring, and training employees, as well as for preparing work schedules and assigning workers to specific duties. Many of these workers hold job titles such as **sales manager or department manager**.

In retail establishments, sales worker supervisors ensure that customers receive satisfactory service and quality goods. They also answer customers' inquiries, deal with complaints, and sometimes handle purchasing, budgeting, and accounting. Their responsibilities vary with the size and type of establishment. As the size of retail stores and the types of goods and services increase, these workers tend to specialize in one department or one aspect of merchandising.

Sales worker supervisors in large retail establishments, often referred to as department managers, provide day-to-day oversight of individual departments, such as shoes, cosmetics, or housewares in large department stores; produce and meat in grocery stores; and sales in automotive dealerships. These workers establish and

implement policies, goals, objectives, and procedures for their specific departments; coordinate activities with other department heads; and strive for smooth operations within their departments. They supervise employees who price and ticket goods and place them on display; clean and organize shelves, displays, and inventories in stockrooms; and inspect merchandise to ensure that nothing is outdated. Sales worker supervisors also review inventory and sales records, develop merchandising techniques, and coordinate sales promotions. In addition, they may greet and assist customers and promote sales and good public relations.

Sales worker supervisors in nonretail establishments supervise and coordinate the activities of sales workers who sell industrial products, automobiles, or services such as advertising or Internet services. They may prepare budgets, make personnel decisions, devise sales-incentive programs, assign sales territories, or approve sales contracts.

In small or independent companies and retail stores, sales worker supervisors not only directly supervise sales associates, but also are responsible for the operation of the entire company or store. Some are self-employed business or store owners.

Working Conditions

Most sales worker supervisors have offices. In retail trade, their offices are within the stores, usually close to the areas they oversee. Although they spend some time in the office completing merchandise orders or arranging work schedules, a large portion of their workday is spent on the sales floor, supervising employees or selling.

Work hours of supervisors vary greatly among establishments, because work schedules usually depend on customers' needs. Supervisors generally work at least 40 hours a week. Long, irregular hours are common, particularly during sales, holidays, busy shopping hours, and times when inventory is taken. Supervisors are expected to work evenings and weekends, but usually are compensated with a day off during the week. Hours can change weekly, and managers sometimes must report to work on short notice, especially when employees are absent. Independent owners can often set their own schedules, but hours must be convenient to customers.

Employment

Sales worker supervisors held about 2.4 million jobs in 2002. Approximately 36 percent were self-employed, most of whom were store owners. Additionally, 43 percent of wage and salary sales worker supervisors are employed in the retail sector. Some of the largest employers are grocery stores, department stores, motor vehicle dealerships, and clothing and accessory stores. The remainder works in nonretail establishments.

Training, Other Qualifications, and Advancement

Sales worker supervisors usually acquire knowledge of management principles and practices—an essential requirement for a supervisory or managerial position in retail trade—through work experience. Many supervisors begin their careers on the sales floor as salespersons, cashiers, or customer service representatives. In these

positions, they learn merchandising, customer service, and the basic policies and procedures of the company.

The educational backgrounds of sales worker supervisors vary widely. Regardless of the education they receive, recommended courses include accounting, marketing, management, and sales, as well as psychology, sociology, and communication. Supervisors also must be computer literate, because almost all cash registers, inventory control systems, and sales quotes and contracts are computerized.

Supervisors who have postsecondary education often hold associate's or bachelor's degrees in liberal arts, social sciences, business, or management. To gain experience, many college students participate in internship programs that usually are developed jointly by individual schools and firms.

The type and amount of training available to supervisors varies from company to company. Many national retail chains and companies have formal training programs for management trainees that include both classroom and on-site training. Training time may be as brief as 1 week, but may also last up to 1 year or more, because many organizations require that trainees gain experience during all sales seasons.

Ordinarily, classroom training includes topics such as interviewing and customer service skills, employee and inventory management, and scheduling. Management trainees may work in one specific department while training on the job, or they may rotate through several departments to gain a well-rounded knowledge of the company's operation. Training programs for retail franchises are generally extensive, covering all functions of the company's operation, including budgeting, marketing, management, finance, purchasing, product preparation, human resource management, and compensation. College graduates usually can enter management training programs directly.

Sales worker supervisors must get along with all types of people. They need initiative, self-discipline, good judgment, and decisiveness. Patience and a mild temperament are necessary when dealing with demanding customers. Sales worker supervisors also must be able to motivate, organize, and direct the work of subordinates and communicate clearly and persuasively with customers and other supervisors.

Individuals who display leadership and team-building skills, self-confidence, motivation, and decisiveness become candidates for promotion to assistant manager or manager. A postsecondary degree may speed a sales worker supervisor's advancement into management, because it is viewed by employers as a sign of motivation and maturity—qualities deemed important for promotion to more responsible positions. In many retail establishments, managers are promoted from within the company. In small retail establishments, where the number of positions is limited, advancement to a higher management position may come slowly. Large establishments often have extensive career ladder programs and may offer supervisors the opportunity to transfer to another store in the chain or to the central office if an opening occurs. Although promotions may occur more quickly in large establishments, some managers may need to relocate every several years in order to advance. Supervisors also can become advertising, marketing, promotions, public relations, and sales managers (workers who coordinate marketing plans, monitor sales, and propose advertisements and promotions) or purchasing managers,

buyers, or purchasing agents (workers who purchase goods and supplies for their organization or for resale).

Some supervisors who have worked in their industry for a long time open their own stores or sales firms. However, retail trade and sales occupations are highly competitive, and although many independent owners succeed, some fail to cover expenses and eventually go out of business. To prosper, owners usually need good business sense and strong customer service and public relations skills.

Job Outlook

Candidates who have retail experience—as a retail salesperson, cashier, or customer service representative, for example—will have the best opportunities for jobs as sales worker supervisors. As in other fields, competition is expected for supervisory jobs, particularly those with the most attractive earnings and working conditions.

Employment of sales worker supervisors is expected to grow more slowly than the average for all occupations through the year 2012. Growth in the occupation will be restrained somewhat as retail companies hire more sales staff and increase the responsibilities of sales worker supervisors. Many job openings will occur as experienced supervisors move into higher levels of management, transfer to other occupations, or leave the labor force. However, as with other supervisory and managerial occupations, job turnover is relatively low.

The Internet and electronic commerce are creating new opportunities to reach and communicate with potential customers. Some firms are hiring Internet sales managers, who are in charge of maintaining an Internet site and answering inquiries relating to the product, to prices, and to the terms of delivery—a trend that will increase demand for these supervisors. Overall, Internet sales and electronic commerce may reduce the number of additional sales workers needed, thus reducing the number of additional supervisors required. However, the impact of electronic commerce on employment of sales worker supervisors should be minimal.

Projected employment growth of sales worker supervisors will mirror, in part, the patterns of employment growth in the industries in which they work. For example, faster-than-average employment growth is expected in many of the rapidly growing services industries. The number of self-employed sales worker supervisors is expected to decline as independent retailers face increasing competition from national chains.

Unlike middle- and upper-level managers, store-level retail supervisors generally will not be affected by the restructuring and consolidation taking place at the corporate and headquarters levels of many retail chains.

Earnings

Salaries of sales worker supervisors vary substantially, depending upon the level of responsibility the individual has; the person's length of service; and the type, size, and location of the firm.

In 2002, median annual earnings of salaried sales worker supervisors of retail sales workers, including commissions, were \$29,700. The middle 50 percent earned between \$22,790 and \$40,100 a year. The lowest 10 percent earned less than \$18,380, and the highest 10 percent earned more than \$55,810 a year. Median annual earnings in the industries employing the largest numbers of salaried supervisors of retail sales workers in 2002 were as follows:

Building material and supplies dealers	\$32,780
Grocery stores	29,940
Clothing stores	28,060
Department stores	27,390
Gasoline stations	25,000

In 2002, median annual earnings of salaried sales worker supervisors of nonretail sales workers, including commission, were \$53,020. The middle 50 percent earned between \$37,680 and \$77,690 a year. The lowest 10 percent earned less than \$26,780, and the highest 10 percent earned more than \$114,210 a year. Median annual earnings in the industries employing the largest numbers of salaried supervisors of nonretail sales workers in 2002 were as follows:

Wholesale electronic markets and agents and brokers	\$74,000
Professional and commercial equipment and supplies merchant wholesalers	72,970
Insurance carriers	63,220
Machinery, equipment, and supplies merchant wholesalers	60,450
Federal Government	50,570

Compensation systems vary by type of establishment and merchandise sold. Many supervisors receive a commission or a combination of salary and commission. Under a commission system, supervisors receive a percentage of department or store sales. Thus, supervisors have the opportunity to increase their earnings considerably, but they may find that their earnings depend on their ability to sell their product and the condition of the economy. Those who sell large amounts of merchandise or exceed sales goals often receive bonuses or other awards.

Sources of Additional Information

Information on employment opportunities for sales worker supervisors may be obtained from the employment offices of various retail establishments or State employment service offices.

General information on management careers in retail establishments is available from National Retail Federation, 325 7th St. NW., Suite 1100, Washington, DC 20004.

Information on management careers in grocery stores and on schools offering related programs is available from International Food Service Distributors Association, 201 Park Washington Ct., Falls Church, VA 22046-4521.

Information about management careers and training programs in the motor vehicle dealers industry is available from National Automobile Dealers Association, Public Relations Dept., 8400 Westpark Dr., McLean, VA 22102-3591. Internet: <http://www.nada.org>

Information about management careers in convenience stores is available from National Association of Convenience Stores, 1600 Duke St., Alexandria, VA 22314-3436.

Machinists

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Significant Points

- Machinists learn in apprenticeship programs, informally on the job, and in high schools, vocational schools, or community or technical colleges.
- Many entrants previously have worked as machine setters, operators, or tenders.
- Job opportunities are expected to be excellent.

Nature of the Work

Machinists use machine tools, such as lathes, milling machines, and machining centers, to produce precision metal parts. Although they may produce large quantities of one part, precision machinists often produce small batches or one-of-a-kind items. They use their knowledge of the working properties of metals and their skill with machine tools to plan and carry out the operations needed to make machined products that meet precise specifications.

Before they machine a part, machinists must carefully plan and prepare the operation. These workers first review blueprints or written specifications for a job. Next, they calculate where to cut or bore into the work piece (the piece of metal that is being shaped), how fast to feed the metal into the machine, and how much metal to remove. They then select tools and materials for the job, plan the sequence of cutting and finishing operations, and mark the metal stock to show where cuts should be made.

After this layout work is completed, machinists perform the necessary machining operations. They position the metal stock on the machine tool—drill press, lathe, milling machine, or other type of machine—set the controls, and make the cuts. During the machining process, they must constantly monitor the feed rate and speed of the machine. Machinists also ensure that the work piece is being properly lubricated and cooled, because the machining of metal products generates a significant amount of heat. The temperature of the work piece is a key concern because most metals expand when heated; machinists must adjust the size of their cuts relative to the temperature. Some rare but increasingly popular metals, such as titanium, are machined at extremely high temperatures.

Machinists detect some problems by listening for specific sounds—for example, a dull cutting tool or excessive vibration. Dull cutting tools are removed and replaced. Cutting speeds are adjusted to compensate for harmonic vibrations, which can

decrease the accuracy of cuts, particularly on newer high-speed spindles and lathes. After the work is completed, machinists use both simple and highly sophisticated measuring tools to check the accuracy of their work against blueprints.

Some machinists, often called production machinists, may produce large quantities of one part, especially parts requiring the use of complex operations and great precision. Many modern machine tools are computer numerically controlled (CNC). Frequently, machinists work with computer-control programmers to determine how the automated equipment will cut a part. The programmer may determine the path of the cut, while the machinist determines the type of cutting tool, the speed of the cutting tool, and the feed rate. Because most machinists train in CNC programming, they may write basic programs themselves and often modify programs in response to problems encountered during test runs. After the production process is designed, relatively simple and repetitive operations normally are performed by machine setters, operators, and tenders.

Some manufacturing techniques employ automated parts loaders, automatic tool changers, and computer controls, allowing machine tools to operate without anyone present. One production machinist, working 8 hours a day, might monitor equipment, replace worn cutting tools, check the accuracy of parts being produced, and perform other tasks on several CNC machines that operate 24 hours a day (lights-out manufacturing). During lights-out manufacturing, a factory may need only a few machinists to monitor the entire factory.

Other machinists do maintenance work—repairing or making new parts for existing machinery. To repair a broken part, maintenance machinists may refer to blueprints and perform the same machining operations that were needed to create the original part.

Working Conditions

Today, most machine shops are relatively clean, well lit, and ventilated. Many computer-controlled machines are partially or totally enclosed, minimizing the exposure of workers to noise, debris, and the lubricants used to cool work pieces during machining. Nevertheless, working around machine tools presents certain dangers, and workers must follow safety precautions. Machinists wear protective equipment, such as safety glasses to shield against bits of flying metal and earplugs to dampen machinery noise. They also must exercise caution when handling hazardous coolants and lubricants, although many common water-based lubricants present little hazard. The job requires stamina, because machinists stand most of the day and, at times, may need to lift moderately heavy work pieces. Modern factories extensively employ autoloaders and overhead cranes, reducing heavy lifting.

Most machinists work a 40-hour week. Evening and weekend shifts are becoming more common as companies justify investments in more expensive machinery by extending hours of operation. However, this trend is somewhat offset by the increasing use of lights-out manufacturing. Overtime is common during peak production periods.

Employment

Machinists held about 387,000 jobs in 2002. Most machinists work in small machining shops or in manufacturing industries, such as machinery manufacturing and transportation equipment manufacturing (motor vehicle parts and aerospace products and parts). Maintenance machinists work in most industries that use production machinery.

Training, Other Qualifications, and Advancement

Machinists train in apprenticeship programs, informally on the job, and in high schools, vocational schools, or community or technical colleges. Experience with machine tools is helpful. In fact, many entrants previously have worked as machine setters, operators, or tenders. Persons interested in becoming machinists should be mechanically inclined, have good problem-solving abilities, be able to work independently, and be able to do highly accurate work (tolerances may reach 1/10,000th of an inch) that requires concentration and physical effort.

High school or vocational school courses in mathematics (especially trigonometry), blueprint reading, metalworking, and drafting are highly recommended. Apprenticeship programs consist of shop training and related classroom instruction lasting up to 4 years. In shop training, apprentices work almost full time, and are supervised by an experienced machinist while learning to operate various machine tools. Classroom instruction includes math, physics, materials science, blueprint reading, mechanical drawing, and quality and safety practices. In addition, as machine shops have increased their use of computer-controlled equipment, training in the operation and programming of CNC machine tools has become essential. Apprenticeship classes are taught in cooperation with local community or vocational colleges. A growing number of machinists learn the trade through 2-year associate degree programs at community or technical colleges. Graduates of these programs still need significant on-the-job experience before they are fully qualified.

To boost the skill level of machinists and to create a more uniform standard of competency, a number of training facilities and colleges are implementing curriculums that incorporate national skills standards developed by the National Institute of Metalworking Skills (NIMS). After completing such a curriculum and passing a performance requirement and written exam, trainees are granted a NIMS credential, which provides formal recognition of competency in a metalworking field. Completing a recognized certification program provides a machinist with better career opportunities.

As new automation is introduced, machinists normally receive additional training to update their skills. This training usually is provided by a representative of the equipment manufacturer or a local technical school. Some employers offer tuition reimbursement for job-related courses.

Machinists can advance in several ways. Experienced machinists may become CNC programmers, tool and die makers, or mold makers, or be promoted to supervisory or administrative positions in their firms. A few open their own shops.

Job Outlook

Despite projected slower-than-average employment growth, job opportunities for machinists should continue to be excellent. Many young people with the necessary educational and personal qualifications needed to obtain machining skills may prefer to attend college or may not wish to enter production occupations. Therefore, the number of workers obtaining the skills and knowledge necessary to fill machinist jobs is expected to be less than the number of job openings arising each year from employment growth and from the need to replace experienced machinists who transfer to other occupations or retire.

Employment of machinists is expected to grow more slowly than the average for all occupations over the 2002-12 period because of rising productivity among these workers. Machinists will become more efficient as a result of the expanded use of and improvements in technologies such as CNC machine tools, autoloaders, and high-speed machining. This allows fewer machinists to accomplish the same amount of work previously performed by more workers. Technology is not expected to affect the employment of machinists as significantly as that of most other production occupations, however, because machinists monitor and maintain many automated systems. Due to modern production techniques, employers prefer workers, such as machinists, who have a wide range of skills and are capable of performing almost any task in a machine shop.

Employment levels in this occupation are influenced by economic cycles—as the demand for machined goods falls, machinists involved in production may be laid off or forced to work fewer hours. Employment of machinists involved in plant maintenance, however, often is more stable because proper maintenance and repair of costly equipment remain critical to manufacturing operations, even when production levels fall.

Earnings

Median hourly earnings of machinists were \$15.66 in 2002. The middle 50 percent earned between \$12.15 and \$19.45. The lowest 10 percent earned less than \$9.57, while the top 10 percent earned more than \$23.17. Median hourly earnings in the manufacturing industries employing the largest number of machinists in 2002 were:

Metalworking machinery manufacturing	\$16.75
Other general purpose machinery manufacturing	15.91
Machine shops; turned product; and screw, nut, and bolt manufacturing	15.45
Motor vehicle parts manufacturing	15.18
Employment services	9.41

Sources of Additional Information

For general information about machinists, contact Precision Machine Products Association, 6700 West Snowville Rd., Brecksville, OH 44141-3292. Internet: <http://www.pmpa.org>

For a list of training centers and apprenticeship programs, contact National Tooling and Machining Association, 9300 Livingston Rd., Fort Washington, MD 20744. Internet: <http://www.ntma.org>

For general occupational information and a list of training programs, contact Precision Metalforming Association Educational Foundation, 6363 Oak Tree Blvd., Independence, OH 44131-2500. Internet: <http://www.pmaef.org>

Surgical Technologists

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Significant Points

- Training programs last 9 to 24 months and lead to a certificate, diploma, or associate degree.
- Job opportunities are expected to be favorable.
- Hospitals will continue to be the primary employer, although much faster employment growth is expected in offices of physicians and in outpatient care centers, including ambulatory surgical centers.

Nature of the Work

Surgical technologists, also called scrubs and surgical or operating room technicians, assist in surgical operations under the supervision of surgeons, registered nurses, or other surgical personnel. Surgical technologists are members of operating room teams, which most commonly include surgeons, anesthesiologists, and circulating nurses. Before an operation, surgical technologists help prepare the operating room by setting up surgical instruments and equipment, sterile drapes, and sterile solutions. They assemble both sterile and non-sterile equipment, as well as adjust and check it to ensure it is working properly. Technologists also get patients ready for surgery by washing, shaving, and disinfecting incision sites. They transport patients to the operating room, help position them on the operating table, and cover them with sterile surgical "drapes." Technologists also observe patients' vital signs, check charts, and assist the surgical team with putting on sterile gowns and gloves.

During surgery, technologists pass instruments and other sterile supplies to surgeons and surgeon assistants. They may hold retractors, cut sutures, and help count sponges, needles, supplies, and instruments. Surgical technologists help prepare, care for, and dispose of specimens taken for laboratory analysis and help apply dressings. Some operate sterilizers, lights, or suction machines, and help operate diagnostic equipment.

After an operation, surgical technologists may help transfer patients to the recovery room and clean and restock the operating room.

Working Conditions

Surgical technologists work in clean, well-lighted, cool environments. They must stand for long periods and remain alert during operations. At times, they may be exposed to communicable diseases and unpleasant sights, odors, and materials.

Most surgical technologists work a regular 40-hour week, although they may be on call or work nights, weekends and holidays on a rotating basis.

Employment

Surgical technologists held about 72,000 jobs in 2002. About three-quarters of jobs for surgical technologists were in hospitals, mainly in operating and delivery rooms. Other jobs were in offices of physicians or dentists who perform outpatient surgery and in outpatient care centers, including ambulatory surgical centers. A few, known as private scrubs, are employed directly by surgeons who have special surgical teams, like those for liver transplants.

Training, Other Qualifications, and Advancement

Surgical technologists receive their training in formal programs offered by community and junior colleges, vocational schools, universities, hospitals, and the military. In 2002, the Commission on Accreditation of Allied Health Education Programs (CAAHEP) recognized 361 accredited programs. High school graduation normally is required for admission. Programs last nine to 24 months and lead to a certificate, diploma, or associate degree.

Programs provide classroom education and supervised clinical experience. Students take courses in anatomy, physiology, microbiology, pharmacology, professional ethics, and medical terminology. Other studies cover the care and safety of patients during surgery, sterile techniques, and surgical procedures. Students also learn to sterilize instruments; prevent and control infection; and handle special drugs, solutions, supplies, and equipment.

Most employers prefer to hire certified technologists. Technologists may obtain voluntary professional certification from the Liaison Council on Certification for the Surgical Technologist by graduating from a CAAHEP-accredited program and passing a national certification examination. They may then use the Certified Surgical Technologist (CST) designation. Continuing education or reexamination is required to maintain certification, which must be renewed every 4 years.

Certification may also be obtained from the National Center for Competency Testing. To qualify to take the exam, candidates follow one of three paths: complete an accredited training program, undergo a 2-year hospital on-the-job training program, or acquire seven years of experience working in the field. After passing the exam, individuals may use the designation Tech in Surgery-Certified, TS-C (NCCT). This certification may be renewed every 5 years through either continuing education or reexamination.

Surgical technologists need manual dexterity to handle instruments quickly. They also must be conscientious, orderly, and emotionally stable to handle the demands of the operating room environment. Technologists must respond quickly and know procedures well to have instruments ready for surgeons without having to be told. They are expected to keep abreast of new developments in the field. Recommended high school courses include health, biology, chemistry, and mathematics.

Technologists advance by specializing in a particular area of surgery, such as neurosurgery or open heart surgery. They also may work as circulating technologists. A circulating technologist is the "unsterile" member of the surgical team who prepares patients; helps with anesthesia; obtains and opens packages for the "sterile" persons to remove the sterile contents during the procedure; interviews the patient before surgery; keeps a written account of the surgical procedure; and answers the surgeon's questions about the patient during the surgery. With additional training, some technologists advance to first assistants, who help with retracting, sponging, suturing, cauterizing bleeders, and closing and treating wounds. Some surgical technologists manage central supply departments in hospitals, or take positions with insurance companies, sterile supply services, and operating equipment firms.

Job Outlook

Employment of surgical technologists is expected to grow faster than the average for all occupations through the year 2012 as the volume of surgery increases. The number of surgical procedures is expected to rise as the population grows and ages. As members of the baby boom generation approach retirement age, the over-50 population, who generally require more surgical procedures, will account for a larger portion of the general population. Technological advances, such as fiber optics and laser technology, will also permit new surgical procedures to be performed.

Hospitals will continue to be the primary employer of surgical technologists, although much faster employment growth is expected in offices of physicians and in outpatient care centers, including ambulatory surgical centers.

Earnings

Median annual earnings of surgical technologists were \$31,210 in 2002. The middle 50 percent earned between \$26,000 and \$36,740. The lowest 10 percent earned less than \$21,920, and the highest 10 percent earned more than \$43,470. Median annual earnings of surgical technologists in 2002 were \$33,790 in offices of physicians and \$30,590 in general medical and surgical hospitals.

Sources of Additional Information

For additional information on a career as a surgical technologist and a list of CAAHEP-accredited programs, contact Association of Surgical Technologists, 7108-C South Alton Way, Centennial, CO 80112. Internet: <http://www.ast.org>

For information on becoming a Certified Surgical Technologist, contact Liaison Council on Certification for the Surgical Technologist, 128 S. Tejon St., Suite 301, Colorado Springs, CO 80903. Internet: <http://www.lcc-st.org>

For information on becoming a Tech in Surgery-Certified, contact National Center for Competency Testing, 7007 College Blvd., Suite 250, Overland Park, KS 66211.

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